

Application # 1

**HARDEE
POWER
STATION**

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

VOLUME 1

CHAPTERS 1-10

SUBMITTED BY:

TECO POWER SERVICES

TAMPA ELECTRIC COMPANY

**SEMINOLE ELECTRIC
COOPERATIVE, INC.**

**APPLICANT INFORMATION
FOR THE
HARDEE POWER STATION PROJECT**

1. Applicant's Official Name: TECO Power Services Corporation
2. Address: 702 N. Franklin Street, Tampa, FL 33602
3. Address of Official Headquarters: 702 N. Franklin Street, Tampa, FL 33602
4. Business Entity (corporation, partnership, co-operative): Corporation
5. Names, owners, etc.: The owners of the Hardee Power Station and associated facilities will be:
 - 1) TECO Power Services Corporation, 702 N. Franklin Street, Tampa, FL 33602
 - 2) Tampa Electric Company, P. O. Box 111, Tampa, FL 33601-0111
 - 3) Seminole Electric Cooperative Inc., P. O. Box 272000, Tampa, FL 3688-2000Refer to Chapter 1, Need for Power and the Proposed Hardee Power Station Project.
6. Name and Title of Chief Executive Officer: Richard E. Ludwig, President, TECO Power Services Corporation
7. Name, Address, and Phone Number of Official Representative responsible for obtaining certification:
Jerry L. Williams, Director Environmental, Tampa Electric Company, P. O. Box 111, Tampa, FL 33601-0111, (813) 228-4111
8. Site Location (counties): Hardee/Polk
9. Nearest Incorporated Cities: Bowling Green (7.5 miles), Wauchula (10 miles), Ft. Meade (9 miles).
10. Latitude and Longitude: 22°38'02" N; 81°57'46" E
11. UTM's Northerly: 3,057,000 meters
Easterly: 405,000 meters (Zone 17)
12. Section, Township, Range: Sections 35 and 36, T32S, R23E; Sections 1 and 2, T33S, R23E
13. Location of any directly associated transmission facilities (counties): Polk, Hardee, DeSoto, Charlotte, and Lee
14. Name Plate Generating Capacity: 295 MW (Nominal Net)
15. Capacity of Proposed Additions and Ultimate Site Capacity (where applicable):

Phase 1A:	295 MW (Nominal Net)
Phase 1B:	145 MW (Nominal Net)
Phase 2 :	220 MW (Nominal Net)
Total :	660 MW (Nominal Net)

Remarks: (Additional information that will help identify the applicant): See Chapter 1, Need for Power and the Proposed Hardee Power Station Project, for a discussion of the Project.

Professional Engineer sponsoring application:

Date: 6/28/89

Signature: Kennard F. Kosky

Kennard F. Kosky
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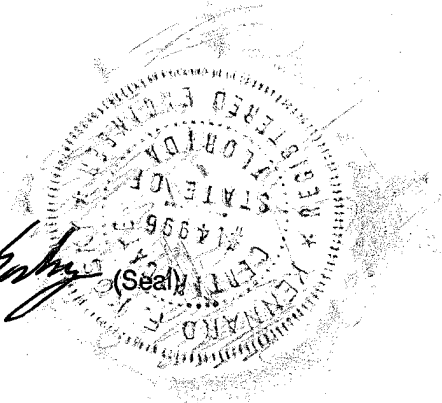


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LIST OF ACRONYMS

AAQS	Ambient Air Quality Standards
ACSR	Aluminum Conductor Steel Reinforced
ADT	Average Daily Traffic
Agrico	Agrico Chemical Company
ANSI	American National Standard Institute
BACT	Best Available Control Alternative
BB4	Tampa Electric's Big Bend Unit Four
CAA	Clean Air Act
CC	Combined Cycle
CCP	Combined Cycle Project
CEQ	Council on Environmental Quality
CFCRPP	Central Florida Comprehensive Regional Policy Plan
CFI	CF Industries, Inc.
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
CO	Carbon Monoxide
COE	U.S. Army Corps of Engineers
CR	County Road
CSX	CSX Transportation
CT	Combustion Turbine
CWCGP	Cool Water Coal Gasification Program
dB	decibel
dBA	A weighted decibels
dbh	Diameter at Breast Height
DCA	Department of Community Affairs
DHR	Division of Historical Resources
DOT	Florida Department of Transportation
DRI	Development of Regional Impact
EA	Environmental Assessment
EDC	Economic Development Council
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EPRI	Electric Power Research Institute
FAC	Florida Administrative Code
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FDA	Florida Department of Agriculture
FDACS	Florida Department of Agriculture and Consumer Services
FDCA	Florida Department of Community Affairs
FDER	Florida Department of Environmental Regulation
FDLES	Florida Department of Labor and Employment Security
FDNR	Florida Department of Natural Resources
FDOD	Florida Department of Commerce
FDOT	Florida Department of Transportation
FEPPSA	Florida Electric Power Plant Siting Act
FGFWFC	Florida Game and Fresh Water Fish Commission

LIST OF ACRONYMS

(Continued)

FGT	Florida Gas Transmission
FHWA	Federal Highway Administration
FLUCCS	Florida Land Use Cover and Classification System
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FPL	Florida Power & Light
FPSC	Florida Public Service Commission
GCC	Gasification Combined Cycle
GIS	Geographic Information System
HA	Hectare
HCPP	Hardee County Comprehensive Plan
HRSG	Heat Recovery Steam Generator
ISCST	Industrial Source Complex Short-Term
KBN	KBN Engineering and Applied Sciences, Inc.
LAER	Lowest Achievable Emission Rate
MCR	Maximum Current Rating
MSL	Mean Sea Level
MVA	Megavolt/Amperes
MW	Megawatts
NEPA	National Environmental Policy Act
NO ₂	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRHP	National Register of Historic Places
NSPS	New Source Performance Standard
NWS	National Weather Service
O ₃	Ozone
PCCP	Polk County Comprehensive Plan
PM	Particulate Matter
POD	Point of Discharge
POS	Plan of Study
PSC	Florida Public Service Commission
PSD	Prevention of Significant Deterioration
RC	Rural Conservation
RCRA	Resource Conservation Recovery Act
REA	United States Department of Agriculture's Rural Electrification Administration
ROMP	Regional Observation Monitoring Program
ROW	Right-of-Way
RV	Recreational Vehicle
SCA	Site Certification Application
SCOT	Shell-Claus Offgas Treatment
SECI	Seminole Electric Cooperative, Inc.
SELS	Severe Local Storms
SO ₂	Sulfur Dioxide
SPL	Sound Pressure Level
SR	State Road
SWFWMD	Southwest Florida Water Management District

LIST OF ACRONYMS
(Continued)

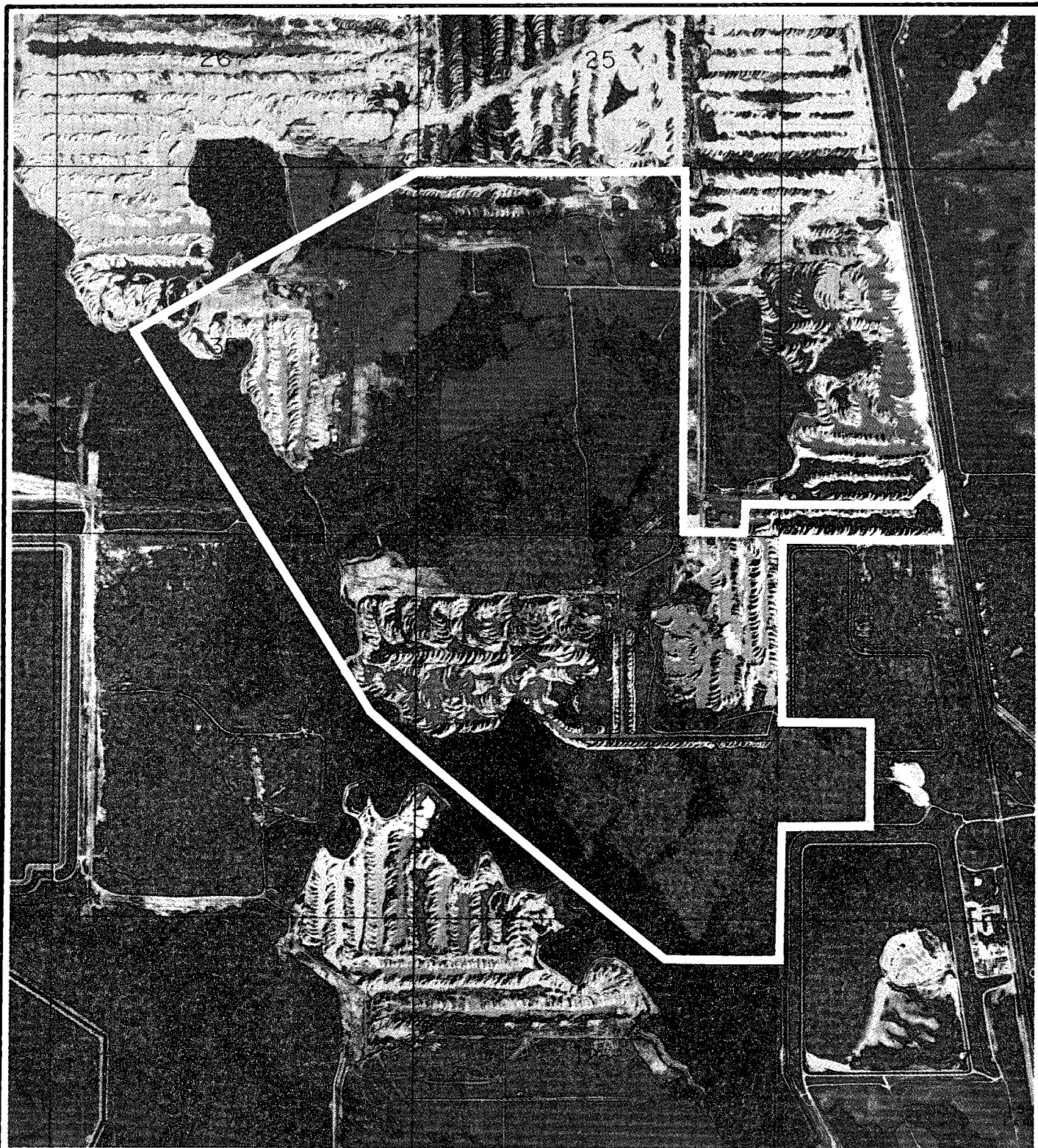
Tampa Electric	Tampa Electric Company, Inc.
TPY	Tons per year
TSP	Total Suspended Particulate
UNAMAP	User's Network for Applied Modeling of Air Pollution
USDA	U.S. Department of Agriculture
USDL	U.S. Department of Labor
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
USSAC	United States Steel Agri-Chemicals

HARDEE
POWER
STATION

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 1

**NEED FOR POWER
AND THE PROPOSED
HARDEE POWER STATION
PROJECT**



0 1/2 1 Miles
0 1/2 1 Kilometers

1/5/89

Figure 1.3.3-1 HARDEE POWER STATION SITE

**Hardee
Power Station**

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1.0 NEED FOR POWER AND THE PROPOSED FACILITIES

1.1 INTRODUCTION

1.1.1 Purpose of Site Certification Application/Environmental Analysis

The applicant is proposing to license, construct, and operate a new combined cycle power plant and associated transmission line, gas pipeline, and liquid fuel pipeline facilities known as the Hardee Power Station. The licensing of power plant and associated facilities in Florida requires compliance with federal, state, and local laws, regulations, and ordinances. The two primary laws governing the licensing of this project are the Florida Electric Power Plant Siting Act [FEPPSA, 403.501-403.517 Florida Statutes (F.S.)] 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 Regulation (FDER) acts as the central coordinator. Certification proceeds with the submittal of a Site Certification Application (SCA) to FDER by the applicant and culminates with approval by the Governor and Cabinet. Implementation procedures of FEPPSA are presented in FDER's Chapter 17-17, Florida Administrative Code (F.A.C.) Electrical Power Plant Siting.

NEPA is the national charter for the 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 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 United States Department of Agriculture's Rural Electrification Administration (REA) has determined that its loan guarantee commitments for bulk power generation and transmission facilities 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 Assessment (EA) document prior to preparing its own Environmental Impact Statement (EIS). REA's environmental policies and procedures are presented in 7 CFR 1794.

A single environmental application, a SCA/EA has been prepared and submitted to FDER and the REA describing the Hardee Power Station 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 followed the scope, quantity and specificity of information described in the "Seminole Electric Cooperative, Inc. SECI Combined Cycle Environmental Licensing Plan of Study" [KBN Engineering and Applied Sciences, Inc. (KBN), et al., 1988]. Approvals and binding agreements were obtained for this Plan of Study pursuant to Section 403.5063, F.S. and Chapter 17-17.041(6) F.A.C.

Agency and public comments regarding the project have been obtained through numerous meetings, discussions and presentations. State and federal interagency meetings and public scoping meetings regarding the Hardee Power Station Project were held in September and December 1988. Public workshops regarding this proposed transmission line were held in February 1989 (see Chapter 9).

1.1.2 The Applicants

The applicants for the SCA for the Hardee Power Station are TECO Power Services (Power Services), Tampa Electric Company (Tampa Electric), and Seminole Electric Cooperative, Inc. (SECI).

Power Services, a wholly-owned subsidiary of TECO Energy, will supply power to both Tampa Electric and SECI as an independent power producer. Power Services will enter into power supply agreements to sell capacity and energy to SECI to meet its backup requirements and to Tampa Electric for a portion of its capacity and energy needs.

Tampa Electric, headquartered in Tampa, Florida, a wholly-owned subsidiary of TECO Energy, is an investor-owned electric utility. Tampa Electric's service territory comprises an area of about 2,000 square miles on the west coast of Florida, including substantially all of Hillsborough County and parts of Polk, Pasco, and Pinellas counties. This territory has an estimated population of about 950,000 and is served by Tampa Electric's three electrical generating plants in or near Tampa. Over 99% of Tampa Electric's electric generation for the years 1987 and 1988 was from its coal-fired units.

SECI, headquartered in Tampa, Florida, is an electric generation and transmission cooperative which provides wholesale electric service to its 11 member distribution rural electric cooperatives serving more than 500,000 customers in Florida. SECI has approximately 1,214 megawatts (MW) of generating capacity consisting of two 600 MW coal-fired generating plants and a 14 MW portion of the Crystal River Unit 3 nuclear plant.

SECI has a demonstrated need for 440 MW of back-up capacity to be available in 1993 to supply power during those periods when one of its coal generating units is taken out of service for maintenance. These maintenance periods usually occur in the spring and fall of each year. Tampa Electric has a need for peak load capacity normally during the summer and winter months. Power Services is contracting with Tampa Electric to supply peak load capacity and with Seminole for back-up capacity. To meet these needs, Power Services will provide 440 MW of capacity by combining 145 MW from Tampa Electric's Big Bend Unit Four (BB4) with 295 MW of new capacity located at the Hardee Power Station. Power Services will contract with Tampa Electric to own certain rights to BB4's capacity. After 10 years, the BB4 capacity will revert fully to Tampa Electric. Power Services will then add 145 MW of new capacity at the Hardee Power Station to continue its commitment to provide Seminole with 440 MW of back-up capacity.

1.2 NEED FOR THE PROJECT

On February 23, 1988, SECI filed a petition to determine need for two 220 MW combined cycle facilities, having an in-service date of January 1, 1993, with the PSC, pursuant to Section 403.519 F.S. SECI also submitted a comprehensive Need Determination Study and Need Determination Study Appendices to the PSC in support of that petition. Those documents, which are incorporated herein by reference, contained the information required by the PSC's rule (Chapter 25-22.081, F.A.C.) in order for it to make a determination of need for the facilities pursuant to the FEPPSA. Copies of those documents are available for inspection at the Florida Public Service Commission, Division of Records and Reporting, 101 East Gaines Street, Tallahassee, Florida.

Concurrently with filing the need determination petition, SECI issued a request for proposals (RFP) for capacity from qualifying facilities, independent power producers and others to determine if there was a viable and cost-effective purchased power alternative to SECI's construction of the proposed combined cycle facilities.

The PSC held public hearings on SECI's petition on December 7-8, 1988. At the time of the hearings, the RFP process had resulted in the identification of two short list bidders with whom negotiations were proceeding for a potential capacity alternative. Power Services was one of those bidders.

The PSC issued its "Initial Order on Need Determination" (Order No. 20930, Docket No. 88309-EC) on March 23, 1989. (A copy of that order is reproduced in Appendix 11.9.) In that order, the PSC determined that: (1) SECI had proven a need for 450 MW of capacity in 1993; and (2) of the alternatives fully developed in the record, SECI's need would be best and most economically met by the two 220 MW combined cycle facilities proposed for the Hardee Power Station site. The PSC deferred issuance of a final need determination order pending presentation of the results of SECI's RFP process at a subsequently noticed public hearing.

The RFP process is concluding a series of contracts among SECI, Power Services, and Tampa Electric, which will provide 440 MW of electric capacity to meet SECI's capacity needs through a combination of capacity from Tampa Electric's BB4 and capacity from the phased construction of the two 220 MW combined cycle facilities comprising Phases I-A and I-B of the Hardee Power Station.

Concurrently with filing this application, SECI, Power Services and Tampa Electric are filing with the PSC a "Joint Motion to Add Coapplicants and to Supplement Need Determination Petition," together with supporting testimony and exhibits. That filing contains the additional information required by the PSC in order to make a final determination of need for the facilities comprising the Hardee Power Station. A final hearing before the PSC on the supplemented need determination petition is scheduled for September 20, 1989.

1.3 OVERVIEW OF HARDEE POWER STATION PROJECT

1.3.1 Introduction

The project is composed of four major types of facilities:

1. The Hardee Power Station facilities within Hardee and Polk counties,
2. Associated transmission facilities extending from the power plant facilities to existing transmission facilities in central and south Florida,
3. Associated gas pipeline facilities within Polk and Hardee counties, and
4. Associated liquid fuels pipeline extending from Port Manatee to the power plant facility.

This document addresses the environmental aspects of the Hardee Power Station project as a whole and each of the three major types of facilities in more detail: Hardee Power Station facilities are described in Chapter 3 and associated transmission line, gas pipeline, and liquid fuel pipeline facilities are described in Chapter 6. Each of the major types of

facilities is further divided into major components. As an overview, Figure 1.3.1-1 illustrates the Hardee Power Station project's composition. Terminology used through this SCA/EA document is presented in Table 1.3.1-1.

1.3.2 General Site Location and Description

The proposed site for the Hardee Power Station project is located in Hardee and Polk Counties about 14 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 project site is bordered on the east by County Road (CR) 663, CSX Transportation (CSX) railroad line, and CF Industries, Inc. (CFI), Hardee Phosphate Complex. Agrico Chemical Company, a division of Freeport McMoand Resource Partners, a Delaware Limited Partnership (Agrico) properties surround the remaining portions of the site. Payne Creek flows along the site's western border. Mining is the primary land use of the project site and adjoining areas. The site will utilize lands that have been approved for phosphate mining by Florida Department of Natural Resources (FDNR) and FDER.

1.3.3 Project Description

The Hardee Power Station project consists of constructing and operating combined cycle electric generating facilities with an ultimate capacity of 660 MW constructed in two phases. In Phase 1-A, Power Services will place 295 MW of capacity into commercial operation in January 1993. This capacity will consist of a stand alone 75 MW combustion turbine (CT) and a 220 MW combined cycle facility comprised of two 75 MW CT's connected to a 70 MW heat recovery steam generator system (HRSG). In Phase 1-B, Power Services will add 145 MW to replace the BB4 capacity. This new capacity will add one 75 MW CT and a 70 MW HRSG system to the stand alone CT. Phase 1-A and 1-B will result in two 220 MW combined cycle facilities. Phase 2 is the addition of a third 220 MW combined cycle facility at an unspecified future date.

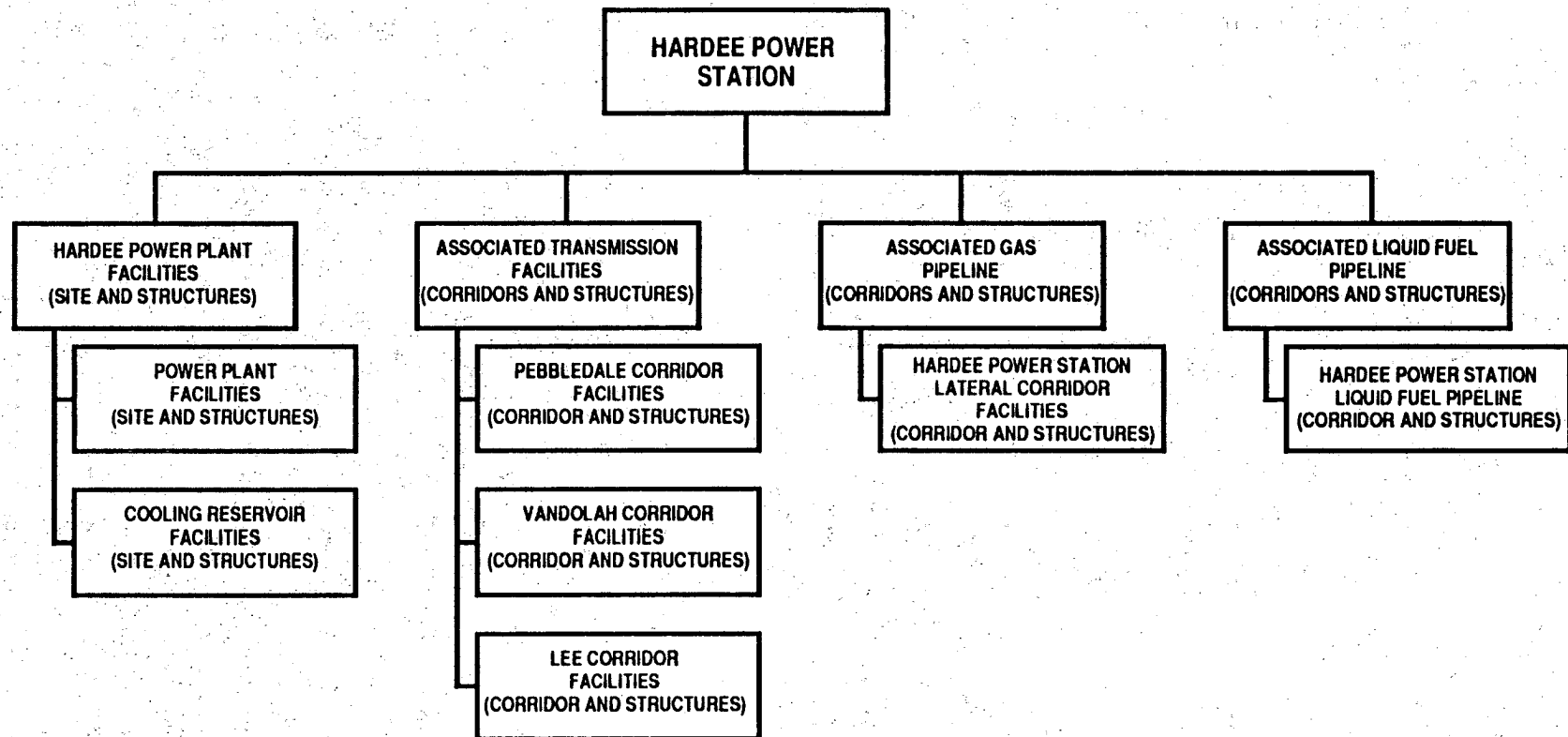


Figure 1.3.1-1 HARDEE POWER PLANT STATION
PROJECT COMPOSITION

**Hardee
Power Station**

Table 1.3.1-1. Hardee Power Station Project Terminology (Page 1 of 2)

Hardee Power Station Project	The overall project: Hardee Power Station plant facilities plus the associated transmission facilities plus the associated fuel delivery facilities.
Hardee Power Station plant facilities (site plus structures)	The area encompassing the power plant site, the railroad spur corridors, and the cooling reservoir and the structures to be constructed within that area.
power plant facilities (site plus structures)	The 20-hectare (50-acre) area and the structures to be constructed within that area.
cooling reservoir facilities (site plus structures)	The 231-hectare (570-acre) area encompassing the cooling reservoir site and the discharge structures to be constructed within that area.
access road facilities (corridors plus structures)	The area traversed by the access road connecting to CR 663 and the structures to be constructed within that area.
associated transmission facilities (corridor structures)	The area traversed by the preferred transmission corridor and the structures to be constructed within that area.
Pebbledale corridor facilities (corridor plus structures)	The area traversed by the preferred transmission corridor from the power plant facilities to the existing Pebbledale Substation and the structures to be constructed within that Pebbledale area.
Vandolah corridor facilities (corridor plus structures)	The area traversed by the preferred transmission corridor from the power plant facilities to the existing Vandolah Substation and the structures to be constructed within that area.
Lee corridor facilities (corridor plus structures)	The area traversed by the preferred transmission corridor from the power plant facilities to the existing Lee Substation and the structures to be constructed within that area.
Hardee Power Station Lateral facilities (corridor plus structures)	The area traversed by the gas pipeline corridor from the existing gas pipeline west of Polk City and the structures to be constructed within that area.

Table 1.3.1-1. Hardee Power Station Project Terminology (Page 2 of 2)

Hardee Power Station Liquid Fuel Pipeline facilities (corridor plus structures)	The area traversed by the liquid fuel pipeline corridor from Port Manatee to the plant site and the structures to be constructed within that area)
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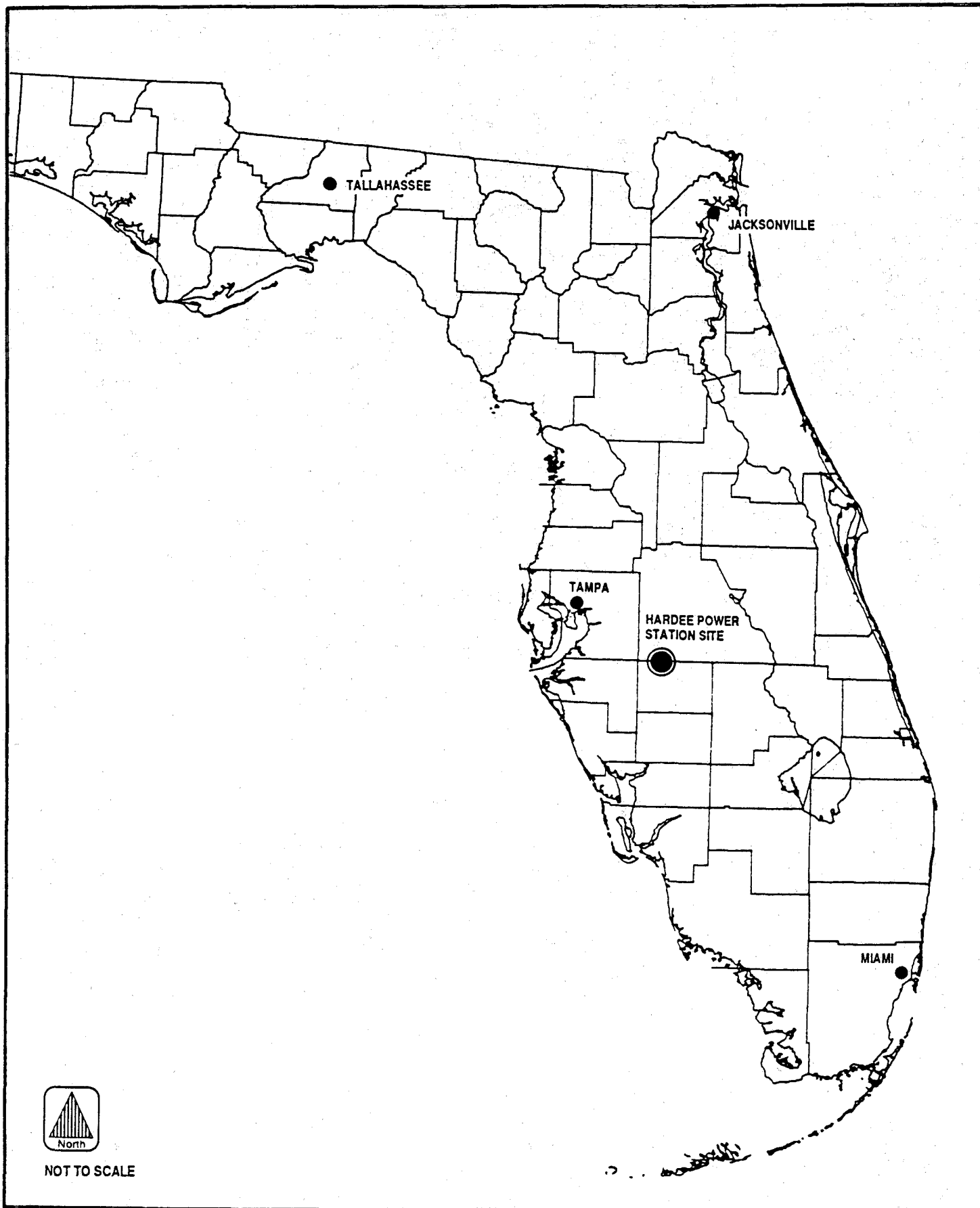


Figure 1.3.2-1 GENERAL LOCATION OF
HARDEE POWER STATION

**Hardee
Power Station**

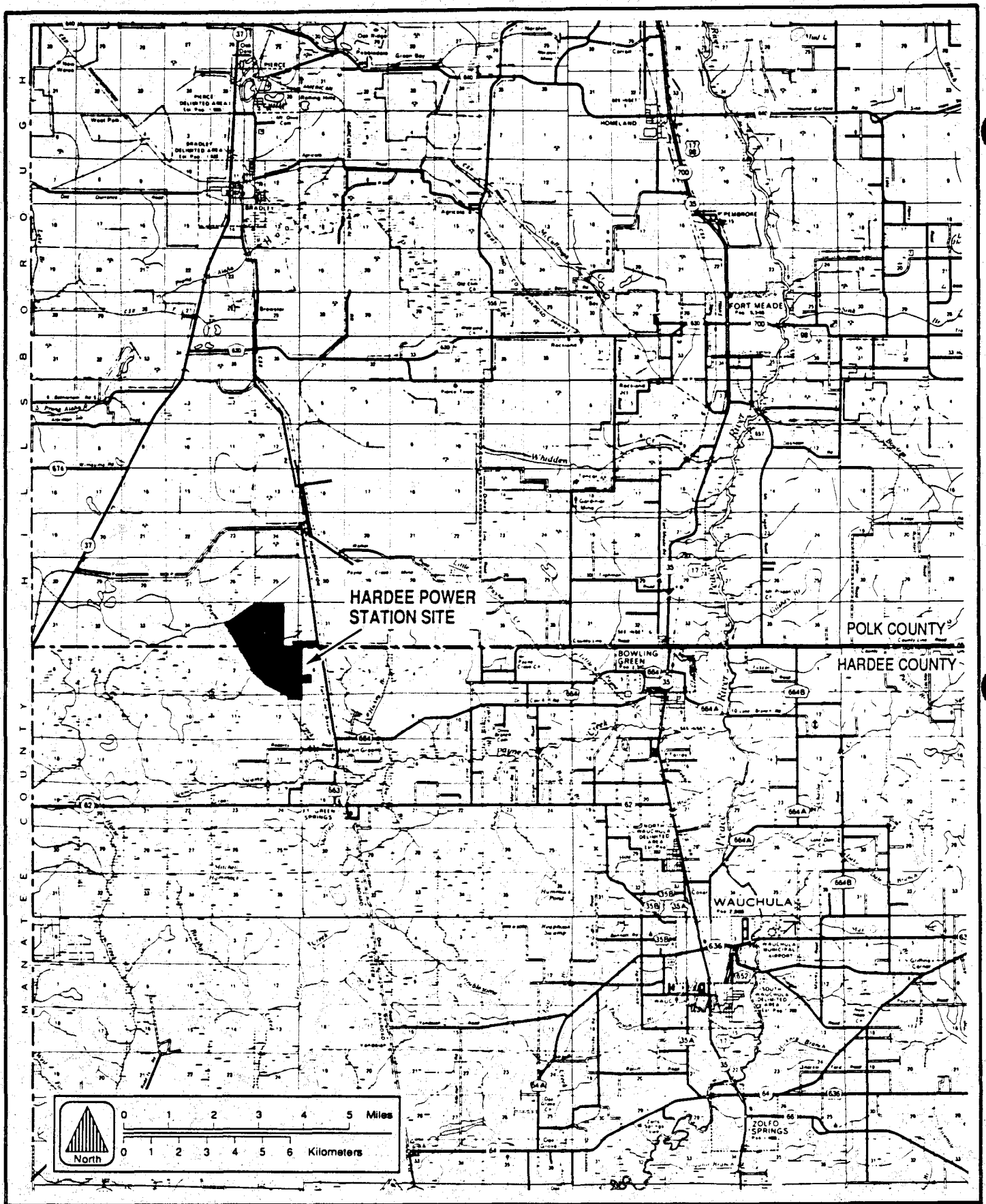


Figure 1.3.2-2 HARDEE POWER STATION SITE LOCATION

**Hardee
Power Station**

The new capacity will use natural gas or distillate oil as a fuel source, but will be constructed so as not to preclude the use of coal gas should that fuel prove more economical.

The project provides for building the new generating facilities on a 526 hectare (ha) (1300 acre) site (Figure 1.3.3-1) selected by SECI in northwest Hardee County and southwest Polk County. The Hardee Power Station site will be owned by SECI with a portion of this land being leased to Power Services for the duration of the project. Power Services will own and operate the power generating facilities associated with Phases 1-A and 1-B.

Steam cycle cooling for the entire 660 MW facility will be achieved through the use of an on-site 231 ha (570 acre) cooling reservoir constructed specifically for the Hardee Power Station. This reservoir will be constructed by Agrico, who is currently mining the area where it will be located. The construction of the reservoir will be part of Agrico's reclamation plan required by the FDNR to restore the area to a functional use once mining activities are complete. Once the reservoir is constructed it will be owned by SECI.

Groundwater from on-site well fields will provide the primary supply of plant makeup water. Cooling water will be infrequently discharged to Payne Creek.

SECI will build, own, operate, and maintain two 230 KV transmission lines originating at the Hardee Power Station (Figure 1.3.3-2). The first line will connect to Lee Substation located in Lee County, south of the plant site. The second line will connect to Florida Power Corporation's Vandolah Substation located in Hardee County, also south of the plant site.

Tampa Electric will build, own, operate, and maintain one 230 KV transmission line connecting the Hardee Power Station with Tampa Electric's Pebbledale Substation located in Polk County, north of the plant site (Figure 1.3.3-2).

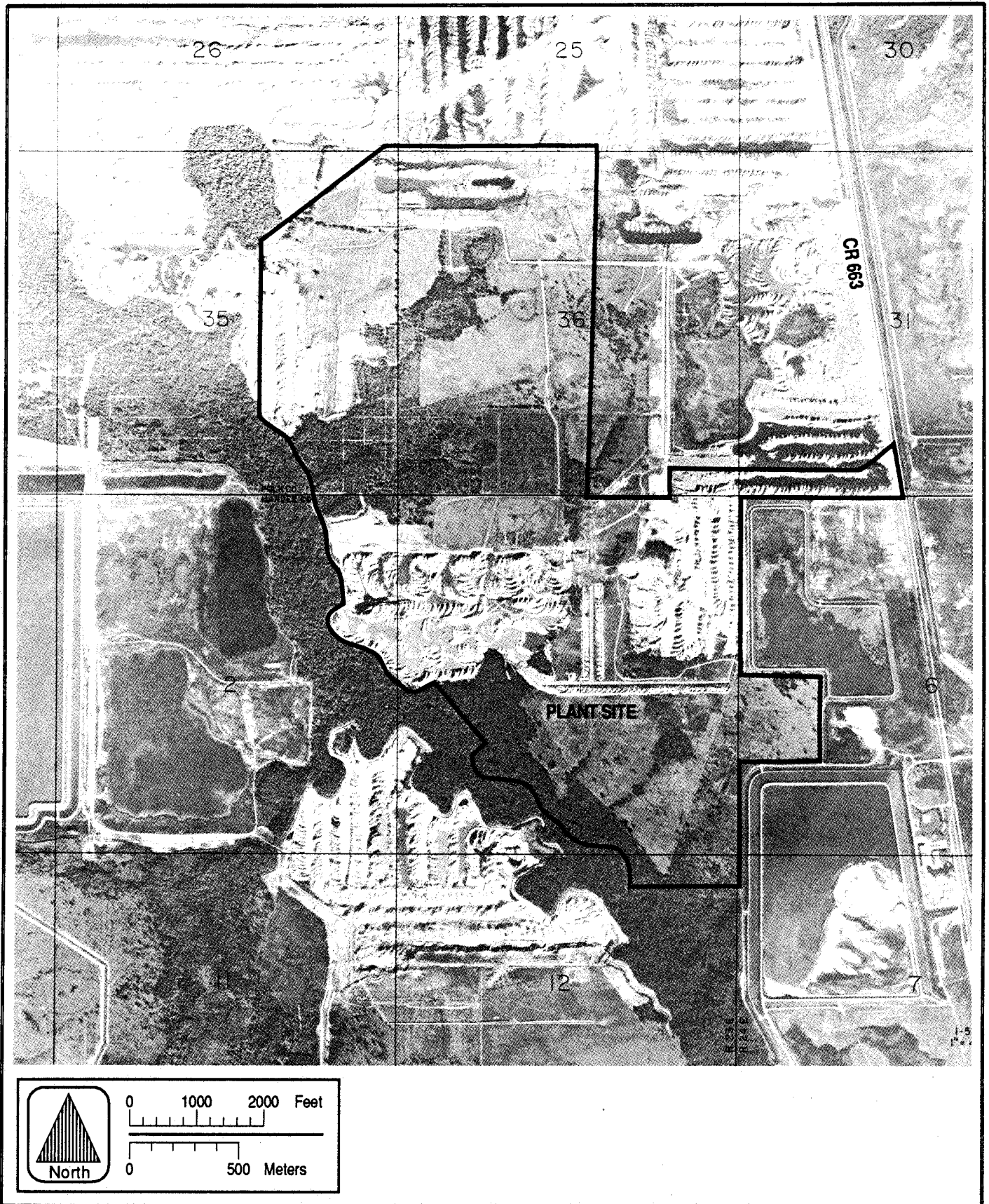


Figure 1.3.3-1a HARDEE POWER STATION SITE BOUNDARY

**Hardee
Power Station**

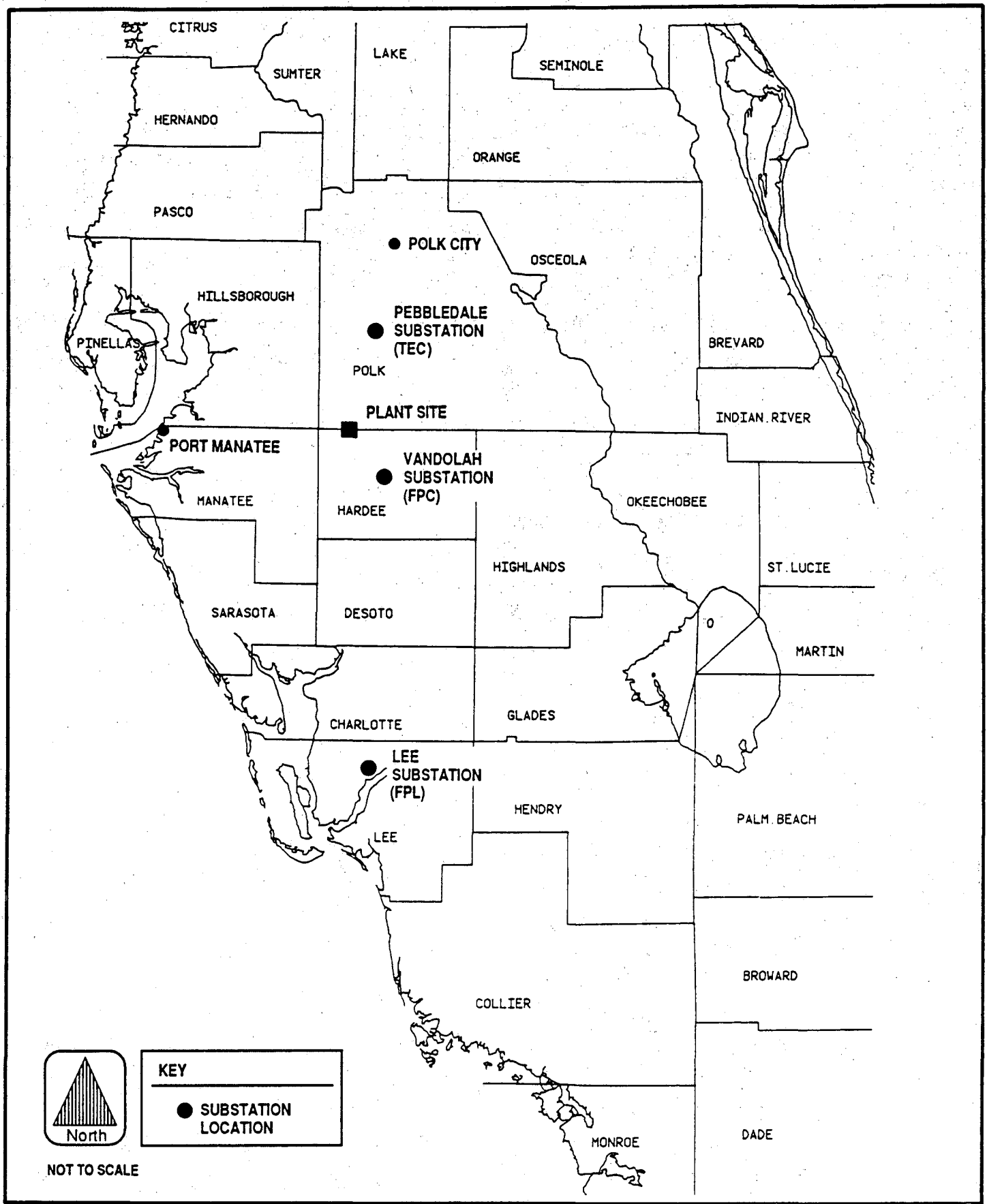


Figure 1.3.3-2 LOCATION OF HARDEE POWER STATION, ASSOCIATED TRANSMISSION LINE SUBSTATIONS AND INTERCONNECT POINTS FOR PIPELINES

**Hardee
Power Station**

Power Services and/or Florida Gas Transmission (FGT) and/or a qualified third party will build, own, operate, and maintain a 48 centimeter (cm) (18-inch) natural gas pipeline to the Hardee Power Station connecting into FGT's existing pipeline system at a point north of Polk City (Figure 1.3.3-2).

Fuel oil will be delivered to the Hardee Power Station by truck or via an 20.3 cm (8-inch) liquid fuels pipeline. This liquid fuels pipeline will be built, owned, operated, and maintained by Power Services and/or a qualified third party and, when constructed, will run from Port Manatee to the Hardee Power Station (Figure 1.3.3-2).

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 the provision of energy, the Hardee Power Station project will provide employment and tax revenues. The Hardee Power Station project makes beneficial use of mined lands in Hardee and Polk Counties and is compatible with proposed reclamation plans.

Because of the previously altered environment in the project area and the relatively clean nature of the project, no significant adverse impacts will result from the project.

1.4.2 Internal Benefits

This project is beneficial to the customers of SECI and Tampa Electric due to the diversity of SECI's need for backup capacity and Tampa Electric's need for peaking capacity. The project provides optimum utilization of the power resources and minimizes the total generating capacity required on an individual basis. SECI's primary need is in their spring and fall maintenance periods, whereas Tampa Electric has greater need during its summer and winter peak load periods. In accordance with statewide planning objectives, the proposed mix of intermediate and peaking resources, along

with existing baseload coal-fired resources, make efficient use of all these resources within the state of Florida. Improved utilization of existing coal-fired capacity and deferral of construction of new capacity results in both SECI's and Tampa Electric's ratepayers realizing significant savings.

REFERENCES - Chapter 1

KBN Engineering and Applied Sciences, Inc., Applied Technology and Management, Inc., and Stone & Webster Engineering Corporation. 1988. Seminole Electric Cooperative Incorporated SECI Combined Cycle Project Environmental Licensing Plan of Study. Prepared for: Seminole Electric Cooperative, Inc.

HARDEE
POWER
STATION

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 2

**SITE AND VICINITY
CHARACTERIZATION**

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2.0 SITE AND VICINITY CHARACTERIZATION

2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

The perimeter of the proposed Hardee Power Station site in relation to abutting and adjacent properties is shown in Figure 2.1-1. The site abuts Agrico on the north, west and south, and CFI on the east. The total size of the proposed station site is 526 ha (1,300 acres). The northern portion of the site is presently being mined and will be reclaimed to a cooling reservoir. The southern portion of the site is primarily in pastureland and will contain the power block, fuel oil storage tanks, site runoff detention pond and other facilities. The western boundary of the property is Payne Creek. Areas immediately adjoining the creek are in the 100-year floodplain. However, none of the proposed plant structures or associated facilities will be located in the 100-year floodplain of Payne Creek.

2.2 SOCIO-POLITICAL ENVIRONMENT

2.2.1 Governmental Jurisdiction

The proposed site is located in the northwest, unincorporated portion of Hardee County, approximately 3.2 to 4.8 km (2 to 3 miles) north of State Road (SR) 62 and 1.6 km (1 mile) west of CR 663 and extending north into an unincorporated portion of Polk County. The site is located about 12 km (7.5 miles) west of the City of Bowling Green, 16 km (10 miles) northwest of Wauchula, and 14 km (9 miles) southwest of Ft. Meade. The property on which the plant is to be constructed is currently owned by Agrico, but SECI holds a purchase option contract. Figure 2.2.1-1 shows the site in relation to the political boundaries within an approximate 8-km (5-mile) radius. With the exception of the county boundaries, there are no political boundaries in this area (the small communities of Ft. Green and Ft. Green Springs are not incorporated towns). Figure 2.2.1-2 is an aerial photo of the site and vicinity. None of the federal, state, regional, local, or private areas specified in FDER's instruction guide are located within 8 km (5 miles) of the proposed site.

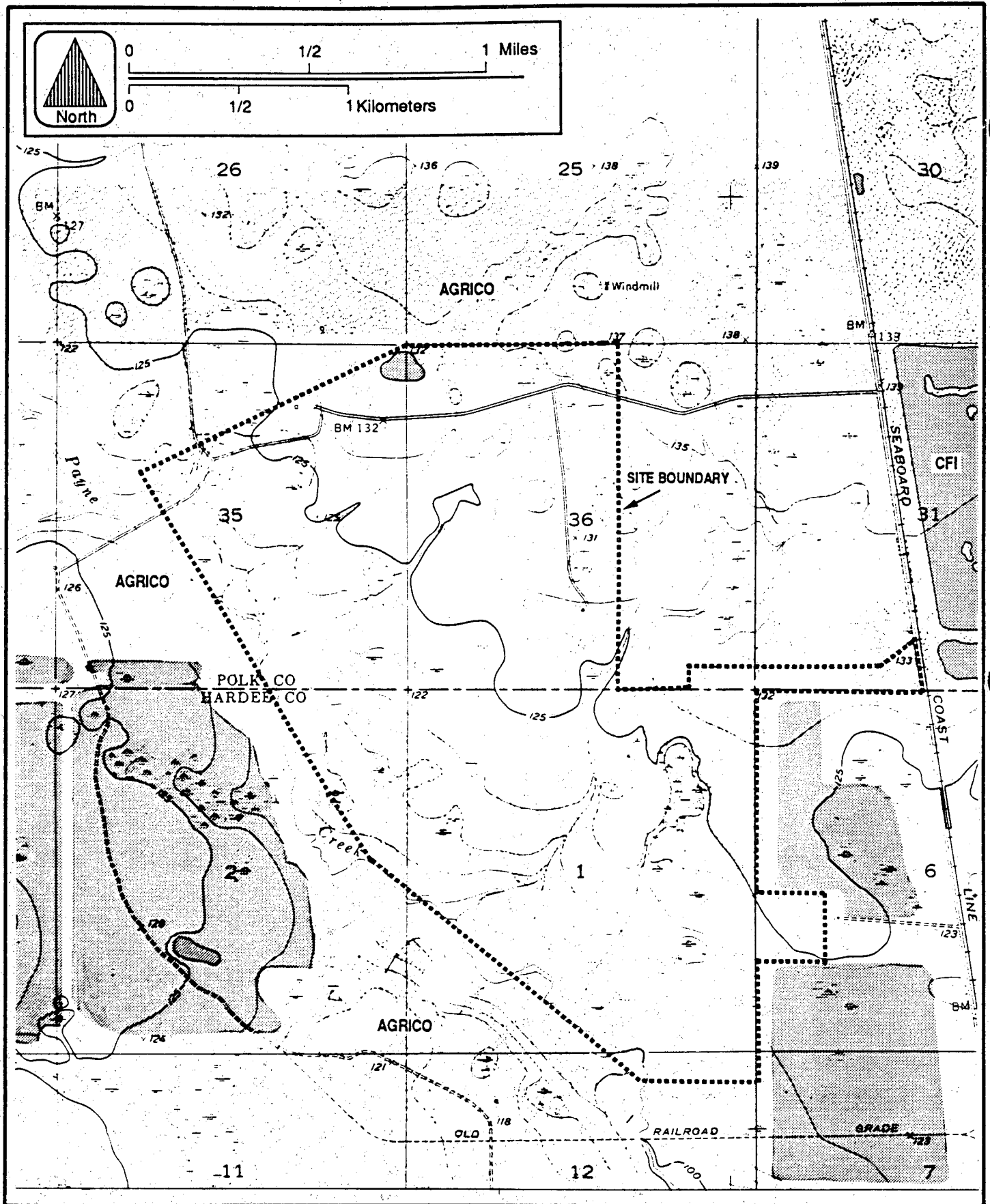
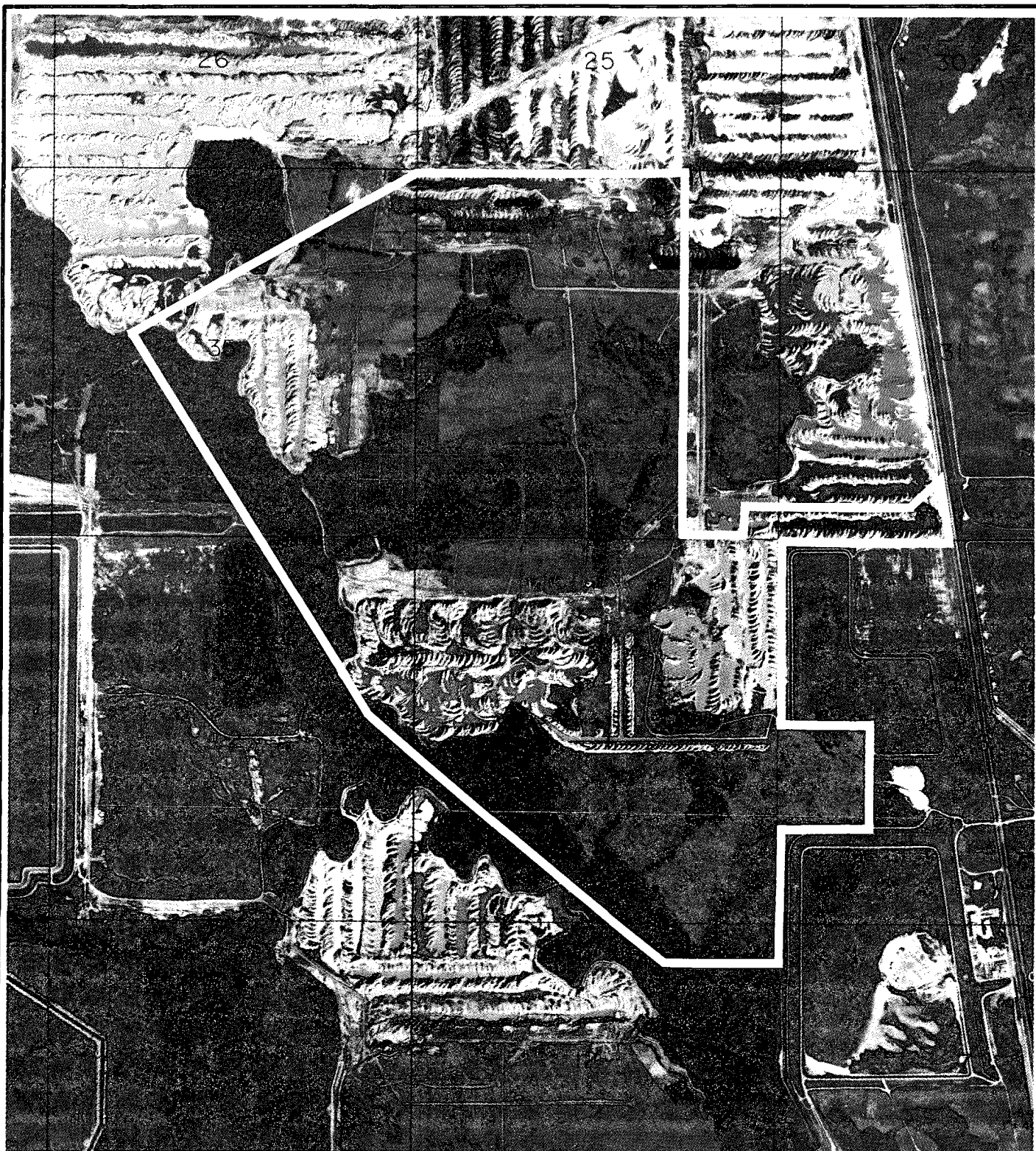


Figure 2.1-1 LOCATIONS OF SITE BOUNDARY (PERIMETERS)
AND ADJACENT PROPERTIES

**Hardee
Power Station**



0 1/2 1 Miles
0 1/2 1 Kilometers

1/5/89

Figure 2.2.1-2 AREAS WITHIN A ONE MILE RADIUS
OF HARDEE POWER STATION PLANT FACILITIES

**Hardee
Power Station**

2.2.2 Zoning and Land Use Plans

The Hardee Power Station will be constructed in Hardee County, and the appurtenant cooling reservoir will lie in Hardee and Polk County. Local government comprehensive plans governing this site include the Hardee County Comprehensive Plan and the Polk County Comprehensive Plan.

(Information relevant to other associated facilities, i.e., transmission lines, the natural gas pipeline, and liquid fuel pipeline, is found in Chapter 6.)

HARDEE COUNTY

The Hardee County Comprehensive Plan Land Use Element primarily utilizes narrative standards and policies, as opposed to mapped designated areas. The Land Use Element identifies and describes a "growth corridor" that extends from the City of Bowling Green, southward through Wauchula, and terminating at Zolfo Springs. This "growth corridor" is several kilometers to the south and east of the plant site. The Hardee County portion of the Hardee Power Station is presently designated for phosphate mining.

In general, a Hardee County Comprehensive Plan "goal" for industrial land use is to achieve "sufficient industry to allow adequate employment opportunities for Hardee County residents" (Land Use Plan, p. H-4). Specific policies intended to further this goal include:

- o Industrial growth should not be at the expense of the agricultural base of the Hardee County economy.
- o Encourage environmentally acceptable industry to locate in Hardee County.
- o Encourage public or private industrial development of a suitably located industrial park of at least 81 ha (200 acres) with provisions for incremental development as the demand necessitates. Such a park should have major rail, air or highway access.

- o Encourage incoming industry to locate at existing industrial areas in the County.
- o Preserve, where possible, the valuable railroad frontage necessary to heavier forms of industry.

The Electric Utility Element of the Hardee County Comprehensive Plan sets a goal of availability of electric power to all Hardee County residents.

Policies to further this goal include:

- o The County shall encourage the placement of utility facilities compatible with current and long range planning principles.
- o The Ten Year Power Site Plan shall be reviewed every two years to determine compatibility with Hardee County's policies.
- o Any power facility, i.e., substations and generating facilities (public or private), shall be buffered from residential areas.
- o Coordination between the County and the various power companies and cooperatives on future power needs shall be encouraged (Utility Element, p. B-2).

As indicated above the Hardee County Comprehensive Plan's utility element states that all electric power generating plants shall be buffered from residential areas. This element also states that environmental considerations "relative to noise, air quality and water quality shall be observed when identifying new locations of power facilities."

The Hardee Power Station is consistent with Hardee County's Comprehensive Plan. The site is not proximate to any existing or future (planned) residential or commercial areas, and therefore is compatible with current and long range planning principles. The new plant will promote the availability of electric power to all Hardee County residents and will be

sited for the most part on previously disturbed phosphate mining lands (essentially an "existing industrial area"). The plant will comply with all state and local environmental requirements.

On May 11, 1989, the Hardee County Commission approved the rezoning of the site property to light industrial (I-1) effective December 31, 1989. The plant is an authorized use in the I-1 district under the Hardee County Zoning Ordinance and is consistent with the Hardee County Comprehensive Plan.

POLK COUNTY

As in Hardee County, the Polk County Comprehensive Plan Land Use Element utilizes the so-called "policy plan technique," which forgoes graphic designations of specific uses of property (i.e., maps identifying projected land uses) in favor of a narrative "set of policies and standards" to "guide decision makers." The Polk County Comprehensive Plan sets forth an inventory of existing land uses. The Hardee Power Station Site has been identified in the Polk County Comprehensive Plan as an area utilized for phosphate mining. (The site is classified as Rural Conservation (RC) under the Polk County Zoning Ordinance). The Land Use Element notes that reclamation of such mined phosphate lands "may be directed toward a variety of productive land uses, including . . . industrial . . . use," and expressly encourages and promotes "the restoration of previously mined lands for beneficial uses" (Land Use Plan, pp. 4-5, 5-2). Moreover, an objective of the Land Use Plan is "to ensure that sufficient and appropriate lands are available for the development of industrial uses to broaden the economic/employment base of the county" (Land Use Plan, p. 5-3). To that end, the Land Use Plan specifies that:

- o Each new [industrial] development shall be so located as to protect and complement existing or proposed future land use patterns of the immediate neighborhood.

- o Each new [industrial] development shall be properly located with respect to highways and other transportation facilities adequate to serve the proposed development and the existing demand load.
- o All new industrial development shall be properly buffered from existing and proposed residential areas through the use of space and/or natural vegetation.
- o No industrial development shall be established which would create adverse environmental effects upon adjacent land uses or the larger urban community.

The Hardee Power Station is consistent with the Polk County Comprehensive Plan. The plant will broaden the economic/employment base of the county and will promote the general goal, articulated in the Comprehensive Plan's Electric Utility Element, of ensuring "an adequate source of electrical power capable of serving the present and future needs of the residents." Moreover, siting the Hardee Power Station on reclaimed phosphate lands promotes the goal of restoring mined lands to beneficial uses. The plant site is harmonious with existing and future land use patterns in the area, and is distant from any existing or foreseeable residential or commercial developments.

Appendix 11.2 includes a January 24, 1989, letter from Gerald C. Martin, Zoning Administrator of Polk County, and a January 20, 1989 memorandum from Ron Borchers, Chief of Current Planning for Polk County. The letter and memorandum demonstrate that all components of the Hardee Power Station to be located in Polk County are consistent and in compliance with the Polk County Zoning Ordinance and Comprehensive Plan. These plant components are specifically authorized as "essential services" under the Zoning Ordinance and Land Use Plan.

2.2.3 Demography and Ongoing Land Use

2.2.3.1 Demography

The area surrounding the Hardee Power Station site is sparsely populated. Table 2.2.3-1 lists county and local area historic and projected populations. Figure 2.2.1-1 shows the site location in relation to the surrounding communities. In 1980, the U.S. Census Bureau counted a total of 20,357 people as residents of Hardee County at an average density of 12 people per square km (32 people per square mile) (U.S. Bureau of the Census, 1988). Hardee County's population was estimated to grow by about 17.4% to a total of about 22,745 people in 1988 at an average density of 14 people per square km (36 people per square mile) [U.S. Bureau of the Census, 1988; Central Florida Regional Planning Council (CFRPC), 1988]. The population is projected to continue growing and is expected to reach a total of approximately 26,286 people by the year 2000 (CFRPC, 1988).

The Hardee County population centers nearest to the site are the cities of Bowling Green, about 12 km (7.5 miles) to the east of the site, and Wauchula about 14 km (9 miles) southeast of the site (see Figure 2.2.1-1). Wauchula is the county seat and largest city in Hardee County. The small unincorporated community of Ft. Green Springs is located about 4 km (2.5 miles) south of the southern border of the site. Based on a house count and average household size, it is estimated that approximately 100 people reside in the area.

Approximately 40 km (25 miles) to the north of the site are the Winter Haven and Lakeland census divisions of Polk County which in 1980 contained approximately 78,000 people and 136,445 people, respectively, or about 66% of Polk County's total population. The two divisions grew over 50% between 1970 and 1980 (U.S. Bureau of the Census, 1983). The Lakeland/Winter Haven area is highly urbanized and the focus of most of the growth in Polk County.

The City of Bowling Green showed a high growth rate between 1970 and 1980 during which time its population increased about 70%; from 1,357 to 2,310 people. This rate of increase appears to have slowed during the current

Table 2.2.3-1. Historic and Projected Population for Selected Communities in Hardee and Polk Counties

	1970	1980	1988*	1990*	2000*
HARDEE CO.	14,889	20,357	22,745	24,328	26,286
Bowling Green	1,357	2,310	2,361	2,378	2,437
Wauchula	3,007	2,296	3,294	3,294	3,292
Zolfo Springs	1,117	1,495	1,659	1,714	1,901
POLK CO.	228,515	321,652	398,557	410,902	484,885
Bartow	12,891	14,780	17,079	17,570	19,665
Ft. Meade	4,374	5,546	5,828	5,888	6,144
Frostproof	2,814	2,995	3,235	3,287	3,508
Lakeland	42,803	47,406	63,303	64,986	72,729
Winter Haven	16,136	21,119	25,738	26,725	30,934

* Projected from Central Florida Regional Planning Council, 1988.

Source: Central Florida Regional Planning Council, 1988.

U.S. Bureau of the Census, 1980 Census of Population. Number of Inhabitants - Florida. PC80-1-All Fla. 2/82.

U.S. Bureau of the Census, County and City Data Book, 1988, USGPO, 1988.

decade. The 1988 population was estimated at 2,361 people; only a 2.2% growth over the 1980 total (CFRPC, 1988). The unincorporated portions (Bowling Green Division, Wauchula Division, and Zolfo Springs Division) of Hardee County grew at a much slower rate of about 41% between 1970 and 1980. This more rural portion of the county was estimated to have grown at a rate of about 16% between 1980 and 1988 (CFRPC, 1988).

Polk County contained a population of 321,652 people in 1980 and is estimated to have grown to about 398,557 people between 1980 and 1988, an increase of 23.9% (U.S. Bureau of the Census, 1988; CFRPC, 1988). In 1980 over 70% of Polk County's population resided in urban areas, with a majority of that population located in the north central portion of the county in the Winter Haven and Lakeland vicinities. Population density in Polk County was estimated at 85 people per square km (219 people per square mile) in 1988 (CFRPC, 1988). This density, however, includes the high density areas in the north central part of the county. Population density in Polk County within an 8- or 16-km (5- or 10-mile) radius of the proposed site is actually more closely aligned to densities found in Hardee County.

The City of Ft. Meade, in Polk County, is about 16 km (10 miles) northeast of the site. Ft. Meade has experienced a similar growth pattern to Bowling Green. Its population increased 26.8% to a total of 5,546 between 1970 and 1980, but has slowed during this decade. Estimated population for 1988 indicates that Ft. Meade's population has increased by only 5.1% to a total of 5,828 people (CFRPC, 1988).

2.2.3.2 Ongoing Land Use

Most of the land within an 8-km (5-mile) radius of the site is actively being mined. Citrus groves are the predominant agricultural activity and occupy small pockets of land to the south of the site.

The only residential community within 8 km (5 miles) is Ft. Green Springs which contains about 60 houses (permanent dwellings and mobile homes) and is located about 4 km (2.5 miles) south of the proposed 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. 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 United States Geological Survey (USGS) 7.5 minute quadrangle maps of the site area, aerial photographs dated 1987 and 1988, and field reconnaissance during late 1988 and early 1989.

2.2.4 Easements, Title, Agency Works

The property on which the Hardee Power Station is to be constructed will be owned by SECI.

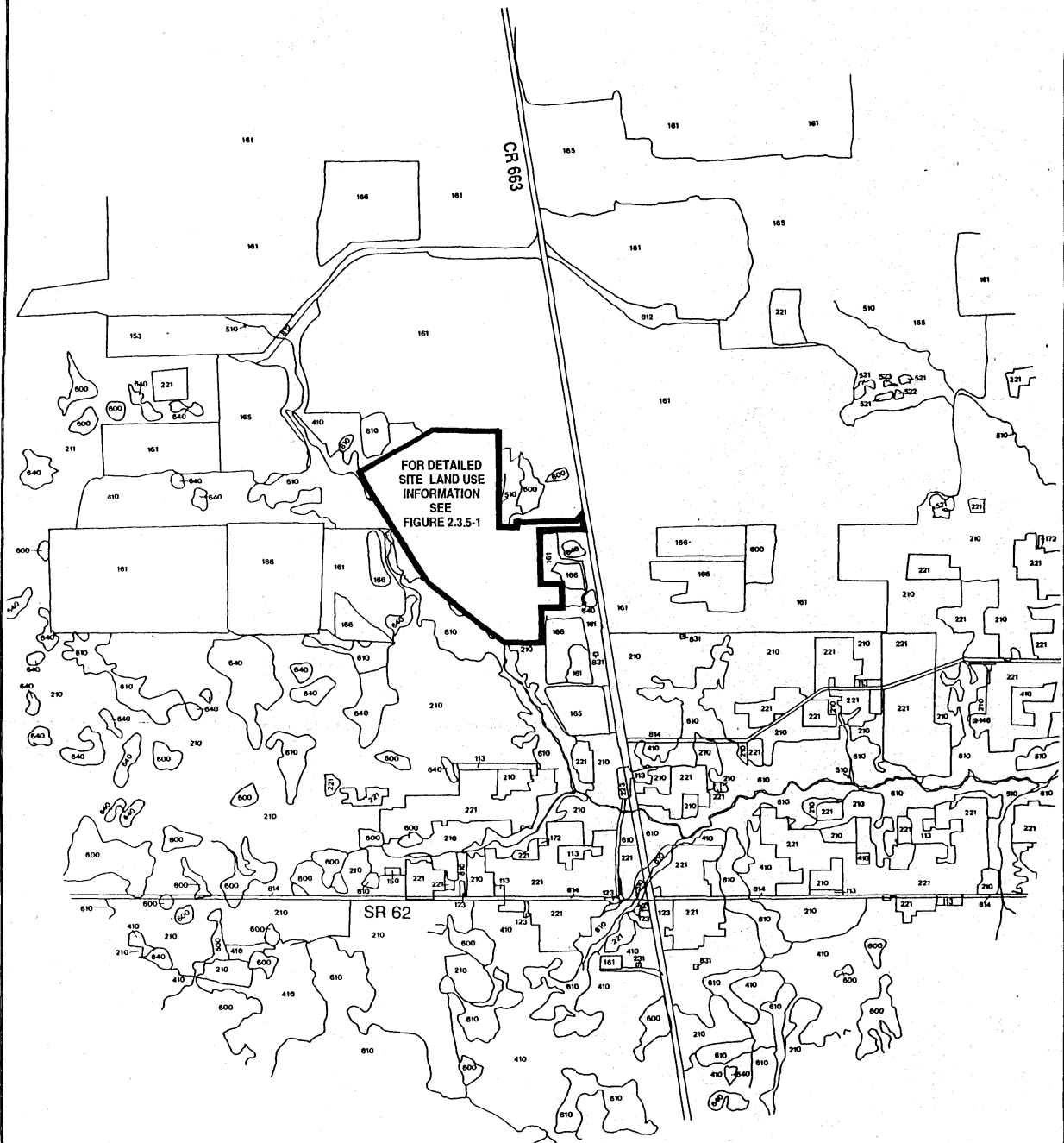
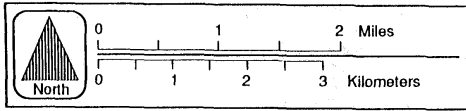
2.2.5 Regional Scenic, Cultural and Natural Landmarks

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

2.2.6 Archaeological and Historic Sites

There are no significant archaeological or historical resources on the site or within the associated facilities area. The area 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 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 and is located in the Hardee County portion of the plant site. The prehistoric site was found by Jerald Milanich and Raymond Willis during a survey of the Ft. Green Mine Tract in 1976. Milanich and Willis concluded that the site was not significant in terms of National Register of Historic Places criteria as stated in 36 CFR 63. This recommendation was made to the Florida Division of Historical Resources (DHR) which concurred with the recommendation.

The Polk County portion of the plant site in Sections 35 and 36 of Township 32 South, Range 23 East and Section 31 of Township 32 South, Range 24 East



113	MIXED UNITS
122	MIXED UNITS
150	INDUSTRIAL
161	STRIP MINE
165	RECLAIMED LANDS
166	HOLDING PONDS
172	RELIGIOUS
210	CROPLANDS AND PASTURELANDS
221	CITRUS GROVES
231	CATTLE FEEDING OPERATIONS
410	UPLAND CONIFEROUS FOREST

510	STREAMS AND WATERWAYS
521	LAKES LARGER THAN 500 ACRES
522	LAKES LARGER THAN 100 ACRES BUT LESS THAN 500 ACRES
523	LAKES LARGER THAN 10 ACRES BUT LESS THAN 100 ACRES
600	WETLANDS
610	WETLAND HARDWOOD FOREST
640	VEGETATED NON FOREST WETLANDS
812	RAILROADS
814	ROADS AND HIGHWAYS
831	ELECTRIC FACILITIES

Figure 2.2.3-1 EXISTING AND PROJECTED LAND USE FOR THE HARDEE POWER STATION PROJECT AREA

**Hardee
Power Station**

has not been surveyed by professional archaeologists. There are, however, no recorded archaeological or historic sites and it is the opinion of the DHR (see Appendix 11.3) "that no significant archaeological and/or 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."

There have been other professional archaeological surveys near the site. Harry Piper, Jacquelyn Piper and Mark Thomsen surveyed Agrico property in northwest Hardee County in 1981. This Agrico Tract was approximately 10 km (6 miles) west of the plant site, and no sites were found in the approximately 91 ha (225 acres) surveyed.

To the north, the Agrico Hookers Prairie Tract was surveyed in 1980 by David Swindell, Dale Benton, Mildred Fryman and James Miller. This tract is, at its closest point, 8 km (5 miles) north-northeast of the Hardee Power Station site. It consisted of approximately 486 ha (1,200 acres) and contained four prehistoric sites. It was the opinion of Swindell, Benton, Fryman and Miller that the sites were not significant in terms of National Register of Historic Places criteria, and the DHR also concurred with this opinion.

2.2.7 Socioeconomics and Public Services

2.2.7.1 Social and Economic Characteristics

EMPLOYMENT

According to the Central Florida Comprehensive Regional Policy Plan, employment opportunities emerged as a regional issue after central Florida's largest employers were affected by economic downturns in the late 1970s and early 1980s (CFRPC, 1987). From 1980 to 1985, the Central Florida Region (comprised of Polk, Hardee, DeSoto, Highlands and Okeechobee Counties) had an annual average unemployment rate of 11.4%; 4.5 percentage

points higher than the state's rate of 6.9%. The CFRPC indicates that this situation is not likely to change in the near future (CFRPC, 1987).

Table 2.2.7-1 lists recent and projected employment for the region.

A majority of the population in Hardee County is employed in agriculture. The 1980 census reported that over 30% of the personal income in Hardee County was derived from farm related activities; less than 6% of the personal income was derived from manufacturing (U.S. Bureau of the Census, 1983). Agriculture was still the highest employment sector in 1985 in Hardee County as reflected in average monthly employment (Table 2.2.7-2), but was followed closely by government, which employed approximately 18% of the county labor force [Florida Department of Labor & Employment Security (FDLES), 1988].

Employment in Polk County is focused in the retail trade services and manufacturing employment sectors (Table 2.2.7-2). In 1985, over 50% of its employed labor force was engaged in one of those sectors. About 14% of the employed labor force was employed by the government. While a significant portion of land in Polk County is dedicated to the mining industry, less than 14% of the county's workforce is employed in mining (FDLES, 1988). Less than 15% of the manufacturing labor force in Polk County is organized, but nearly 90% of the county's unionized workers are involved in the phosphate industry [Economic Development Council (EDC, undated)]. Employment and average annual pay in Polk and Hardee Counties are listed by industry in Table 2.2.7-2.

Hardee and Polk Counties contained a combined labor force of 158,575 workers in 1986 (University of Florida, 1987). During that same year the unemployment rate was estimated at 11.9% in Hardee County and 10.6% in Polk. The unemployment rates for both counties have exceeded 10% since at least the early 1980s and remain among the highest in the state and the country (U.S. Bureau of the Census, 1988).

Table 2.2.7-1. Employment Distribution by Industry for Service Delivery Area 18*

Industry Division	1985 Employment	Percent Of Total Employment	Projected 1995 Employment	Percent Of Total Employment	Percent Growth 1985-1995
Total, All industries	199,501	100.0	269,629	100.0	35.2
Agriculture	15,826	7.9	16,506	6.1	4.3
Mining	4,912	2.5	5,168	1.9	5.2
Construction	10,466	5.3	13,391	5.0	28.0
Manufacturing	23,875	12.0	32,692	12.1	36.9
Durable Goods	10,185	5.1	14,666	5.4	44.0
Nondurable Goods	13,690	6.9	18,026	6.7	31.7
Transportation, Communications & Public Utilities	8,000	4.0	10,250	3.8	28.1
Wholesale & Retail Trades	44,593	22.4	66,727	24.8	49.6
Wholesale	8,035	4.0	10,478	3.9	30.4
Retail	36,558	18.4	56,249	20.9	53.9
Finance, Insurance & Real Estate	9,048	4.5	13,550	5.0	49.8
Services	50,666	25.4	73,397	27.2	44.9
Government	9,387	4.7	12,093	4.5	28.8
Self Employed Workers	22,727	11.4	25,855	9.7	13.8

* Service Delivery Area 18 includes the DeSoto, Hardee, Highlands, Okeechobee, and Polk Counties.

Source: Florida Department of Labor and Employment Security, Bureau of Labor Market Information. SDA Profiles, Labor Market Information, 1988.

Table 2.2.7-2. Employment and Wages of Hardee and Polk County Workers Covered by the Florida Unemployment Compensation Law - 1985

Industry Division	HARDEE COUNTY			POLK COUNTY		
	Average Reporting Units	Average Monthly Employment	Average Annual Pay	Average Reporting Units	Average Monthly Employment	Average Annual Pay
Agriculture, Forestry & Fishing	115	1,761	\$ 7,753	555	9,432	\$ 9,957
Mining	-	-	-	26	4,716	24,769
Construction	29	134	12,170	988	8,442	16,849
Manufacturing	14	292	12,571	445	21,678	19,370
Transportation, Communication, & Public Utilities	15	113	21,155	307	5,329	20,012
Wholesale Trade	23	196	12,500	583	6,690	19,634
Retail Trade	103	845	9,959	1,664	29,407	11,552
Finance, Insurance, and Real Estate	26	191	14,109	639	6,562	16,997
Services	100	536	12,474	2,396	26,088	14,280
Government	32	1,148	14,951	123	16,984	17,771
Federal	6	45	22,316	22	1,133	25,538
State	15	134	16,560	66	3,051	17,291
Local	11	969	14,386	35	12,800	17,198

Source: Florida Department of Labor and Employment Security, Bureau of Labor Market Information. SDA Profiles, Labor Market Information, 1988.

Polk and Hardee Counties recently have been in the top ten unemployment areas of the country. According to the Polk County Economic Development Council (EDC) as the phosphate industry has reduced operations/employment, a large number of persons in the unskilled and semi-skilled labor categories have been left unemployed. These individuals are, in general, stable, lifelong residents of the area who provide a very strong base for training and adaptation to new jobs (EDC, undated).

Polk County has been designated a labor surplus area by the U.S. Department of Labor, which means companies located in the Polk Urban Area become eligible for preference in obtaining federal contracts. The unskilled labor supply of the county consistently exceeds local demands. A state sponsored Industrial Services Training Program is actively promoted within Polk County to help in establishing training programs for employees of new and existing businesses. The program is designed to give immediate response to meet training requirements by providing custom-tailored training services (EDC, undated).

ECONOMIC CHARACTERISTICS

Personal per capita income in the area varies considerably on a county basis. Per capita income in Hardee County was estimated in 1985 at \$7,333, a figure considerably below the state average of \$11,271. Polk County was somewhat higher, with a per capita income in 1985 of \$9,447 (U.S. Bureau of the Census, 1988).

In 1979, about 19% of the families in Hardee County and 10% of the families in Polk County had incomes below the poverty level and over 41% and 34% earned incomes less than \$10,000 in Hardee and Polk Counties, respectively (U.S. Bureau of the Census, 1983). Income characteristics by county are listed in Table 2.2.7-3. Table 2.2.7-4 identifies source of personal income by industry sector.

Table 2.2.7-3. Income Characteristics for Hardee and Polk Counties By Industry

Income Characteristic	Hardee County	Polk County
Average wage/salary earnings per job (1984)	\$11,290	\$15,273
Per Capita Income (1984)	\$ 7,333	\$ 9,447
Median Income - Family (1979)	\$13,661	\$16,512
Median Income - Household (1979)	\$12,028	\$15,273
% of Families below Poverty Level (1979)	19%	10%

Source: U.S. Bureau of the Census. 1988 County and City Data Book, July 1988.

Bureau of Economic & Business Research, College of Business Administration, University of Florida, 1987. Florida Statistical Abstract, 1987.

Table 2.2.7-4. Hardee and Polk County Personal Income By Industry Private
Nonfarm Earnings on Place-of-Work Basis

Industry Division	<u>Percentage of County Total</u>	
	Hardee County	Polk County
Manufacturing	10.86	23.24
Mining	*	6.33
Contract Construction	*	8.48
Wholesale Trade	5.92	7.10
Retail Trade	19.19	17.15
Finance, Insurance and Real Estate	7.01	5.70
Transportation, Communications and Public Utilities	8.16	7.97
Services	19.75	21.24
Other	14.37	2.78

Source: Bureau of Economic and Business Research, College of Business
Administration, University of Florida, 1987. Florida Statistical
Abstract, 1987.

HOUSING

Hardee County contained 6,253 households in 1980 at an average size of 3.05 people per household. This represents a 43.2% increase in the number of households from those counted in the 1970 federal census, but a 9.2% decrease in household size during the same time period. The average household size is somewhat above the average for the state of 2.55 people per household in 1980 and 2.90 in 1970. The number of households is anticipated to continue to increase and was estimated to have grown to approximately 7,321 households at an average size of 2.94 people in 1986. Polk County was estimated to contain approximately 139,724 households in 1986 at an average household size of 2.59 people (University of Florida, 1987).

Housing in Hardee County is primarily owner-occupied and single family structures, a majority of which have been constructed since 1960. In 1985, 33 building permits were issued for new single family homes one of which was to be located in the Bowling Green area. Forty-nine new single family structures were authorized in 1986, with one being located in Bowling Green (University of Florida, 1987).

Polk County experienced a much higher demand for new housing and authorized 2,057 single family homes and 1,009 multi-family structures in 1985 and 2,146 single family and 721 multi-family structures in 1986. A majority of the new units authorized in Polk County are located in the Lakeland/Winter Haven areas (University of Florida, 1987).

In 1980, the median value of an owner occupied home was \$26,300 in Hardee County and \$43,000 in Polk County. Both counties fell below the median for the State of \$45,300 (U.S. Bureau of the Census, 1988). In 1988, the average price for a 2 to 3 bedroom home in the portion of Polk County within 16 km (10 miles) of the site was estimated at \$41,600; the average price in Hardee County was \$40,000 (Bartow Realty, 1989; Davis, 1989). Apartments rented for between \$250 and \$300 per month (Davis, 1989).

2.2.7.2 Area Public Service and Utilities

EDUCATION

In the 1986-87 school year, a total of 3,937 persons were enrolled in public schools (including kindergarten) in Hardee County and 59,233 persons were enrolled in Polk County. Hardee County had a per capita expenditure for education in 1982 of \$527; Polk County spent slightly less, with a per capita expenditure of \$417 (U.S. Bureau of the Census, 1988).

About 45% of the population of Hardee County over the age of 25 years hold high school diplomas and about 7.4% have attended up to 4 years of college. In Polk County about 60% attended high school and 11.4% went through 4 years of college (U.S. Bureau of the Census, 1988).

TRANSPORTATION

Access in and around the area surrounding the Hardee Power Station site is by private vehicle. There are no public transit facilities serving the local area and communities. Figure 2.2.7-1 shows major access routes to the Hardee Power Station.

SR 37 is the primary north-south state highway in southwest Polk County. This is a two-lane facility south of SR 60 in Mulberry and is expected to serve as the primary access route (to its intersection with CR 630) for workers coming from the Lakeland area, and smaller communities such as Mulberry, and Bradley Junction north of the plant site. It is anticipated that workers from these areas will take SR 37 south to CR 630, then turn east to CR 663 and then south to access the site. The 1988 ADT count for the section of SR 37 from SR 60 to SR 630 was 3,969 vehicles (total two-way) [Florida Department of Transportation (FDOT, 1989)]. There are four at-grade railroad crossings on this section, and some truck traffic (about 5%).

The section of SR 37 south of CR 630, down to SR 674 is also likely to be used by workers coming from west of Polk County on SR 674. From SR 674, workers would travel north on SR 37 to CR 630 where they would turn east.

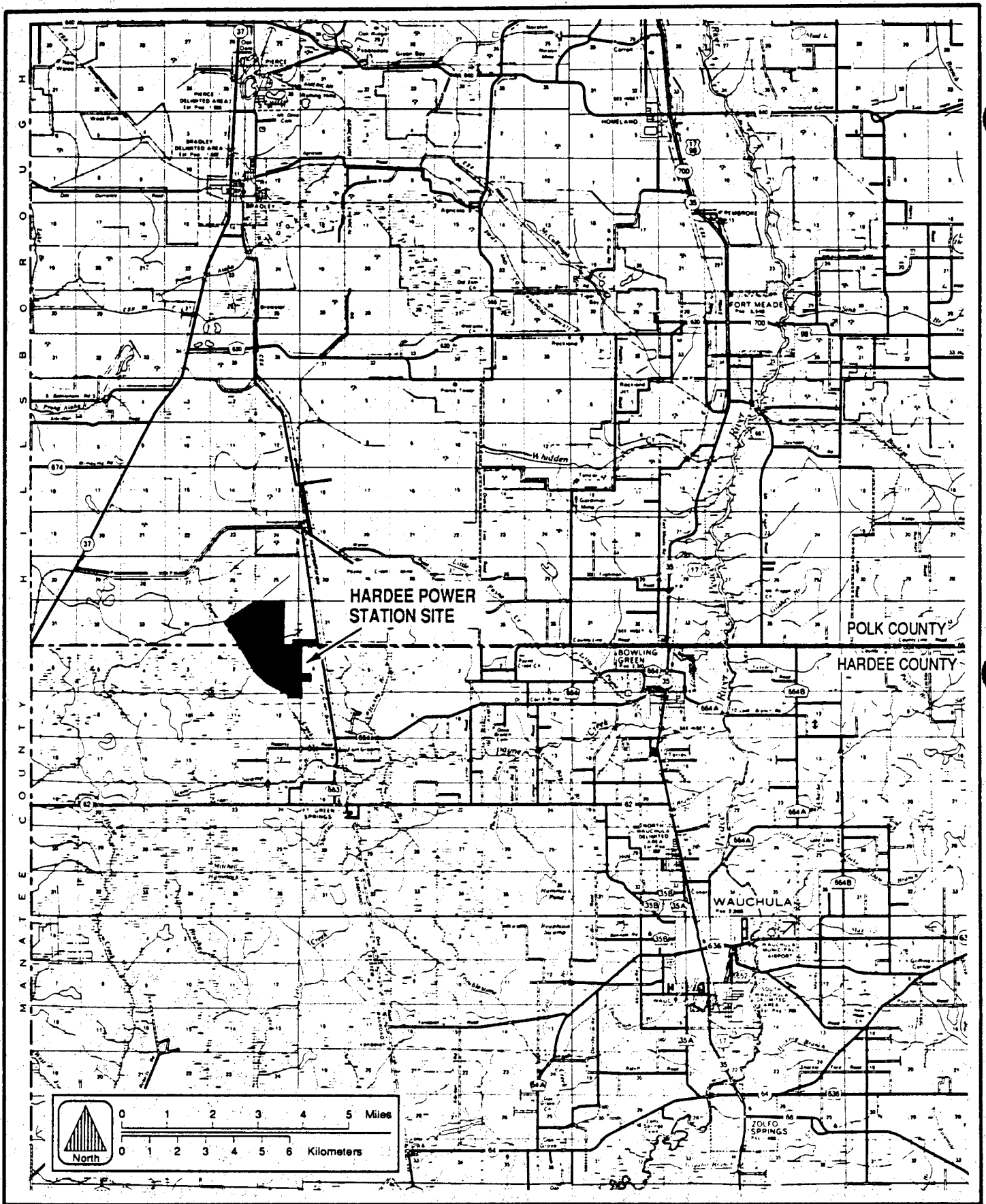


Figure 2.2.7-1 MAJOR ACCESS ROUTES IN THE VICINITY OF HARDEE POWER STATION

Hardee Power Station

The section of SR 37 between SR 674 and CR 630 had a 1988 ADT of 3,660. There are no rail crossings on this section of the road.

Access to the site from Polk County communities of Winter Haven and Bartow, northeast of the site, and Ft. Meade to the east is provided over US 17/SR 35. This is a four lane-divided highway from SR 60 in Bartow to its intersection with SR 700 in Ft. Meade. While this highway follows a somewhat southeasterly direction (away from the site) between Bartow and Ft. Meade, its high speed/high capacity design and its absence of rail crossings will likely induce many workers coming from northern communities to take it south to CR 630, where they will turn west to CR 663 to gain access to the site. Its current ADT in 1988 was 13,903 north of the intersection with CR 630/SR 700, and 8,982 south of that location.

While US 17/SR 35 carries a strong volume of almost 9,000 ADT south to Bowling Green in Hardee County, it is not likely that site workers will follow that route to the site (via CR 664 and CR 663) since it is a longer route to the site than the one through Polk County (via CR 630 and CR 663). The only portion of US 17/SR 35 in Hardee County that is likely to be used by workers would be that portion south of its intersection with SR 62. This segment would provide access for workers coming from Wauchula and Zolfo Springs in Hardee County, and Arcadia in DeSoto County. These workers would turn west at SR 62 to head toward the site. The current (1988) ADT on the portion of US 17/SR 35 just south of SR 62 is 10,167. There is moderate truck traffic, and no at-grade rail crossings along this route.

CR 555 was built by the state and is currently maintained by Polk County and provides northeast-southwest access to the site from SR 60 in Bartow to CR 630 west of Ft. Meade. This road provides a direct, low volume alternative (to US 17/SR 35) for workers coming from the Winter Haven-Bartow area. Its current ADTs are 3,112 south of SR 60, and 2,512 just north of CR 630. At its intersection with CR 630, workers would turn west toward the site. 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/SR35. This two lane Polk County highway was also originally a state highway. Site workers would use this route both eastbound from SR 37, and westbound from either US 17/SR 35 or CR 555 to CR 663, where they would turn south toward the site. ADT volumes on CR 630 are generally low; 2,851 and 1,485 to the east and west of CR 555, respectively. East of CR 663 the ADT is 2,091 and west of it the ADT is 1,857. There is a high level of truck traffic on this road as well as four at-grade rail crossings.

Access to the site from western coastal communities and the population centers of Hillsborough County is provided over SR 674. This two-lane, east-west highway terminates at its intersection with SR 37. At that point workers would travel north to CR 630 to the site. The 1988 ADT for SR 674 just west of SR 37 was 1,449.

CR 663 is a two-lane, county-maintained highway extending from Bradley Junction to the south of the site entrance. South of SR 62, CR 663 is an unpaved road and is not a viable alternative to other local roads. CR 663 will provide the principal access for workers coming south from all directions. While the road has generally good surface condition, and presently carries a very low ADT (about 450 in 1986 in Polk County and 430 in 1987 in Hardee County), the Polk County portion has some alignment changes and rail crossings. Traveling south from CR 630, the road makes four 90-degree turns as it crosses first to the east, then back to the west of the CSX rail line. The CSX trains average 8-12 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 two-lane state highway that runs east-west, and will provide workers with access from points west and from the southeast (via US 17/SR 35). Worker traffic coming from either the west or the east on SR 62 would turn north on CR 663 to access the site. The ADT on the section of SR 62 just east of CR 663, was 2,589 in 1988. There is moderate truck traffic on this road.

CR 664 is a two 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 be those coming west from Bowling Green. While no recent ADT was available for this route it was estimated by Hardee County Road staff to be about 300, including some truck traffic, and possibly some seasonal (December-June) farm equipment. 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 (1/2 mile) to the east of the center of the site and 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 airports or airfields are located within an 8-km (5-mile) radius of the proposed site.

MEDICAL FACILITIES

A variety of medical service is available in the region. The average physician/patient rate in Polk County was 123.4 per 100,000 people in 1980; Hardee County's rate was somewhat lower at 51.6. Both rates are below the state average of 170.7 (U.S. Bureau of the Census, 1983).

Hardee County contains one general hospital with 50 beds and Polk County contains eight hospitals with a total capacity of 1,811 beds. 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 (Jones, 1989). In Polk County, within an approximate 16-km (10-mile) radius of the facility, Ft. Meade and Mulberry each contain

one ambulance and medical team. Bartow, located further north, also contains two ambulances and two emergency medical teams (Geiger, 1989).

FIRE FIGHTING FACILITIES

Fire fighting 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 21 (Jones, 1989).

In Polk County, Ft. Meade's force of 25 is entirely voluntary, however, the fire department in Bartow contains 15 full-time firefighters and 35 voluntary members. Bradley Junction has one full-time and seven volunteer members (Gunter, 1989). Table 2.2.7-5 lists firefighting equipment by communities.

POLICE PROTECTION

The Hardee County Sheriff Department maintains a force of 55 with 24 vehicles and is responsible for police protection in the unincorporated portions of the county (Maddox, 1989). Bowling Green, Wauchula and Zolfo Springs have police departments which serve those communities. The police force in Bowling Green consists of five full-time employees, five part-time employees and five vehicles (Pearson, 1989). Wauchula's police department consists of 11 full-time, one part-time, and five auxiliary employees, and eight vehicles (Morin, 1989). Zolfo Springs' police department consists of four employees and three vehicles (Vickery, 1989). In addition to county and local police the area is also served by the Florida Highway Patrol, with three to four officers stationed in Hardee County (Maddox, 1989).

As of January 1, 1989, Polk County had 345 certified law enforcement full-time employees and 27 certified law enforcement part-time employees. Within the unincorporated portion of the county are four primary patrol zones. Each patrol zone is normally staffed by one uniform deputy sheriff per shift, 24 hours a day. In addition, Bartow, Mulberry, and Ft. Meade each have police departments which service these communities (Lawton, 1989).

Table 2.2.7-5. Firefighting Equipment for Communities Within Approximately 10 Miles of the Hardee Power Station Site

	<u>EQUIPMENT</u>	
	<u>PUMPERS</u>	<u>TANKERS</u>
HARDEE CO.		
Bowling Green	1	1
Wauchula	2	1
Zolfo Springs	1	1
Polk Co.		
Ft. Meade	3	2
Bartow	3	2 (Plus 1 Aerial truck)
Bradley Junction	1	1

Source: Captain Harold Jones, Hardee Fire & EMS Dept., 1989.
W. Gunter, Bartow & Ft. Meade Fire Depts., 1989.
L. Webb, Bradley Fire Dept., 1989.
D. Geiger, Polk County Public Safety, 1989.

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, over 32 km (20 miles) away.

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 are located within 16 km (10 miles) of the proposed site.

ELECTRIC AND GAS

Electricity is supplied to the area by the Peace River Electric Cooperative, Florida Power & Light and Tampa Electric (Polk County only). Hardee County contains no natural gas pipelines. The Florida Gas Transmission Company distributes gas to Ft. Meade.

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. Table 2.2.7-6 lists usage and capacity of each system.

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

Table 2.2.7-6. 1989 Municipal Water Supply Usage and Capacity for
Selected Communities in Hardee and Polk Counties

	Current Use	Capacity
HARDEE COUNTY		
Bowling Green	0.4 MGD	1.2 MGD
Wauchula	0.875 MGD	2.0 MGD
Zolfo Springs	0.225 MGD	0.4 MGD
POLK COUNTY		
Ft. Meade	1.0 MGD	1.0 MGD*
Bartow	3.6 MGD	4.0 MGD

* Amount permitted - estimated capacity is 6.0 MGD.

Source: D. Allen, Bartow Water Dept., 1989.
M. Hodge, Polk Co. Water Dept., 1989.
Zolfo Springs Municipal Office, 1989.
M. Bryan, Bowling Green Municipal Offices, 1989.
J. Colson, Polk Co. Water & Sewer Dept., 1989.
G. Heine, Wauchula Municipal Offices, 1989.
L. Messer, Ft. Meade Municipal Offices, 1989.

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 Ft. Meade and Bartow in Polk County. Table 2.2.7-7 lists usage and capacity for each system.

SOLID WASTE DISPOSAL

One solid waste disposal area, a landfill, is located in Wauchula in Hardee County. The landfill has a capacity of 10 to 15 years and an average usage of 200,000 tons per year.

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 has an average usage of about 1,100 tons per day with an anticipated capacity of 45 years.

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

	Current Use	Capacity
HARDEE COUNTY		
Bowling Green	0.175 MGD	0.3 MGD
Wauchula	0.83 MGD	1.0 MGD
Zolfo Springs	0.11 MGD	0.2 MGD
POLK COUNTY		
Ft. Meade	0.45 MGD	1.0 MGD
Bartow	2.3 MGD	2.75 MGD

Source: M. Bryan, Bowling Green Municipal Offices, 1989.
J. Colson, Polk Co. Water & Sewer Dept., 1989.
Zolfo Springs Municipal Offices, 1989.
G. Heine, Wauchula Municipal Offices, 1989.
D. Allen, Bartow Water Dept., 1989.

2.3 BIOPHYSICAL ENVIRONMENT

2.3.1 Geohydrology

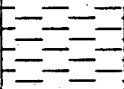
2.3.1.1 Geologic Description of the Site-Area

REGIONAL STRATIGRAPHY

The Hardee Power Station lies within Polk and Hardee Counties and is underlain by soils and rock primarily of Tertiary age (Stewart, 1966; Wilson, 1977). Most of the immediate site area has been or is in the process of being mined, however, these activities directly affect only the upper 9 to 12 m (30 or 40 ft) of substrate. After mining, reclamation estimates will 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 formation is the Cedar Keys which overlies rocks deeper than 610 m (2,000 ft). Above these formations is the Oldsmar Limestone which underlies all of the Florida peninsula. The Avon Park Limestone thickens to greater than 305 m (1,000 ft) and is found above the Oldsmar. The Avon Park is the primary aquifer across Florida (see Section 2.3.2). Overlying the Avon Park is the Ocala Group which consists of (in ascending order) the Inglis formation, the Williston formation, and the Crystal River formation. 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,

TERTIARY	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
	PLEISTOCENE						
	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.	
	OLIGOCENE		SUWANNEE			LIMESTONE, NODULAR, GRANULAR, CHALKY, FOSSILS, CREAM TO WHITE IN COLOR.	FLORIDAN AQUIFER
	EOCENE	OCALA	CRYSTAL RIVER			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.	
			WILLISTON				
			INGLIS				
	PALEOCENE		AVON PARK			LIMESTONE, CHALKY, NODULAR, FRAGMENTAL, w/ANHYDRITE AND GYPSUM; CREAM WHITE TO BUFF.	
			OLDSMAR			LIMESTONE, AS ABOVE, WITH RUBBLE ZONES.	
			CEDAR KEYS			ANHYDRITE AND DOLOMITE BEDS WITH GYPSUM NODULES.	

SOURCES: AD HOC COMMITTEE ON FLORIDA
HYDROSTRATIGRAPHIC UNIT DEFINITION (1986)
WILSON (1977)
STEWART (1966)

Figure 2.3.1-1 GENERALIZED STRATIGRAPHIC COLUMN OF THE SITE VICINITY

**Hardee
Power Station**

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.

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.

SITE-AREA STRATIGRAPHY

The results of four deep borings were used to prepare the general stratigraphic section for the site. These borings are the Southwest Florida Water Management District (SWFWMD) Regional Observation Monitoring Program (ROMP) #40 well near Duette, the United States Steel Agri-Chemicals (USSAC) South Rockland Well in Section 1 of T33S R24E about 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 T34S R23E about 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 from 108 to 204 m (355 to 670 ft) and the Ocala Limestone 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 Lake City (Oldsmar) Limestone at a total depth of 550 m (1,800 ft).

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 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.

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 towards 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 either been recently strip mined or are scheduled to be mined in the near future. This mining activity typically removes the unnamed surficial sands (overburden) and places 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), is altered where mining activity is complete. Strip mining has been conducted and is presently taking place on portions of the site resulting in deep ponds of standing water surrounded by arcuate spoil piles rising as much as 6 to 9m (20 to 30 ft) above natural grade. Other parts of the site have not been mined and remain undisturbed.

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

1. Ten Standard Penetration Test (SPT) borings. These borings are identified as B-1 through B-10 and were drilled to depths varying from 12 m (40 ft) to over 61 m (200 ft).

2. Six shallow surficial aquifer piezometers drilled and developed from an approximate depth of 6.1 m (20 ft). These piezometers are identified as B-1, B-2, B-3, B-10, B-11 and B-12.
3. Three deep intermediate aquifer piezometers drilled and developed to depths greater than 61 m (200 ft). These piezometers are identified as B-3A, B-10A and B-12A.

The logs of these borings and piezometer installations were submitted to FDER under separate cover and are also included in the Appendix 11.4.

These borings were advanced with casing and water to approximately 9 m (30 ft), except for the deep borings which were advanced with casing to 25 m (80 ft) and then open hole using native drilling mud to bottom of hole. Geologic logs of these borings have been submitted to FDER under separate cover and are available on request.

Split spoon samples, Shelby tube samples, and wash samples were obtained. 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 all 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.

An east-west cross section of the upper 30 m (100 ft) of soil is shown in Figure 2.3.1-3, and a north-south cross section showing the deeper units is shown in Figure 2.3.1-4. Cross sections across the site have been developed (see Figure 2.3.1-5 for locations).

SOIL CLASSIFICATION CHART ASTM D 2487

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COURSE-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
HARDEE POWER STATION SITE

**Hardee
Power Station**

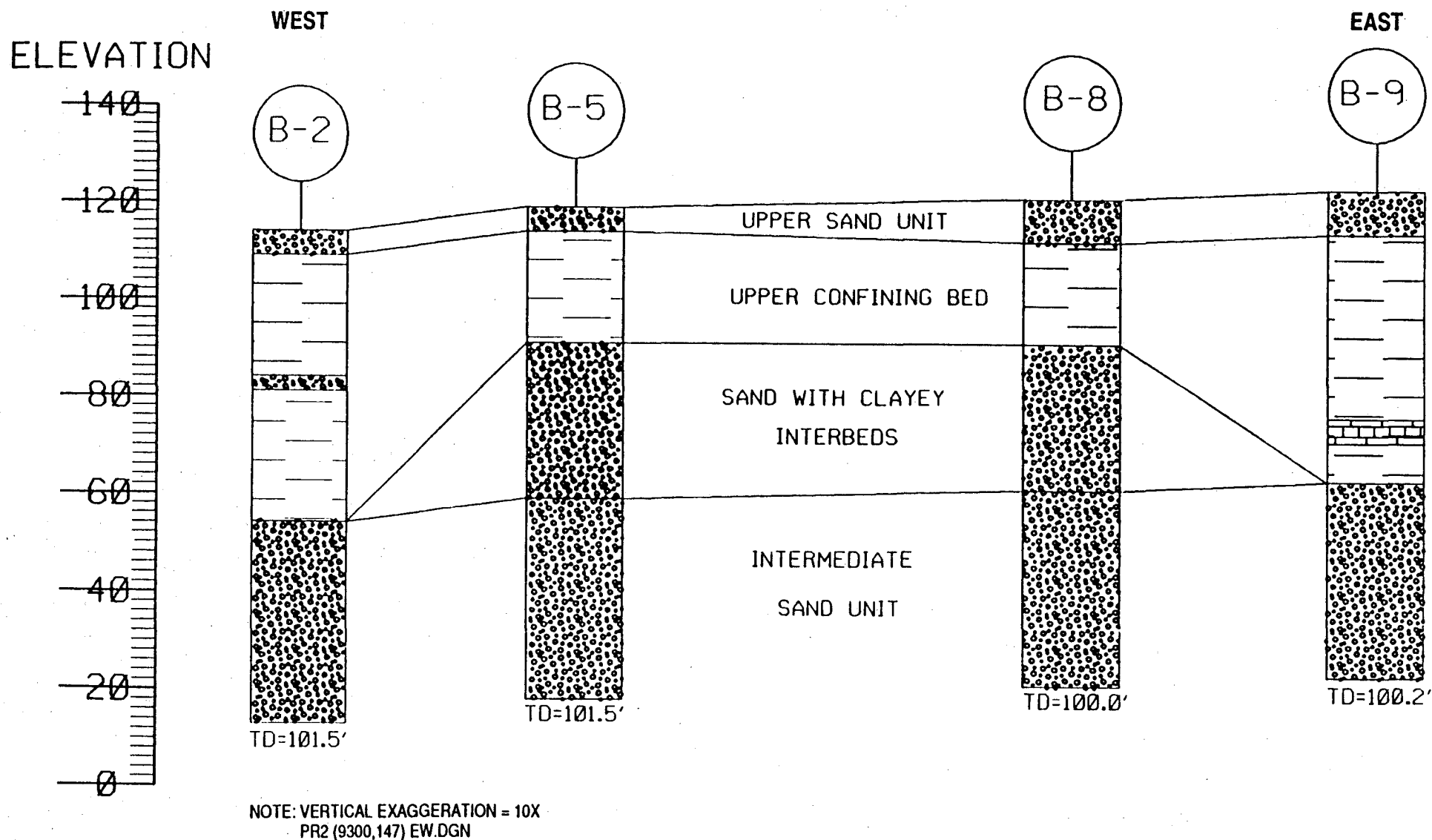
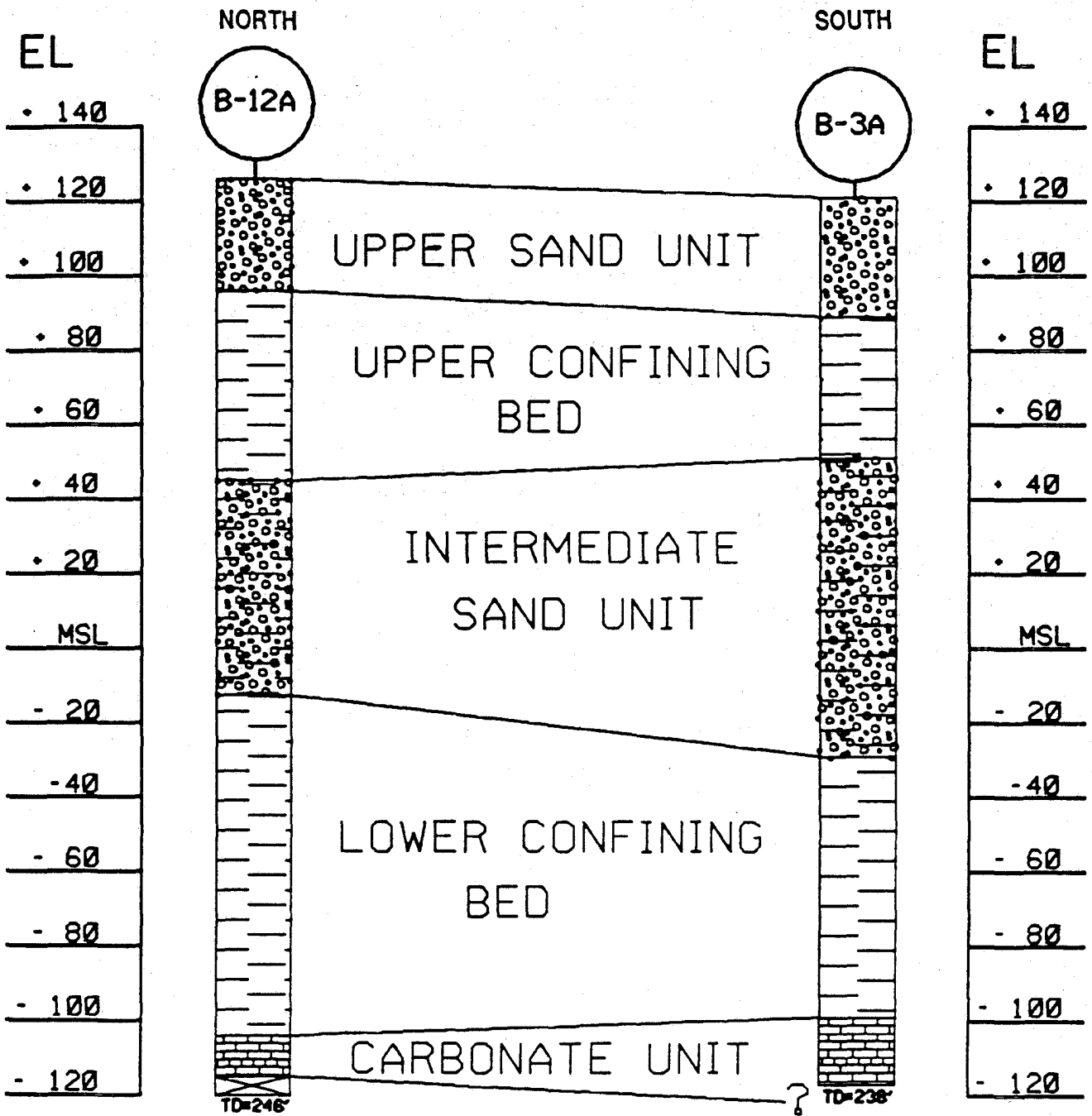


Figure 2.3.1-3 GENERALIZED EAST-WEST STRATIGRAPHIC CROSS-SECTION OF THE HARDEE POWER STATION SITE

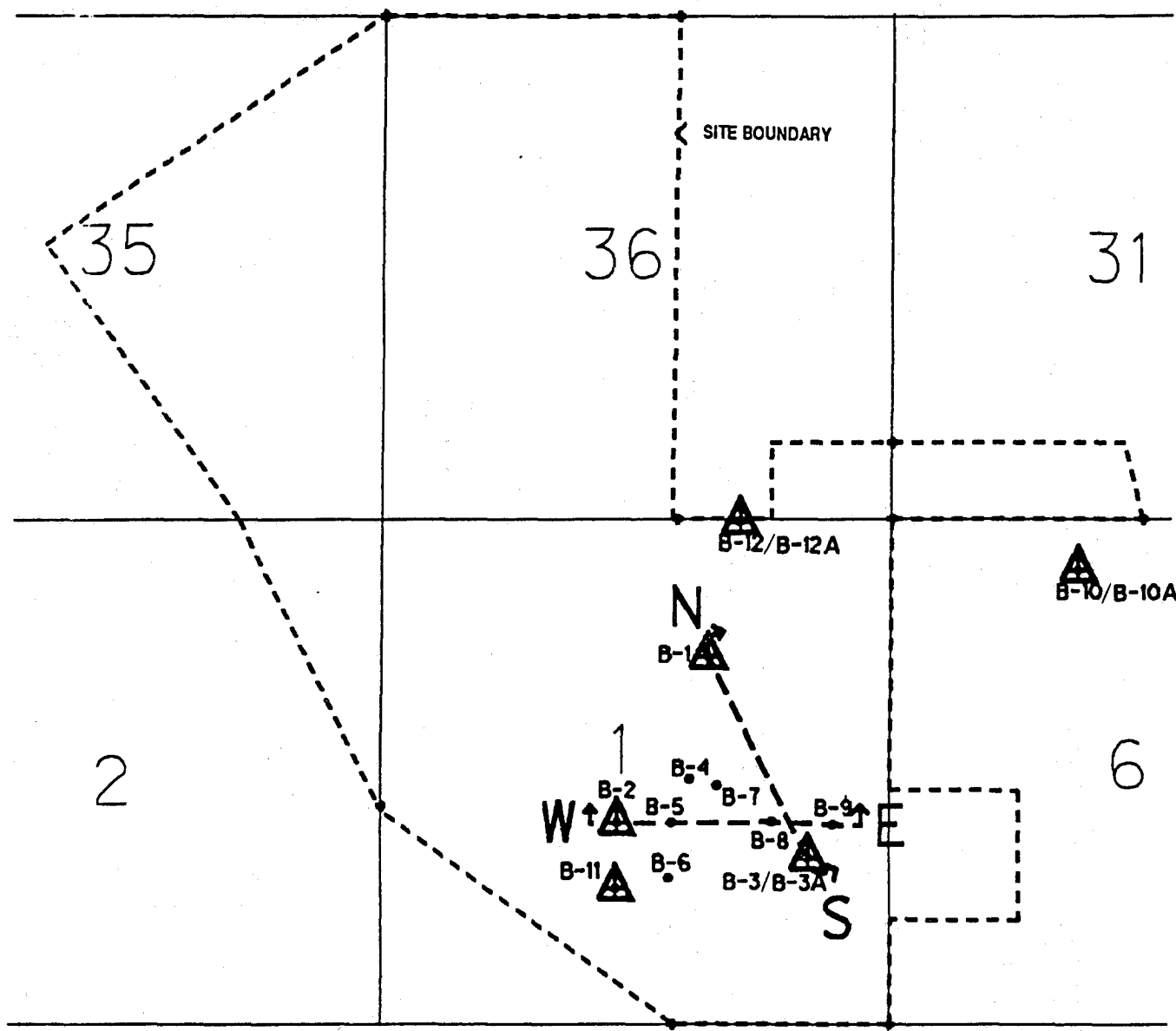
**Hardee
Power Station**



NOTE: VERTICAL EXAGGERATION = 40X

Figure 2.3.1-4 GENERALIZED NORTH-SOUTH STRATIGRAPHIC CROSS-SECTION OF THE HARDEE POWER STATION SITE

**Hardee
Power Station**



LEGEND



TEST BORING LOCATION (B-SERIES, 1988 PROGRAM)

OBSERVATION WELL LOCATION

NOTES: B-1, 2, 3, 10, 11, AND 12 ARE SHALLOW
B-3, 10, AND 12 ARE ALSO DEEP (IDENTIFIED IN TEXT AS
B-3A, B-10A, AND B-12A)

HARDPAN (BASE OF SURFICIAL AQUIFER) CONTOUR
ELEVATIONS IN FEET ABOVE MSL
EXTRAPOLATION FROM B-SERIES TEST BORINGS BASED
ON FLORIDA GEOLOGICAL SURVEY IC-103,
WELLS W-15346, W-13238, W-13238, W-11570, W-13245

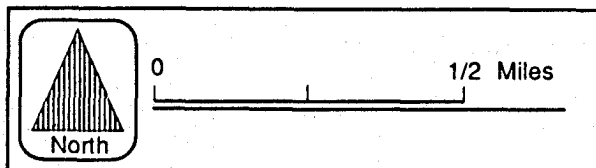


Figure 2.3.1-5 BORING LOCATION PLAN WITH CROSS-SECTION LINES

**Hardee
Power Station**

The Upper Sand Unit is being mined and replaced with tailing sands on portions of the site. The material is a gray, fine grained sand which becomes browner and siltier with depth. The natural water content of these soils averages 12% and the percent fines ranged from 18 to 34% in 8 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 towards the base. Water contents range from 25-60% from 37 tests on these materials. Liquid limits averaging 90% and plastic limits averaging 30% were found in 27 tests. Dry densities from tube samples were extremely variable from 18 tests yielding total porosities of 30 to 70%. From 30 grain size tests, the percent fines ranged from 18 to 62%. 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% found in some samples. Cation exchange capacities are expected to be as high as 100 milliequivalents (meq)/100 grams (gms) for the clays which 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 gms. The relationship between ion exchange capacity and movement of contaminants is discussed in Section 2.3.1.3. 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 ranges 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%, the liquid limit was 74% (avg) and the plastic limit was 37% (avg) 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 sample gave total porosity values of 52% and 64% and percent fines ranged from 15 to 45%. 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%, an average liquid limit of 60%, plastic limit of 38%, and percent fines ranged from 35 to 60%. 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 (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% 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 with 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, Ft. Green fine sand on 2 to 5% 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 greater than 2 m (80 inches) from the surface.

This statement describes the present topography and soils at the site prior to reclamation and construction.

The lowest point on the 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 towards the north and northeast at a fairly uniform grade to a maximum elevation +42 m (+137 ft) at the extreme northeastern corner of the site. Several circular depressions are shown on the air-photos and topographic maps which predate the mining activity. These features are discussed in Section 2.3.2.2.

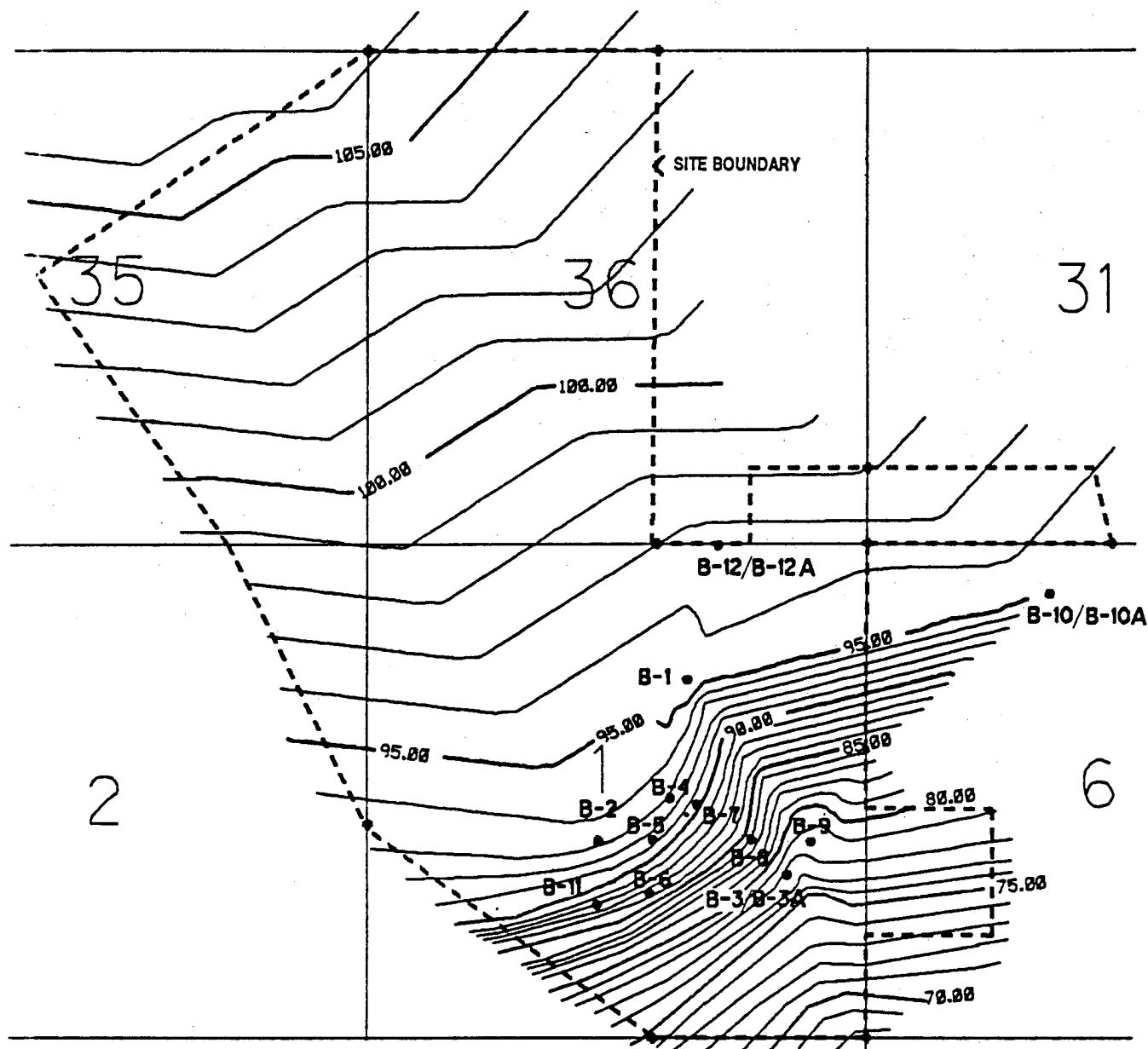
Polk County has been geologically mapped in detail (Campbell, 1986) while Hardee County has not. Significant geologic units in the site area (Brooks, 1981) include mainly the Pliocene Bone Valley (Pbv) formation which is mapped in the site area. To the east along the Peace River, the Miocene Hawthorn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

Differentiating 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 can not be relied upon as a confining bed. Presence of ditch drains (see Section 4.1.4) and deeper mine pits on site 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 2.3.1-5 shows the boring location plan for the 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

Ten test borings (B-1 through B-10) were executed near the power plant site and two (B-5 and B-6) were drilled in the power block area. Test borings, using the standard penetration test were performed in accordance with ASTM-D1586. The bearing strengths of the overburden soils were determined from standard penetration tests (performed in accordance with ASTM D1586) in the coarser material and unconsolidated undrained triaxial compression tests (per ASTM 2850) in the finer material. The coarser material had blow counts



↑ — ↑ CROSS SECTION LOCATIONS (FIG. 2.3-2, 2.3-3)

● TEST BORING LOCATION (B-SERIES, 1988 PROGRAM)

△ OBSERVATION WELL LOCATION

NOTES: B-1, 2, 3, 10, 11, AND 12 ARE SHALLOW
B-3, 10, AND 12 ARE ALSO DEEP (IDENTIFIED IN TEXT AS
B-3A, B-10A, AND B-12A)

HARDPAN (BASE OF SURFICIAL AQUIFER) CONTOUR
ELEVATIONS IN FEET ABOVE MSL
EXTRAPOLATION FROM B-SERIES TEST BORINGS BASED
ON FLORIDA GEOLOGICAL SURVEY IC-103,
WELLS W-15346, W-13238, W-13238, W-11570, W-13245



0 1/2 Miles

Figure 2.3.1-6 GEOLOGIC MAP OF HARDPAN

**Hardee
Power Station**

varying from five blows per foot to over 50 blows per foot, with the higher blow count material generally indicating a cemented layer. The shear strengths and settlement characteristics of the finer materials were determined through triaxial and consolidation testing, performed in accordance with ASTM D2850 and D2435 respectively, and in situ dilatometer tests. The dilatometer tests were performed in accordance with the recommendations of ASTM subcommittee D18.02.10. These results are included in Appendix 11.4. The strength of the Hawthorn Formation was determined from standard penetration tests. The blow counts were generally greater than 50 blows per ft indicating well compacted material.

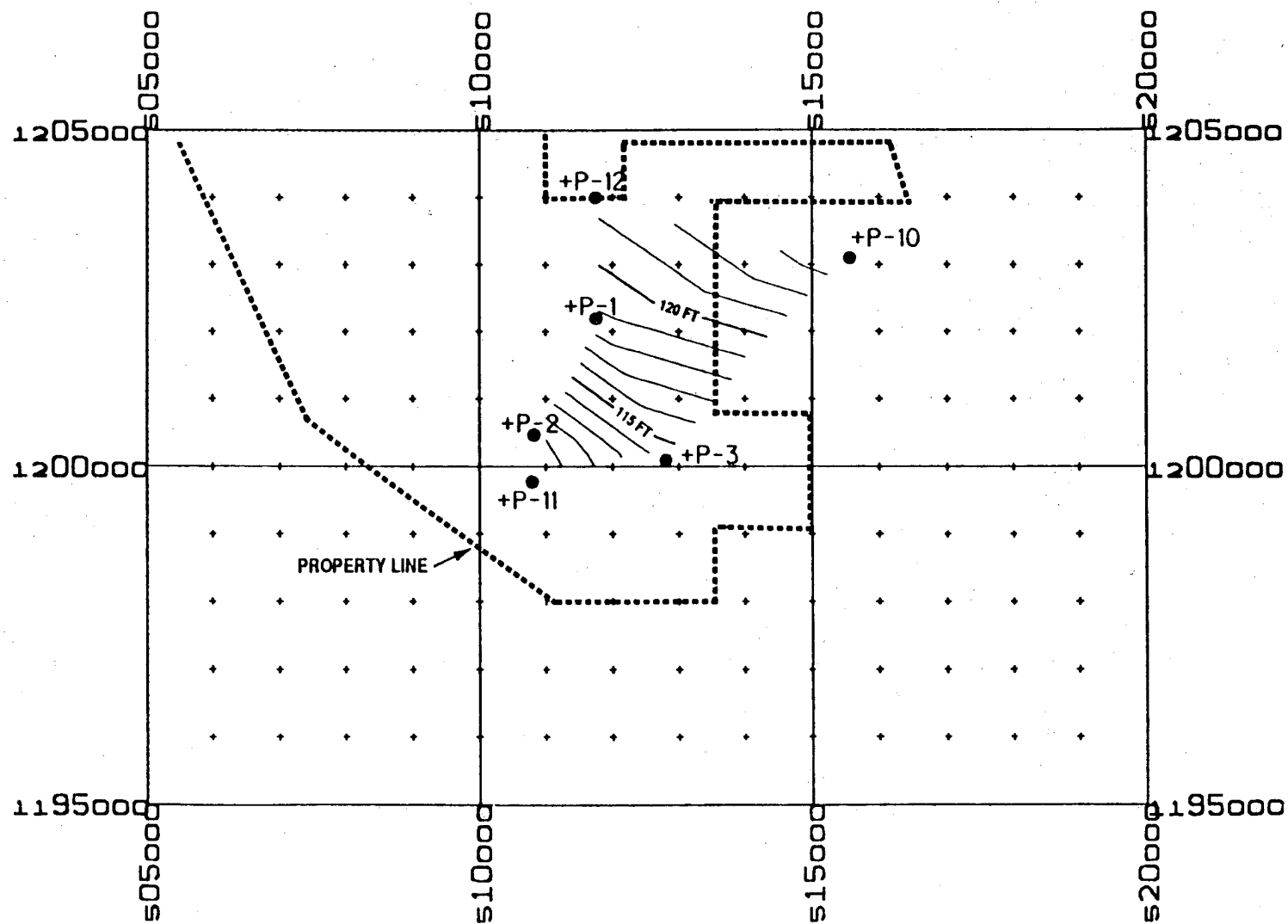
The main plant structures, while relatively lightly loaded, have stringent settlement requirements. Using mat foundations, the estimated settlements will exceed those requirements, primarily due to the compressible shallow clay deposits. Therefore, foundations for the main plant structures will be supported on either driven displacement piles with predrilling or auger cast piles. The displacement piles will enact friction and end bearing for resistance, while the auger cast pile will enact only friction for resistance. Both pile types will be placed to an approximate depth of 15 m (50 ft). More lightly loaded structures may be founded on shallow spread footings. Tanks will be founded on ring-beam footings.

2.3.2 Subsurface Hydrology

2.3.2.1 Subsurface Hydrologic Data for the Site

SHALLOW AQUIFER

Groundwater on this aquifer is classified as G-II. The shallow water table was monitored at the site at six locations (see Figure 2.3.1-5) using 5.1 cm (2-inch) PVC observation wells. These wells have 1.5 m (5 ft) screens at depths of 4.5 to 6 m (15 to 20 ft) below ground. (See Appendix 11.4 for well construction details.) Figure 2.3.2-1 shows the time dependent shallow water table contours across the site. Horizontal gradients are 0.00267 m/m. Falling head borehole permeability testing was conducted in these



NOTE: COORDINATES SHOWN ARE FLORIDA EAST STATE PLANE COORDINATES,
IN FEET CONTOUR INTERVAL EQUALS 1.0 FEET
PR2: (300,147) SITE.DGN

Figure 2.3.2-1 POTENTIOMETRIC SURFACE OF THE WATER TABLE AQUIFER
(DECEMBER 1988)

**Hardee
Power Station**

piezometers on December 11, 1988. Results are shown in Table 2.3.2-1. The objective of these tests was to determine the permeability and hydrologic characteristics of the shallow groundwater aquifer. Continuous monitoring of this aquifer such as at the SWFWMD #40 shallow well near Duette, Florida, indicated that the water levels in the surface water aquifer fluctuated approximately 1.5 m (5 ft) during a 5-year period of record.

Flows in the shallow aquifer are generally towards Payne Creek to the south at a typical rate of 0.5 millimeters (mm) per day. Saturated flows closely parallel the top of the clayey sand which is considered to be the top of the Bone Valley formation.

Data from a total of 13 pump tests within a 24 km (15 miles) radius of the site were obtained from SWFWMD (SWFWMD, 1988, Table 4). These tests suggest that for the shallow aquifer, the coefficient of transmissibility (T) equals 1,500 square ft per day and that the specific yield (Sy) equals 0.13 or 13% 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 (SWFWMD, 1988, Figure 20) ambient groundwater quality monitoring program, the following regional trends are considered as background levels: total dissolved solids (TDS) is expected to be less than 250 milligrams/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 confirmed in February and March 1989, with results listed in Table 2.3.2-2. Pertinent parameters tested met primary and secondary drinking water standards.

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

Piezometer No.	Ground Surface Elevation (ft) Mean Sea Level	Ground Water Elevations (ft) Mean Sea Level	Permeability (cm/sec)
P-1	122.3	118.8	$2.0 \times 10E-4$
P-2	114.2	109.4	$2.0 \times 10E-4$
P-3	121.7	114.3	$4.9 \times 10E-4$
P-10	127.4	123.9	$1.3 \times 10E-4$
P-11	113.1	109.8	$1.7 \times 10E-4$
P-12	126.3	121.7	$3.2 \times 10E-4$

Table 2.3.2-2 Water Quality Characteristic of the Shallow Aquifer at the Hardee Power Station Site (February/March 1989)

Parameters	Well Number	
	P3*	P12*
Total Alkalinity, mg/L as CaCO ₃	6.0	12.0
Chloride, mg/L	15.5	24.2
Nitrate+Nitrite Nitrogen, mg/L	<0.005	0.009
Ortho-Phosphorous	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, umhos/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, ug/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, ug/L	4.0	6.0

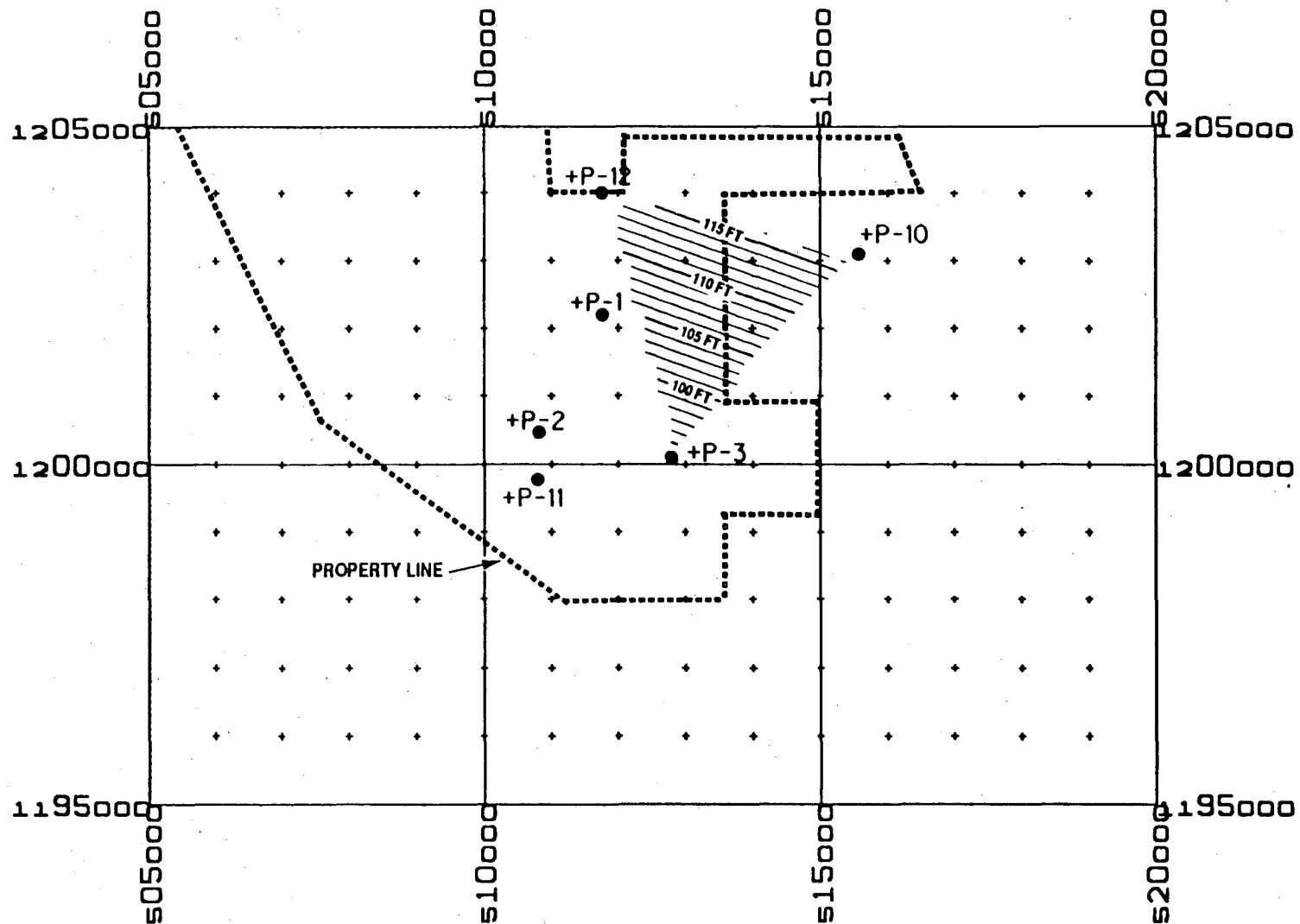
* These wells are 30 feet below present existing grade

INTERMEDIATE AQUIFER

The Intermediate aquifer was monitored at the site at three locations (B-3A, B-10A and B-12A) using 2-inch PVC observation wells. These wells were screened between depths of 30 and 60 m (100 and 200 ft) below existing grade. (For construction details, see Section 10.5.3.) Figure 2.3.2-2 shows the time dependent intermediate aquifer piezometric contours across the site. Horizontal gradients were 0.00625 m/m. Falling head borehole permeability testing was conducted in these piezometers on December 11, 1988 to determine the permeability and hydrologic characteristics of the intermediate aquifer. Results are shown in Table 2.3.2-3. When B-3A was developed, the groundwater level was measured at an elevation of 29.7 m (97.3 ft). This elevation was slightly lower than the reported average elevation range [30.4 to 33.5 m (100 to 110 ft)] of the intermediate aquifer (SWFWMD, 1988) and the measured elevations at piezometers B-10A and B-12A. Measurements taken later indicate that groundwater at B-3A was at an elevation of 16.7 m (54.7 ft) suggesting that the piezometer was drilled and developed in the Upper Floridan Aquifer reported by SWFWMD (1988) to have an average range in elevation of 15.2 to 18.3 m (50 to 60 ft).

A total of nine pump tests within a 24 km (15 miles) radius of the site were obtained from SWFWMD (SWFWMD, 1988, Table 4). These tests suggest that for the intermediate aquifer, the coefficient of transmissibility (T) equals 2,400 square ft per day; storativity (S) equals 0.0002; and leakance coefficient (L) equals 0.0002 cu ft per day per cu ft. The ratio of horizontal to vertical hydraulic conductivity is on the order of 2000.

Based on the SWFWMD (1988, Figure 27) ambient groundwater quality monitoring program, the following regional trends are considered as background levels: total dissolved solids (TDS) is expected to be between 200 and 300 mg/L; total hardness (TH) less than 120 mg/L; chlorides (Cl) less than 25 mg/L; and sulfates (SO₄) less than 25 mg/L. Site specific water quality results



NOTE: COORDINATES SHOWN ARE FLORIDA EAST STATE PLANE COORDINATES,
IN FEET CONTOUR INTERVAL EQUALS 1.0 FEET
PR2: (300,147) SITE.DGN

Figure 2.3.2-2 POTENTIOMETRIC SURFACE OF THE INTERMEDIATE AQUIFER
(DECEMBER 1988)

**Hardee
Power Station**

Table 2.3.2-3. Results of Permeability Testing of Intermediate Aquifer Observation Wells at the Hardee Power Station Site (December 1988)

Piezometer No.	Ground Surface Elevation (ft) Mean Sea Level	Ground Water Elevations (ft) Mean Sea Level	Permeability Centimeters/second
B-3A	121.7	93.7*	$4.4 \times 10E-5$
B-10A	127.4	117.2	$1.7 \times 10E-5$
B-12A	126.3	114.8	$9.3 \times 10E-6$

* Depth to water dropped to EL. 54.7 Ft. on 2/16/89 suggesting that this is a Floridan Aquifer observation well.

are listed in Table 2.3.2-4. The sampled parameters generally meet state drinking water quality standards.

FLORIDAN AQUIFER

The Floridan Aquifer is presently not monitored at the site. Figure 2.3.2-3 shows the piezometric contours for the Floridan Aquifer in May 1987.

Continuous monitoring, such as at the SWFWMD Romp #40 Avon Park well near Duette, Florida, indicated that the water levels in the Floridan Aquifer can fluctuate approximately 8.5 m (28 ft) during a 5-year period of record. Periodic monitoring results in 2 Floridan wells approximately 2.4 km (1.5 miles) from the site are shown in Figure 2.3.2-4.

Flows in the Floridan Aquifer are generally towards Payne Creek to the south-southwest. Saturated flows are thought to be concentrated in the fractured rock zone in the Avon Park carbonates.

Data from a total of 11 pump tests within a 24 km (15 mile) radius of the site were obtained from SWFWMD (SWFWMD, 1988, Table 4). These tests indicated that for the Floridan Aquifer T equals 133,000 square ft per day, S equals 0.0014, and L equals 0.00015 cu ft per day per cu ft. The ratio of horizontal to vertical hydraulic conductivity is on the order of 2.

Water quality in the Floridan Aquifer is dependent on the recharge from the overlying aquifers. Based on the SWFWMD (SWFWMD, 1988, Figure 36) ambient groundwater quality monitoring program, the following regional trends are considered as background levels: TDS is expected to be between 200 and 300 mg/L; total hardness (TH) between 120 and 180 mg/L; CL less than 25 mg/L; and SO_4 , 25 and 250 mg/L range. Additional water quality characteristics are provided in Table 3.5.1-1, based on available data collected offsite.

Table 2.3.2-4 Water Characteristics (Inorganics) at the Hardee Power
Station Site for Intermediate Aquifer (February/March 1989)
Page (1 of 2)

Parameters	Well Number P12A
Total Alkalinity, mg/L as CaCO ₃	216
Chloride, mg/L	27.9
Nitrate+Nitrite Nitrogen, mg/L	0.072
Ortho-phosphorous	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, umhos/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 _m , mg/L	5.4
COD, mg/L	<10
Turbidity, NTU	6.8
Aluminum, ug/L	67
Antimony, ug/L	<10
Arsenic, ug/L	2.0
Beryllium, ug/L	<2
Cadmium, ug/L	0.5
Calcium, mg/L	43.0
Chromium, ug/L	<11
Copper, ug/L	<7
Iron, ug/L	198
Lead, ug/L	<3
Magnesium, mg/L	19.8
Manganese, ug/L	<6
Mercury, ug/L	<0.2
Nickel, ug/L	<26
Potassium, mg/L	4.4
Selenium, ug/L	<2
Silver, ug/L	<0.05
Sodium, mg/L	35.6
Zinc, ug/L	18.0
Phenols, ug/L	<5
Aldrin, ug/L	<0.003
Dieldrin, ug/L	<.0003
Chlordane, ug/L	<.01
4,4' DDT, ug/L	<.001
Demeton, ug/L	<.1

Table 2.3.2-4 Water Characteristics (Inorganics) at the Hardee Power
Station Site for Intermediate Aquifer (February/March 1989)
Page (2 of 2)

Parameters	Well Number P12A
Endosulfan, ug/L	<.003
Endrin, ug/L	<.004
Guthion, ug/L	<.01
Heptachlor, ug/L	<.001
Lindane, ug/L	<.01
Malathion, ug/L	<.1
Methoxychlor, ug/L	<.03
Myrex, ug/L	<.001
Parathion, ug/L	<.04
2,4-D, ug/L	<10
Silvex, ug/L	<20
Toxaphene,, ug/L	<.005
PCB-1016, ug/L	<.001
PCB-1221, ug/L	<.001
PCB-1232, ug/L	<.001
PCB-1242, ug/L	<.001
PCB-1248, ug/L	<.001
PCB-1260, ug/L	<.001
Chlorinated Hydrocarbons	
2-Chloronapthalene, ug/L	<10
1,2-Dichlorobenzene, ug/L	<10
1,3-Dichlorobenzene, ug/L	<10
1,4-Dichlorobenzene, ug/L	<10
Hexachlorobenzene, ug/L	<10
Hexachlorobutadiene, ug/L	<10
Hexachlorocyclopentadiene, ug/L	<10
Hexachloroethane, ug/L	<10
1,2,4-Trichlorobenzene, ug/L	<10
Gross Alpha, pc/L	2.2±2.3
Gross Beta, pc/L	5.7±4.2
Radium 226, pc/L	4.1±0.1
Radium 228, pc/L	0.0±1.0
Strontium 90, pc/L	<0.5

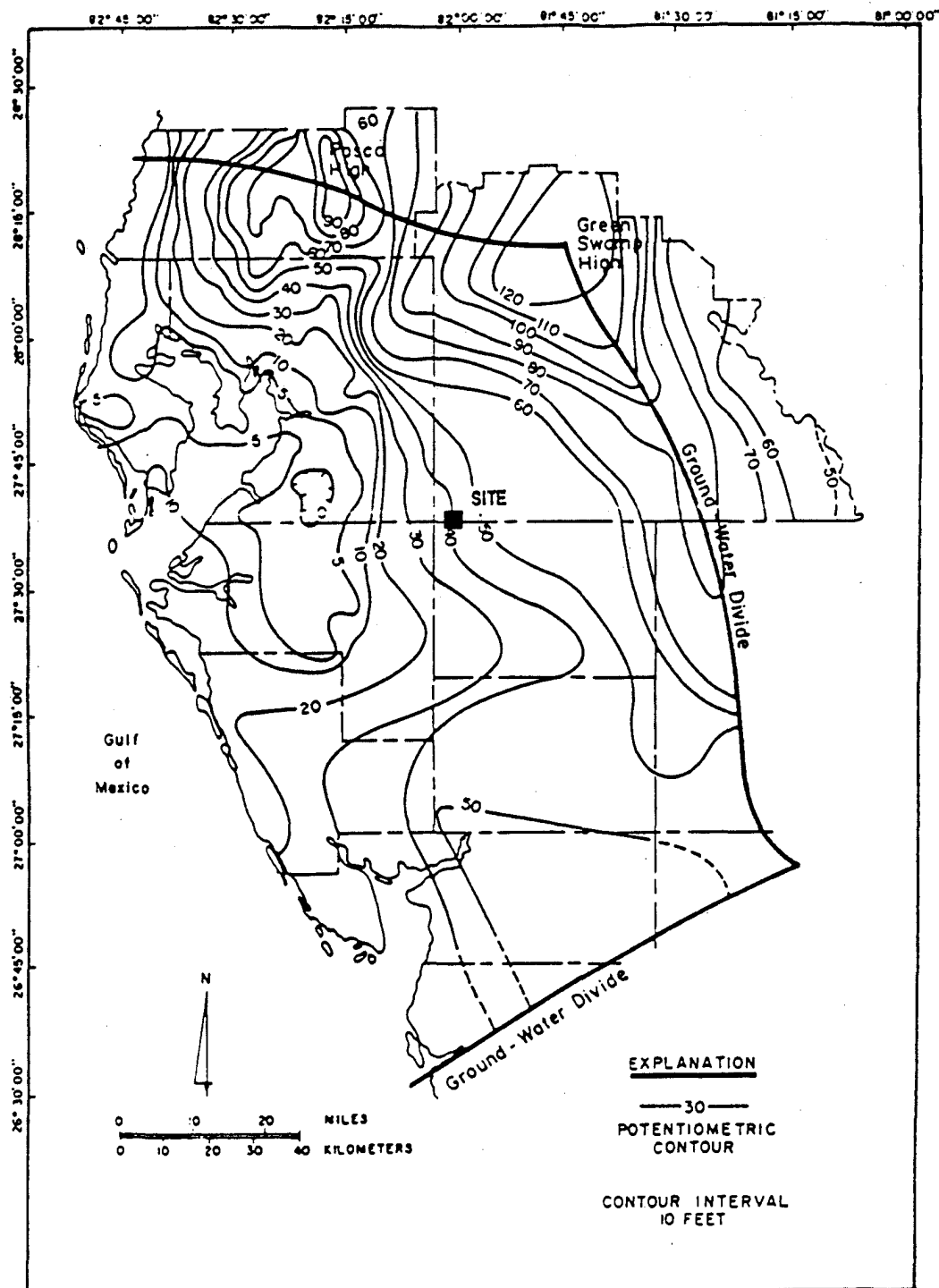


Figure 2.3.2-3 POTENTIOMETRIC SURFACE - FLORIDAN AQUIFER
(MAY 1987)

**Hardee
Power Station**

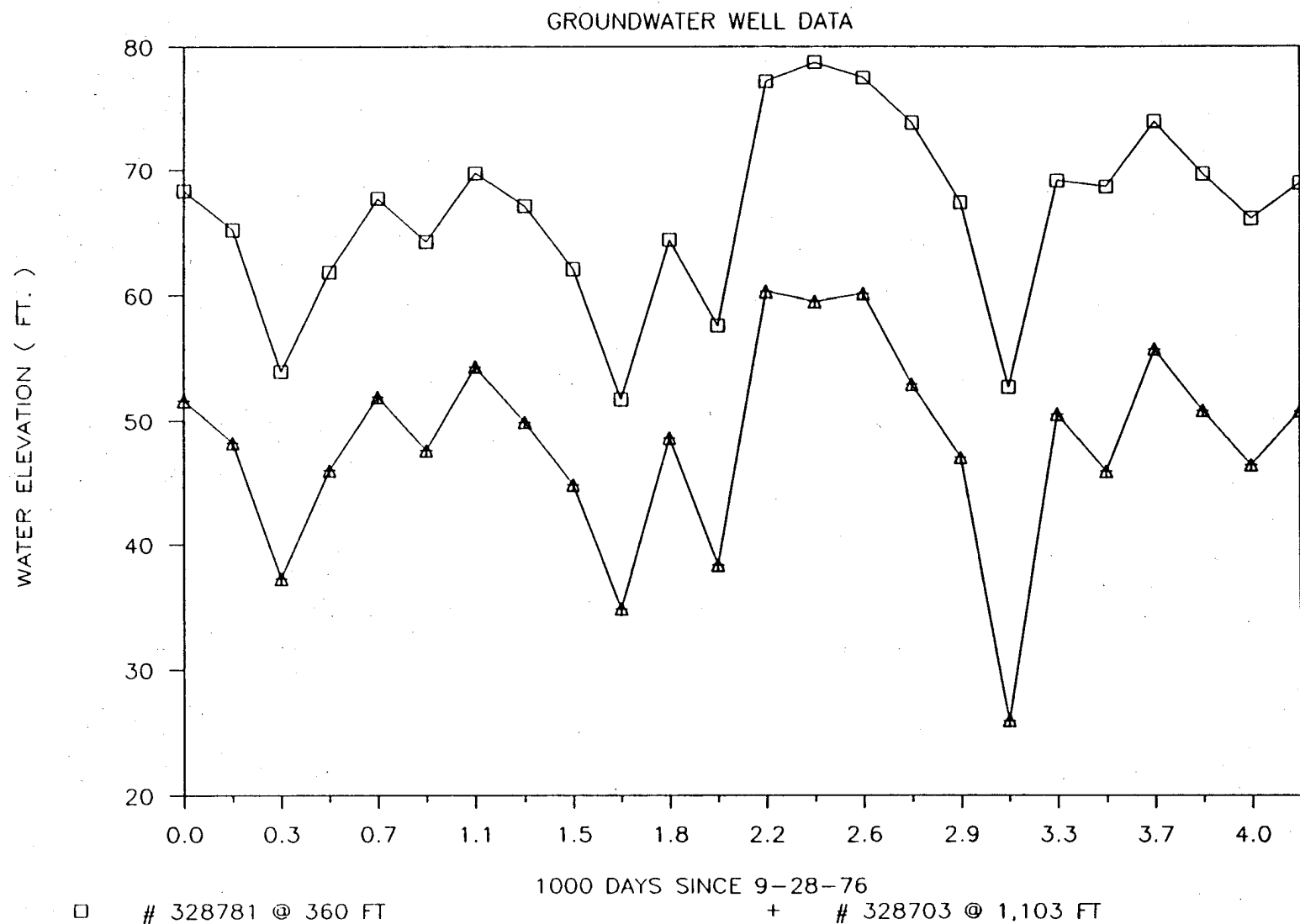


Figure 2.3.2-4 WATER LEVEL FLUCTUATIONS IN THE FLORIDAN AQUIFER FROM WELLS IN THE VICINITY OF THE HARDEE POWER STATION

SOURCE: AGRICO PERSONAL COMMUNIQUE, 1989.

**Hardee
Power Station**

CHARACTERISTIC CONFINING UNITS

The Upper Confining Bed as described in Section 2.3.1.2 separates the Shallow Surface 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 25 cm (0 to 10 inches) per year. The predominant recharge area near the site is the Lakeland Ridge in southwest Polk County.

The Lower Confining Bed as described in Section 2.3.1.2 separates the Intermediate aquifer above it from the Floridan (Carbonate) aquifer below. Recharge to the Floridan Aquifer through the Lower Confining Bed is classified as very low, ranging from 5 to 25 cm (2 to 10 inches) per year. This is in areas where the Intermediate aquifer piezometric level is high, producing a vertical gradient towards the deeper aquifer.

2.3.2.2 Karst Hydrogeology

The site area 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 effect 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 very deep and removed from any threat of current karstic activity.

All apparent sink features in the proposed plant vicinity were identified and ground-truthed. Most karst features identified are shallow and are located outside the main plant area, although some are within the cooling reservoir area (see Appendix 11.4 for exhibit and descriptions). Initial subsurface explorations conducted in the plant area through December 1988 did not reveal significant solutioning of the surfaces of the Hawthorn and surficial soils.

Topographic depressions near the site are typically 5 to 10 acres in size and are roughly circular. They are aligned according to an east-northeast fracture trend related to sinkhole activity in the past.

Based on current field operations, the effects of paleokarst features on the power plant are not expected to be significant and can be minimized with proper foundation design. The cooling reservoir is also not expected to be significantly impacted by paleokarst features. This assessment is consistent with Agrico's experience in the area. Agrico has indicated that the paleokarst features and sinkhole formation have not affected their clay settling ponds, reclamation lakes, or foundations.

2.3.3 Site Water Budget and Area Users

2.3.3.1 Site Water Budget

Components of the existing 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). The monthly data from Wauchula are given in Appendix 11.5.1. Data on long term monthly averages, maximums, and minimums is summarized in Table 2.3.3-1. The annual precipitation averages 135 cm

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

Month	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: All units in inches.

Sources: Southwest Florida Water Management District, 1988.
NOAA, 1988.

(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 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%. 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 dew point temperature, relative humidity, evaporation, 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 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) from the proposed site.

The only industrial users near the site are CFI and Agrico. CFI operates two deep process water make-up wells, and one drinking water well at their Hardee Complex east of the site. Agrico has four potable water wells in the vicinity. None is closer than 4 km (2.5 miles) from the plant site and all are more than 120 m (400 ft) deep.

Table 2.3.3-2. Estimated Climatic Conditions at the Hardee Power Station Site

Item	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Monthly Temperature Normals ¹	Degrees 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 Dew Point Temperature	Degrees 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 ²	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	--

Notes: 1. Temperature normals based on 1941-70 data from Mauchula station.

2. Actual ET based on an average annual crop coefficient of 0.7.

Sources: Institute of Food and Agricultural Sciences, U of F, 1979.

Institute of Food and Agricultural Sciences, U of F, 1983.

Approximately 46 permitted wells lie within 1.6 km (1 mile) of the site boundaries. The well construction permit listing for the four townships surrounding the site (SWFWMD, 1989) is shown in Table 2.3.3-3. The wells tap the Surficial Aquifer at depths of 6 to 9 m (20 to 31 ft), the Intermediate Aquifer is tapped at depths of 60 to 90 m (200 to 300 ft), and the Floridian aquifer at depths greater than 120 m (400 ft). Only these wells listed as "D" in Table 2.3.3-3 are potable water wells.

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

PHYSICAL CHARACTERISTICS

The proposed Hardee Power Station 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. 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 2.3.4-1. Data in this figure were developed by combining on site vertical survey information in the immediate vicinity of the creek with data from 1:24000 USGS topographic maps.

Payne Creek and the Peace River to Charlotte Harbor are classified as Class III surface waters (Chapter 17-3, F.A.C.). Charlotte Harbor is classified as a Class II surface water (Chapter 17-3, F.A.C.).

The site consists of gently sloping terrain with gradients from 0% to 6% in the direction of Payne Creek (see Figure 2.3.4-2). Several wetland areas exist on or adjacent to the site with individual drainage ways to Payne

Table 2.3.3-3. Well Construction Permits Within One Mile of the Hardee Power Station

Permit No.	Town + Range	Section	Type*	Well Depth (ft)	Diameter (Inches)
384602	T33S R24E	6	I	275	4
471408	T33S R24E	6	O	21	2
472077	T33S R24E	6	O	223	2
423405	T33S R24E	6	Y	125	4
329524	T33S R24E	7	D	310	4
355801	T33S R24E	7	D	310	4
335749	T33S R24E	7	I	1205	24
473418	T33S R24E	7	O	NR	2
473419	T33S R24E	7	O	NR	2
473420	T33S R24E	7	O	NR	2
473421	T33S R24E	7	O	NR	2
328764	T33S R24E	7	T	31	6
331684	T33S R23E	1	I	125	4
471411	T33S R23E	1	O	21	2
471412	T33S R23E	1	O	21	2
471413	T33S R23E	1	O	21	2
471414	T33S R23E	1	O	21	2
471415	T33S R23E	1	O	21	2
472078	T33S R23E	1	O	238	2
472080	T33S R23E	1	O	246	2
473508	T33S R23E	1	Y	NR	2
473679	T33S R23E	1	Y	NR	6
444614	T33S R23E	2	Z	600	6
444615	T33S R23E	2	Z	600	6
324042	T33S R23E	11	D	260	4
324043	T33S R23E	11	D	260	4
412278	T32S R23E	25	Y	600	6
432020	T32S R23E	25	Y	380	6
362163	T32S R23E	25	Z	380	6
362164	T32S R23E	25	Z	600	6
432016	T32S R23E	25	Z	600	6
432017	T32S R23E	25	Z	600	6
432018	T32S R23E	25	Z	600	6
433278	T32S R23E	26	Z	600	6
444609	T32S R23E	36	Z	600	6
444610	T32S R23E	36	Z	NR	6
435892	T32S R24E	30	Y	600	6
388591	T32S R24E	30	Z	600	6
409378	T32S R24E	30	Z	600	6
409379	T32S R24E	30	Z	600	6
432018	T32S R24E	30	Z	600	6
435385	T32S R24E	30	Z	600	6
440299	T32S R24E	31	Y	600	6
440300	T32S R24E	31	Y	520	6
409380	T32S R24E	31	Z	600	6
425462	T32S R24E	31	Z	600	6

* O = observation well; I = industrial well; T = test well;

Y = plugged well; D = domestic well; Z = mine well

NR = not reported

Source: SWFWMD, 1989.

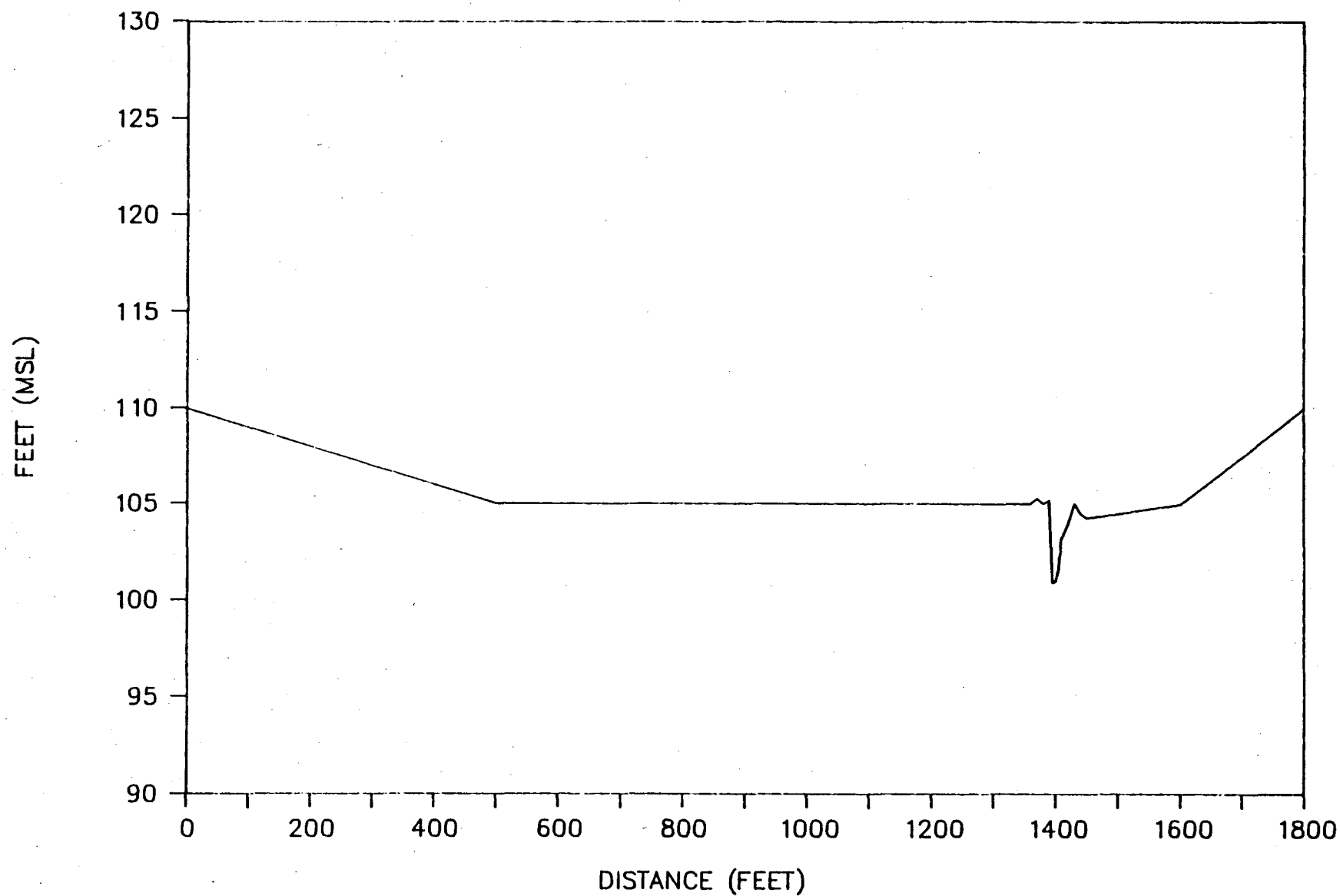


Figure 2.3.4-1 TYPICAL CROSS-SECTION OF PAYNE CREEK AND FLOOD PLAIN
NEAR THE HARDEE POWER STATION (LOOKING UPSTREAM)

**Hardee
Power Station**

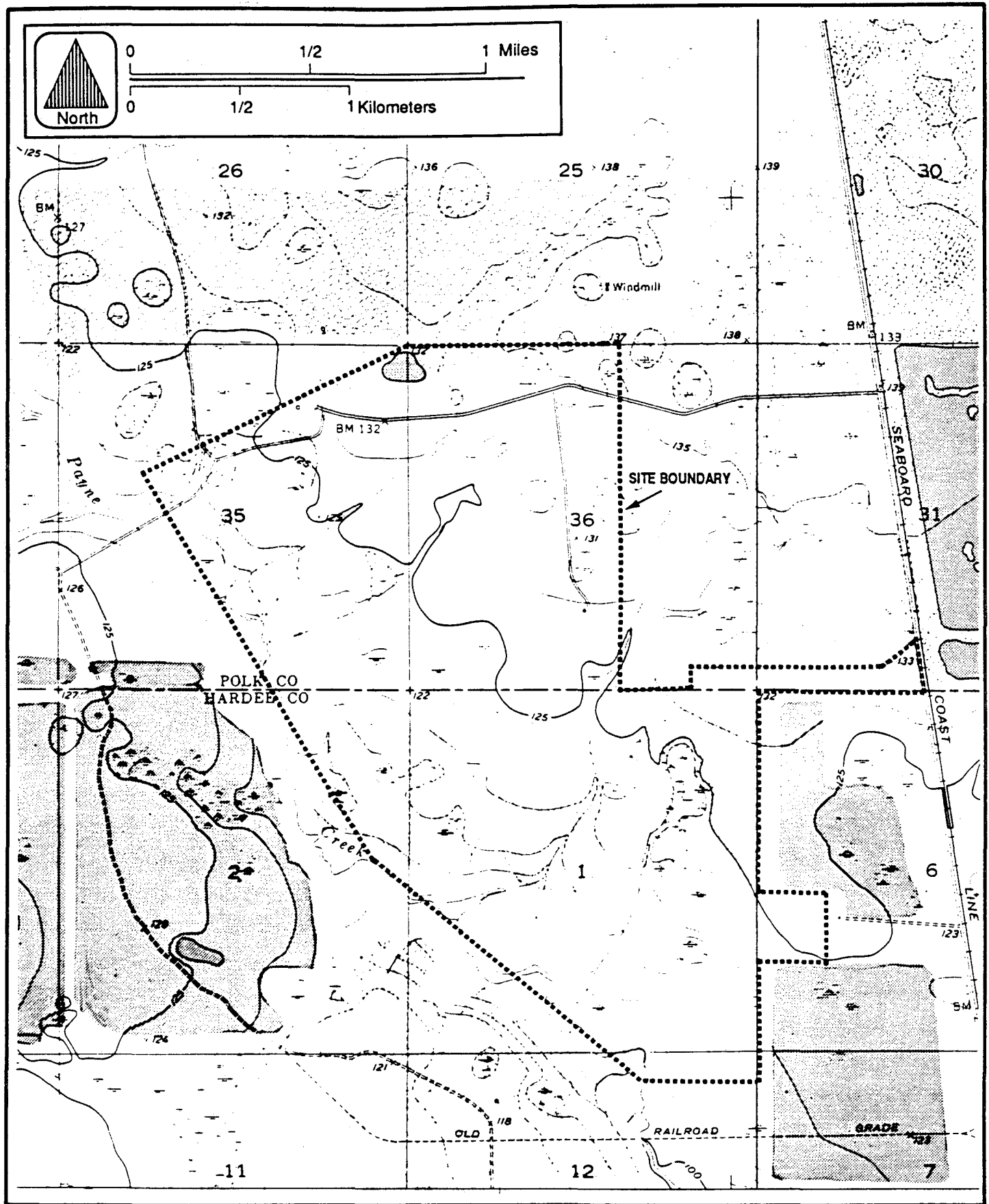


Figure 2.3.4-2 TYPOGRAPHY OF THE HARDEE POWER STATION

**Hardee
Power Station**

Creek. Portions of the site and adjacent lands (on both sides of Payne Creek) have been or are being mined, for phosphate. After mining is completed, these areas will be reclaimed pursuant to approved reclamation plans.

HYDROLOGIC CHARACTERISTICS

The USGS has maintained a stream gauging station on Payne Creek near Bowling Green for 14 years (1964-68, 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. This station was used to estimate the mean, maximum, and minimum average daily streamflow in Payne Creek near the Hardee Power Station site (see Table 2.3.4-1). The USGS station flows were multiplied by the ratio of drainage areas of the two locations to determine the flows at the discharge location. Average annual Payne Creek flow at the Hardee Power Station site is 22 cfs, or approximately 0.9 cfs per square mile.

The low flows in Payne Creek near the Hardee Power Station site were estimated using low flow frequency analyses of the low flows at the Payne Creek-Bowling Green U.S. Geological Survey (USGS) station (USGS, 1984), corrected to the Hardee Power Station 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 2.3.4-2. Seven day low flows of 1.0 cfs or less can be expected to occur with a recurrence interval of 2 years. Thirty day low flows of less than 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 Hardee Power Station 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). The USGS developed a series of regression equations from long term discharge stations using the

Table 2.3.4-1. Summary of Historical Flows on Payne Creek at Bowling Green and Estimated Flows at the Hardee Power Station

Water Year	Daily Streamflow (cfs)		
	Mean	Maximum	Minimum
AT BOWLING GREEN			
1964	111	928	3.6
1965	118	2060	1.9
1966	71	892	4.3
1967	78	1310	1.2
1968	171	1920	2.0
1980	109	981	25
1981	48	276	6.4
1982	125	2500	11
1983	165	1380	27
1984	73	357	11
1985	64	635	4.4
Annual ¹	103	981	4.4
AT HARDEE POWER STATION 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 ¹	22	208	0.9

Note: 1. Annual "average" for maximum and minimum streamflow values for both the Bowling Green and Hardee Power Station site stations are given as the median values for the period of record.

Table 2.3.4-2. Estimated Low Flows on Payne Creek Near the Hardee Power Station 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

Source: U.S. Geological Survey (USGS), 1984.

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 2.3.4-3 for recurrence intervals from 2 to 500 years. The peak 10-year flow at the Hardee Power Station site is estimated to be 1,810 cfs; the peak 25-year flow is estimated to be 2,530 cfs.

Streamflow and stage measurements were taken on Payne Creek as part of the monitoring program developed in support of this application (see Section 2.3.4.2). The discharge hydrograph for the monitoring period on Payne Creek near the Hardee Power Station is shown in Figure 2.3.4-3. The average daily values are presented in tabular form in the Appendix 11.5.2. During the period of site specific stream gaging (October 11, 1988 through April 13, 1989), the Payne Creek discharge varied substantially. The highest Payne Creek discharge was observed on January 25, 1989 (37.6 cfs); the lowest Payne Creek discharge was observed on April 11-13 (1.6 cfs). The Payne Creek discharge hydrograph is presented in Figure 2.3.4-3; the average daily streamflow discharge values are present in tabular form in Appendix 11.5.2.

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 month rainfall, is required to increase this baseflow.

Streamflow measurements were taken once a month near the Hardee Power Station 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 #02295420). The locations of these two stations is presented Figure 2.3.4-4. Table 2.3.4-4 gives a summary of the recorded stages and streamflows at station PC-2, near the Hardee Power Station site.

Table 2.3.4-3. Estimated Flood Flows on Payne Creek at the Hardee Power Station

Recurrence Interval (years)	Regression constant C	Regression exponents			Estimated Flood Flow (cfs)
		B1	B2	B3	
2	93.4	0.756	0.268	-0.803	690
5	192	0.722	0.255	-0.759	1310
10	274	0.708	0.248	-0.738	1810
25	395	0.696	0.24	-0.717	2530
50	496	0.690	0.234	-0.705	3130
100	609	0.685	0.227	-0.695	3780
200	779	0.674	0.205	-0.694	4510
500	985	0.668	0.196	-0.687	5550

Source: USGS, 1982.

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

Regression Equation

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

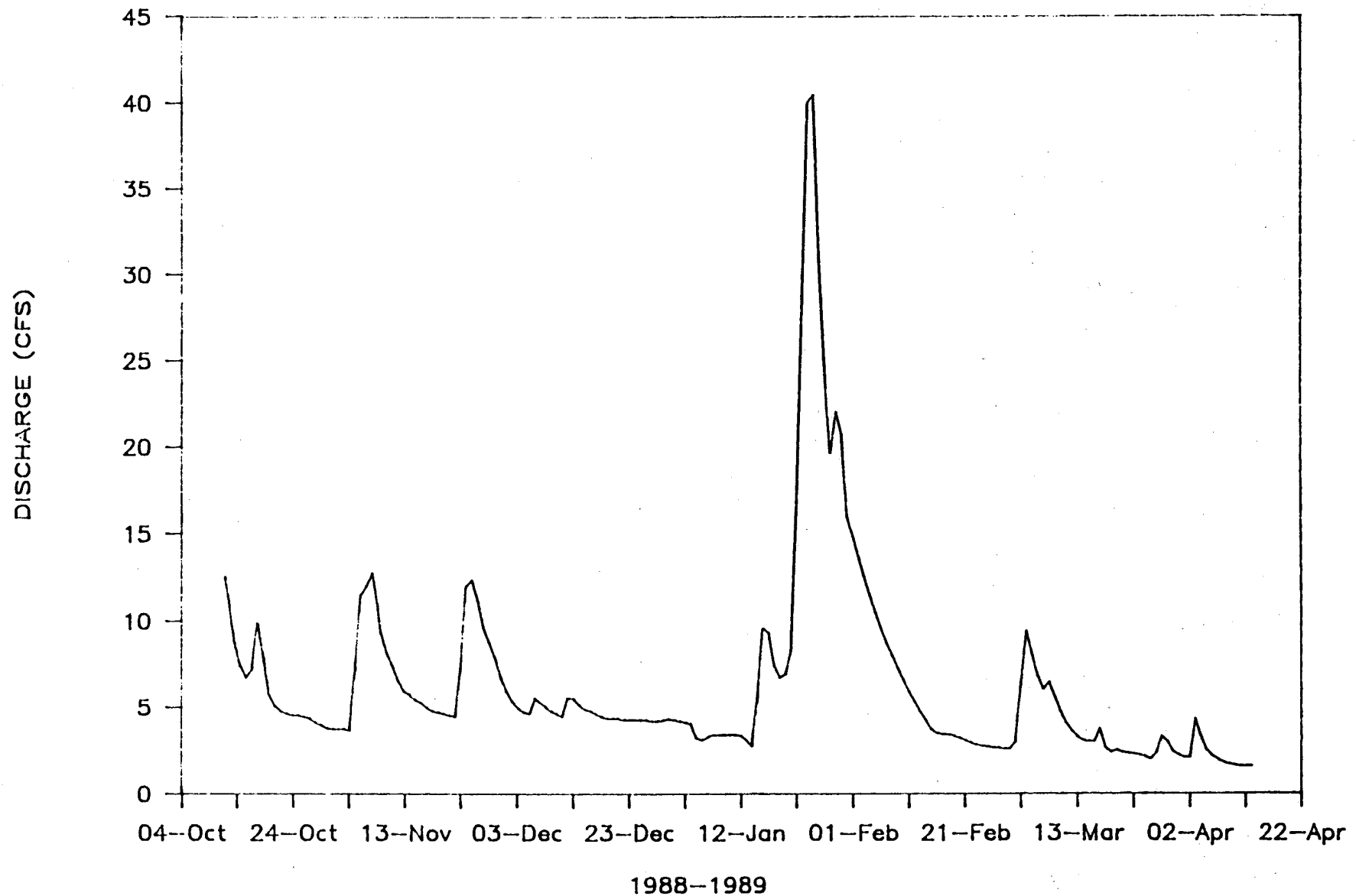


Figure 2.3.4-3 DISCHARGE HYDROGRAPH FOR PAYNE CREEK NEAR
THE HARDEE POWER STATION

**Hardee
Power Station**

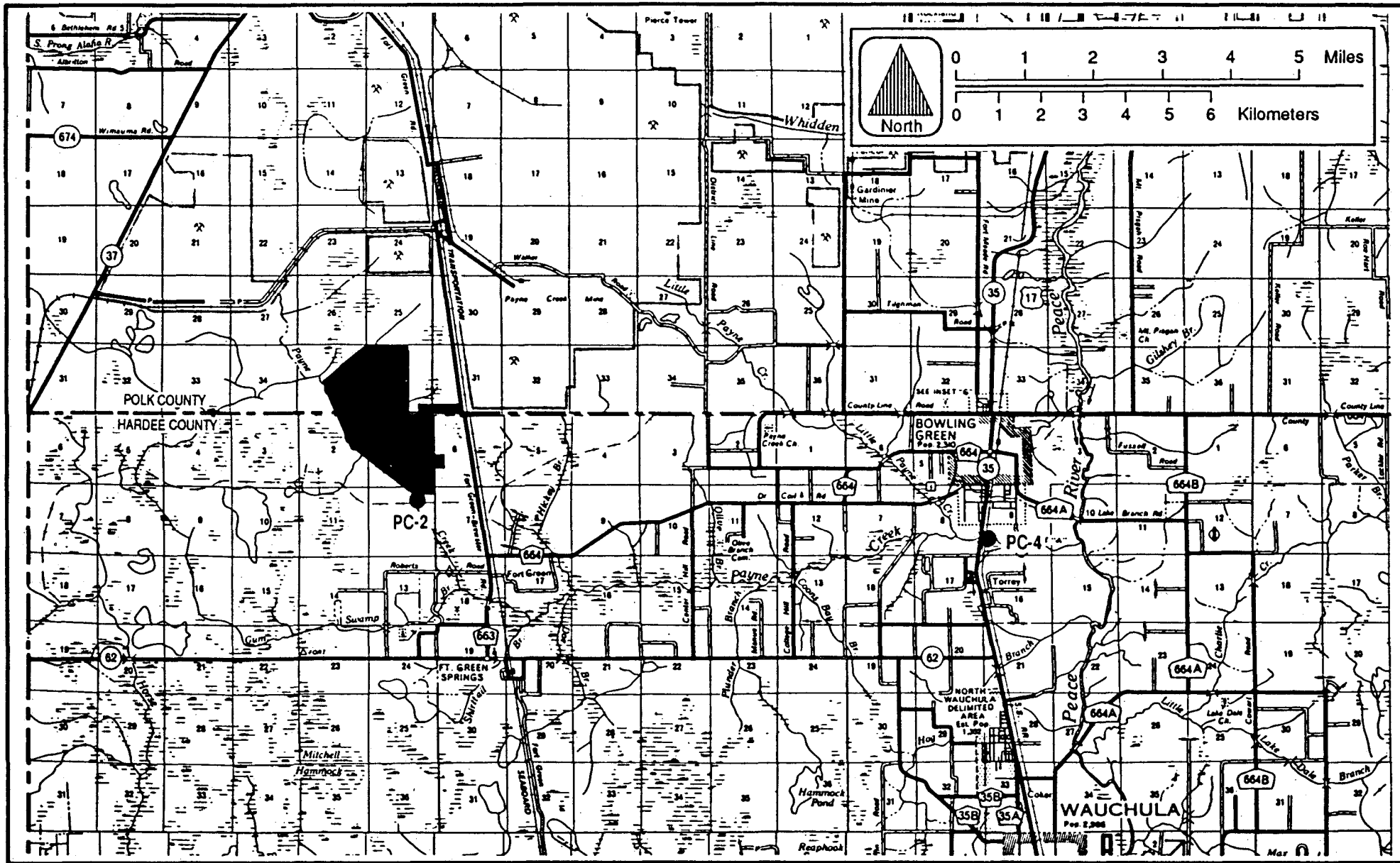


Figure 2.3.4-4 SURFACE WATER LEVELS AND STREAMFLOW MONITORING LOCATIONS

**Hardee
Power Station**

Table 2.3.4-4. Stage and Flow Data for Payne Creek Near the Hardee Power Station Site

Station	Date	Stage (ft)	Flow (cfs)
PC-2	11-Oct-88	2.62	12.2
	08-Nov-88	2.52	11.6
	08-Dec-88	2.06	4.7
	11-Jan-89	1.76	2.3
	15-Feb-89	1.81	3.0
	15-Mar-89	1.85	4.2
	13-Apr-89	1.59	1.9

Appendix 11.5.2 provides the detailed cross-sectional velocity measurements and the stage-discharge curve for the monitoring station near the Hardee Power Station site, PC-2.

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 Impact (DRIs), National Pollution 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 encompasses the period July 1975 through January 1976. Water quality samples collected during these two studies represents data collected from four different station locations (Stations 1, 2, 3 & 4). Data from the two studies are combined and summarized in Table 2.3.4-5. These four station locations are given in Figure 2.3.4-5. The complete data set for the period is provided in Appendix 11.5.3.

For this previous data, the mean values (at any station) for five of the 46 tested parameters 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.

The results of monitoring conducted during October 1988 through March 1989 (i.e., field studies conducted in support of this application) are given in Tables 2.3.4-6 and 2.3.4-7. Table 2.3.4-6 presents the in situ data.

Table 2.3.4-5. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of the Hardee Power Station, 1975 - 1986 (all available data) (Page 1 of 5)

Parameter/Location	Average	Maximum	Minimum	# 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 (oF)				
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 (umhos/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
Calcium				
Station 4	25	34	15	2

Table 2.3.4-5. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of the Hardee Power Station, 1975 - 1986 (all available data) (Page 2 of 5)

Parameter/Location	Average	Maximum	Minimum	# Samples
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 CaCO ₃ /L)				
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 (per 100 ml)				
Station 4	183	360	5	2
Flouride				
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

Table 2.3.4-5. Summary of Historic Payne Creek Surface Water Quality
in the Vicinity of the Hardee Power Station,
1975 - 1986 (all available data) (Page 3 of 5)

Parameter/Location	Average	Maximum	Minimum	# Samples
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
Total Kjeidahl 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

Table 2.3.4-5. Summary of Historic Payne Creek Surface Water Quality in the Vicinity of the Hardee Power Station, 1975 - 1986 (all available data) (Page 4 of 5)

Parameter/Location	Average	Maximum	Minimum	# Samples
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
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

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

Parameter/Location	Average	Maximum	Minimum	# Samples
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	.0025	.005	<0.014	2
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
MBAS				
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

Sources: Dames & Moore, 1976.
Agrico, 1983-86.

Note: All values mg/l unless otherwise noted.
All values are total concentrations unless noted.

Figure 2.3.4-5 SURFACE HISTORIC WATER QUALITY MONITORING LOCATIONS FOR AGRICO AND DAMES & MOORE STUDIES (1975 - 1986)

Hardee Power Station

Table 2.3.4-6. In Situ Water Quality Parameters For Payne Creek
(October 1988 through March 1989)

Station	Parameter	Minimum	Maximum	Mean	Standard Deviation
PC-1	Temperature (°C)	17.3	25.1	20.3	2.5
	pH	6.0	6.7	6.4	0.3
	Dissolved Oxygen (mg/L)	1.0	6.9	4.9	1.9
	Conductivity (umhos/cm)	148	208	183	21.2
	Secchi (ft)	N/A	>2.5	N/A	N/A
	Total Chlorine (mg/L)	0.0	<0.1	<0.1	N/A
PC-2	Temperature (°C)	16.9	25.0	19.6	2.6
	pH	6.4	7.1	6.7	0.3
	Dissolved Oxygen (mg/L)	4.1	7.7	6.6	1.2
	Conductivity (umhos/cm)	174	214	193	14.7
	Secchi (ft)	N/A	>3	N/A	N/A
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	N/A
PC-3	Temperature (°C)	17.3	25.7	20.4	2.7
	pH	6.5	7.2	6.7	0.2
	Dissolved Oxygen (mg/L)	5.5	7.0	6.4	0.5
	Conductivity (umhos/cm)	197	247	216	17.7
	Secchi (ft)	N/A	>4	N/A	N/A
	Total Chlorine (mg/L)	<0.1	<0.2	<0.1	N/A
PC-4	Temperature (°C)	18.1	24.9	20.2	2.2
	pH	6.5	7.2	6.9	0.2
	Dissolved Oxygen (mg/L)	5.7	7.9	7.3	1.6
	Conductivity (umhos/cm)	243	334	286	97.8
	Secchi (ft)	N/A	>3	N/A	N/A
	Total Chlorine (mg/L)	0.0	<0.2	<0.1	N/A

Note: N/A = Not Available or Not Applicable

Table 2.3.4-7. Summary of Water Quality Conditions in Payne Creek (PC-1, PC-2, PC-3, PC-4)
October 1988 - March 1989 (Page 1 of 3)

Parameter	Average	Maximum	Minimum	Number of Samples	Class III Standard	Number of Exceedences
WATER QUALITY DATA						
Alkalinity (Bicarbonate), mg CaCO ₃ /L	56	76	36	24	20	0
Alkalinity, (Carbonate), mg CaCO ₃ /L	<0.5	<0.5	<0.5	24		0
Cyanide, mg/L	<0.004	<0.004	<0.004	24	0.005	0
Fluoride, mg/L	1.0	1.8	0.5	24	10	0
Hardness, mg equiv. CaCO ₃ /L	90.1	133.0	59.5	24		0
Methylene Blue Active Substances, mg/L	0.039	0.116	<0.025	24	0.5	0
Total Kjeldahl Nitrogen, mg/L	0.7	1.5	0.2	24		0
Ammonia Nitrogen, mg/L	0.073	0.486	<0.005	24	0.02	9
Organic Nitrogen, mg/L	0.7	1.5	0.2	24		0
Nitrate+Nitrite-Nitrogen, mg/L	0.81	3.02	0.19	24		0
Total Nitrogen, mg/L	1.53	3.68	0.63	24		0
Oil and Grease, mg/L	<5	<5	<5	24	5	0
Carbonaceous Biochemical Oxygen Demand, (5-day) mg/L	1.1	2.4	1.0	24		0
Chemical Oxygen Demand, mg/L	39	171	<10	24		0
Orthophosphorus, mg/L	0.4	0.6	0.2	24		0
Total Phosphorus, mg/L	0.46	0.70	0.31	24		0
Sulfate, mg/L	30.6	62.6	9.2	24		0
Turbidity, NTU	1.7	6.1	0.5	24	29	0
Aluminum, ug/L	117	365	32	24		0
Antimony, ug/L	<10	<10	<10	24		0
Arsenic, ug/L	<5	<5	<5	24	50	0
Beryllium, ug/L	<3	<3	<3	24	11	0
Cadmium, ug/L	<0.4	<0.5	<0.4	24	0.8	0
Calcium, mg/L	19.2	29.7	12.3	24		0
Chromium, ug/L	<10	<10	<10	24	50	0
Copper, ug/L	7	12	<6	24	30	0
Iron, ug/L	256	648	49	24	1000	0
Lead, ug/L	5.9	9.8	5.0	24	30	0
Magnesium, mg/L	10.2	14.3	7.0	24		0
Manganese, ug/L	8.0	18.0	3.0	24		0
Mercury, ug/L	0.24	0.50	<0.20	24	0.2	4
Nickel, ug/L	16	35	<12	24	100	0
Potassium, mg/L	1.3	2.6	0.1	20		0
Selenium, ug/L	<5	<5	<5	24	25	0
Silver, ug/L	<0.08	<0.08	<0.08	24	0.07	0
Sodium, mg/L	8.6	11.0	6.3	24		0
Zinc, ug/L	6.8	36.0	<5.0	24	30	1
Total Coliforms, colonies/100 ml	382	2000	1	24	2400	0
Fecal Coliforms, colonies/100 ml	94	346	1	24	800	0

Table 2.3.4-7. Summary of Water Quality Conditions in Payne Creek (PC-1, PC-2, PC-3, PC-4)
October 1988 - March 1989 (Page 2 of 3)

Parameter	Average	Maximum	Minimum	Count	17-3,FAC Standard	Number of Violations
RADIATION DATA						
Alpha, Gross (pCi/L)	1.9	4.6	0.0	24	15	0
Alpha, Gross, Ct. Error +/- (pCi/L)	1.7	3.0	1.1	24		0
Beta, Gross (pCi/L)	2.4	6.1	0.0	24		0
Beta, Gross, Ct. Error +/- (pCi/L)	1.9	3.6	1.4	24		0
Radium 226 (pCi/L)	0.7	1.4	0.0	24	2.5	0
Radium 226 Ct. Error +/- (pCi/L)	0.04	0.10	0.00	24		0
Radium 228 (pCi/L)	0.5	1.7	0.0	24	2.5	0
Radium 228, Ct. Error (pCi/L)	0.9	1.9	0.4	24		0
Strontium-90 (pCi/L)	0.5	1.5	<0.5	24		0
Chlorophyll-a, mg/m ³	2.0	29.9	<1	24		0
Chloride, mg/L	13.9	16.1	11.6	4		0
Total Dissolved Solids, mg/L	149.8	199.0	125	4		0
Silica, dissolved reactive, mg/L	3.3	4.8	2.3	4		0
ORGANICS DATA (all values in ug/L)						
Phenols	<5	<5	<5	8	1	0
Aldrin	<0.003	<0.003	<0.003	8	0.003	0
Dieldrin	<0.003	<0.003	<0.003	8	0.003	0
Chlordane	<0.01	<0.01	<0.01	8	0.01	0
4,4'-DDT	<0.001	<0.001	<0.001	8	0.001	0
Demeton	<0.1	<0.1	<0.1	8	0.1	0
Endrin	<0.004	<0.004	<0.004	8	0.004	0
Endosulfan	<0.003	<0.003	<0.003	8	0.003	0
Guthion	<0.01	<0.01	<0.01	8	0.01	0
Heptachlor	<0.001	<0.001	<0.001	8	0.001	0
Lindane	<0.01	<0.01	<0.01	8	0.01	0
Malathion	<0.1	<0.1	<0.1	8	0.1	0
Methoxychlor	<0.03	<0.03	<0.03	8	0.03	0
Myrex	<0.001	<0.001	<0.001	8	0.001	0
Parathion	<0.04	<0.04	<0.04	8	0.04	0
2,4-D	<10	<10	<10	8		0
Silvex	<20	<20	<20	8		0
Toxaphene	<0.005	<0.005	<0.005	8	0.005	0
PCB-1016	<0.001	<0.001	<0.001	8	0.001	0
PCB-1221	<0.001	<0.001	<0.001	8	0.001	0
PCB-1232	<0.001	<0.001	<0.001	8	0.001	0
PCB-1242	<0.001	<0.001	<0.001	8	0.001	0
PCB-1248	<0.001	<0.001	<0.001	8	0.001	0
PCB-1254	<0.001	<0.001	<0.001	8	0.001	0
PCB-1260	<0.001	<0.001	<0.001	8	0.001	0

Table 2.3.4-7. Summary of Water Quality Conditions in Payne Creek (PC-1, PC-2, PC-3, PC-4)
October 1988 - March 1989 (Page 3 of 3)

Parameter	Average	Maximum	Minimum	Count	Class III
Chlorinated Hydrocarbons					
2-Chloronaphthalene	<10.0	<10.0	<10.0	8	0
1,2-Dichlorobenzene	<10.0	<10.0	<10.0	8	0
1,3-Dichlorobenzene	<10.0	<10.0	<10.0	8	0
1,4-Dichlorobenzene	<10.0	<10.0	<10.0	8	0
Hexachlorobenzene	<10.0	<10.0	<10.0	8	0
Hexachlorobutadiene	<10.0	<10.0	<10.0	8	0
Hexachlorocyclopentadiene	<10.0	<10.0	<10.0	8	0
Hexachloroethane	<10.0	<10.0	<10.0	8	0
1,2,4-Trichlorobenzene	<10.0	<10.0	<10.0	8	0

Table 2.3.4-7 presents a summary of the lab parameters and a comparison to water quality standards. The locations of the water quality sampling stations are shown in Figure 2.3.4-6. Detail water quality monitoring data is presented in Appendix 11.5.4.

In general, water quality monitored as part of the recent 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.

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--A continuous water level recording station location was installed on Payne Creek adjacent to the Hardee Power Station site; this station was (PC-2) operated as part of the study for a period of 8 months. This gaging station location is shown in Figure 2.3.4-6. The station consisted 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% data recovery. The charts were digitized and the data stored in computer files. The original charts were catalogued and filed as a permanent record.

In addition, the USGS maintains a gaging station on Payne Creek below the proposed site, near Bowling Green (USGS #02295420). The drainage area to this gage is approximately 313 square km (121 square miles) and includes the Hardee Power Station site. The current data from this station (i.e., for the study period) were obtained.

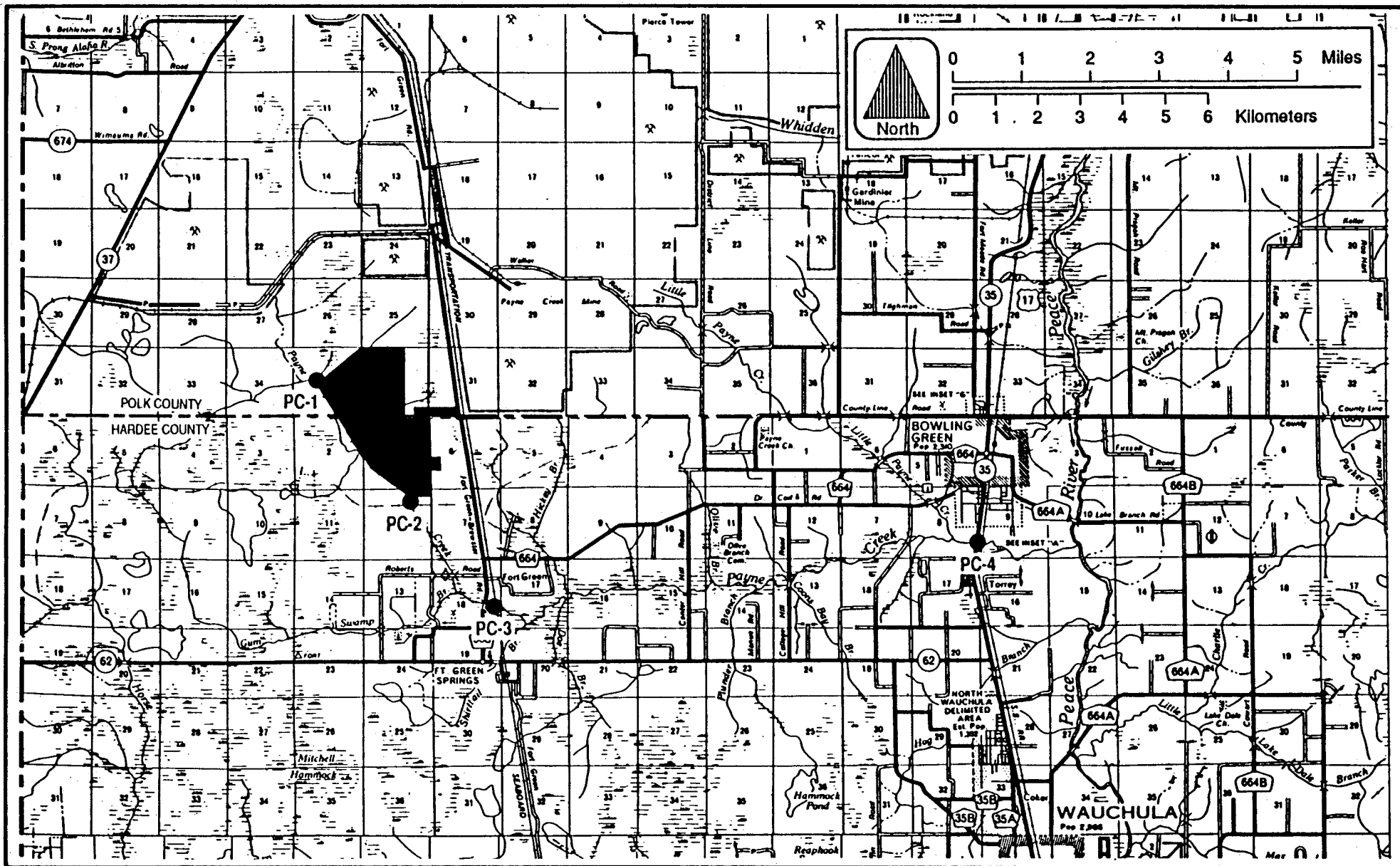


Figure 2.3.4-6 SURFACE WATER QUALITY MONITORING LOCATIONS
(OCTOBER 1988 - MARCH 1989)

**Hardee
Power Station**

Cross-section Survey--A cross-section was conducted at a representative site near the additional water level gaging stations on Payne Creek to determine river/creek morphology in the vicinity of probable points of discharge. The data was collected using a sounding rod and surveyor's level.

Water Quality Sampling--The baseline water quality monitoring program was structured to provide the necessary data base 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 2.3.4-6. Samples were collected from four stations on Payne Creek; one located upstream of the proposed Hardee Power Station site, one located adjacent to the proposed site; and two stations located downstream of the proposed Hardee Power Station site. All samples were surface grab samples.

Samples were analyzed for the parameters listed in Table 2.3.4-8. 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) were conducted monthly for six 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.

Synoptic Streamflow Studies--Streamflow was measured at the Hardee Power Station site and USGS gaging stations once every month for the monitoring period of 8 months. The two gaging stations have been previously shown in Figure 2.3.4-6. 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 gaging techniques. The measurements were coordinated with the water quality sampling efforts and completed within 2 days to ensure consistency among stations.

Table 2.3.4-8. Hardee Power Station Water Quality Monitoring Parameters

Category	Parameters
Field:	- o Specific Conductance - o Temperature - o Dissolved Oxygen - o pH - o Total Chlorine - o Secchi Disk (ft)
Classicals:	Alkalinity, mg/L as CaCO ₃ , Fluoride, mg/L, Total Kjeldahl Nitrogen, mg/L, Ammonia Nitrogen, mg/L, Organic Nitrogen, mg/L, Nitrate+Nitrite-Nitrogen, mg/L, Total Nitrogen, mg/L, Oil and Grease, mg/L, Carbonaceous Biochemical Oxygen Demand, mg/L, Chemical Oxygen Demand, mg/L, Orthophosphorus, mg/L, Total Phosphorus, mg/L, Sodium, mg/L, Sulfate, mg/L, Turbidity, NTU, total Coliforms, colonies/100 ml, Fecal Coliforms, colonies/100 ml, Silica, Hardness mg equiv CaCO ₃ /L, Carbonate mg CaCO ₃ /L, Bicarbonate mg CaCO ₃ /L
Metals:	Aluminum, ug/L, Antimony, ug/L, Arsenic, ug/L, Beryllium, ug/L, Cadmium, ug/L, Chromium, ug/L, Copper, ug/L, Iron, ug/L, Lead, ug/L, Mercury, ug/L, Nickel, ug/L, Selenium, ug/L, Silver, ug/L, Zinc, ug/L, Calcium, mg/L, Manganese ug/L, Manganese mg/L, Potassium mg/L
Other:	Chlorophyll-a, mg/m ³ , Cyanide, mg/L, Methylene Blue Active Substances, mg/L
Organics/Pesticides/ Herbicides:	Phenols, Aldrin, Dieldrin, Chlordane, 4,4'-DDT, Demeton, Endrin, Endosulfan, Guthion, Heptachlor, Lindane, Malathion, Methoxychlor, Myrex, Parathion, 2,4-D, Silvex, Toxaphene, PCB-1016, PCB-1227, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260, and Chlorinated Hydrocarbons; 2-Chloronaphthalene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloroethane, 1,2,4-Trichlorobenzene
Radioactivity:	Alpha, Gross (pCi/L), Alpha, Gross, Ct. Error +/- (pCi/L), Beta, Gross (pCi/L), Beta, Gross, Ct. Error +/- (pCi/L), Radium 226 (pCi/L), Radium 226 Ct. Error +/- (pCi/L), Radium 228 (pCi/L), Radium 228, Ct. Error (pCi/L), Strontium-90 (pCi/L)

2.3.5 Vegetation/Land Use

As mentioned earlier, the Hardee Power Station Site consists of actively mined and yet to be reclaimed lands, lands still to be mined and reclaimed, and lands not to be mined. The lands which are to be mined or which have been mined comprise majority of the site.

Based on field studies in 1988 and 1989, major land uses and vegetation communities onsite include mined lands improved pasture with scattered pine, forested wetland, and the Payne Creek floodplain which is a combination of forested wetland and pine flatwoods. The Florida Land Use Cover and Classification System (FLUCCS) Level III code for these communities are 161, 211, 615, and 411, respectively. There are also some scattered marshes (<0.4 ha or <1 acre each) in the northern part of the site (FLUCCS 641). Figure 2.3.5-1 shows the vegetation communities and the areas of mined land on and adjoining the 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.

2.3.6 Ecology

2.3.6.1 Species-Environmental Relationships

AQUATIC SYSTEMS

Payne Creek and its unnamed tributaries are the only aquatic systems in the vicinity of the Hardee Power Station. Payne Creek is a relatively shallow stream situated on the western boundary of the property. Mining activity has 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. Figure 2.3.6-1 presents the locations of the aquatic sampling sites. The Payne Creek floodplain has been subject to hydrologic change resulting from sedimentation, ditching of its tributaries for agricultural operations, and more recently, elimination of some tributaries as a result of mining. Sedimentation in the creek bed is particularly noticeable near the site. The tree canopy is consequently young and much of the vegetation is in a shrubby successional state.

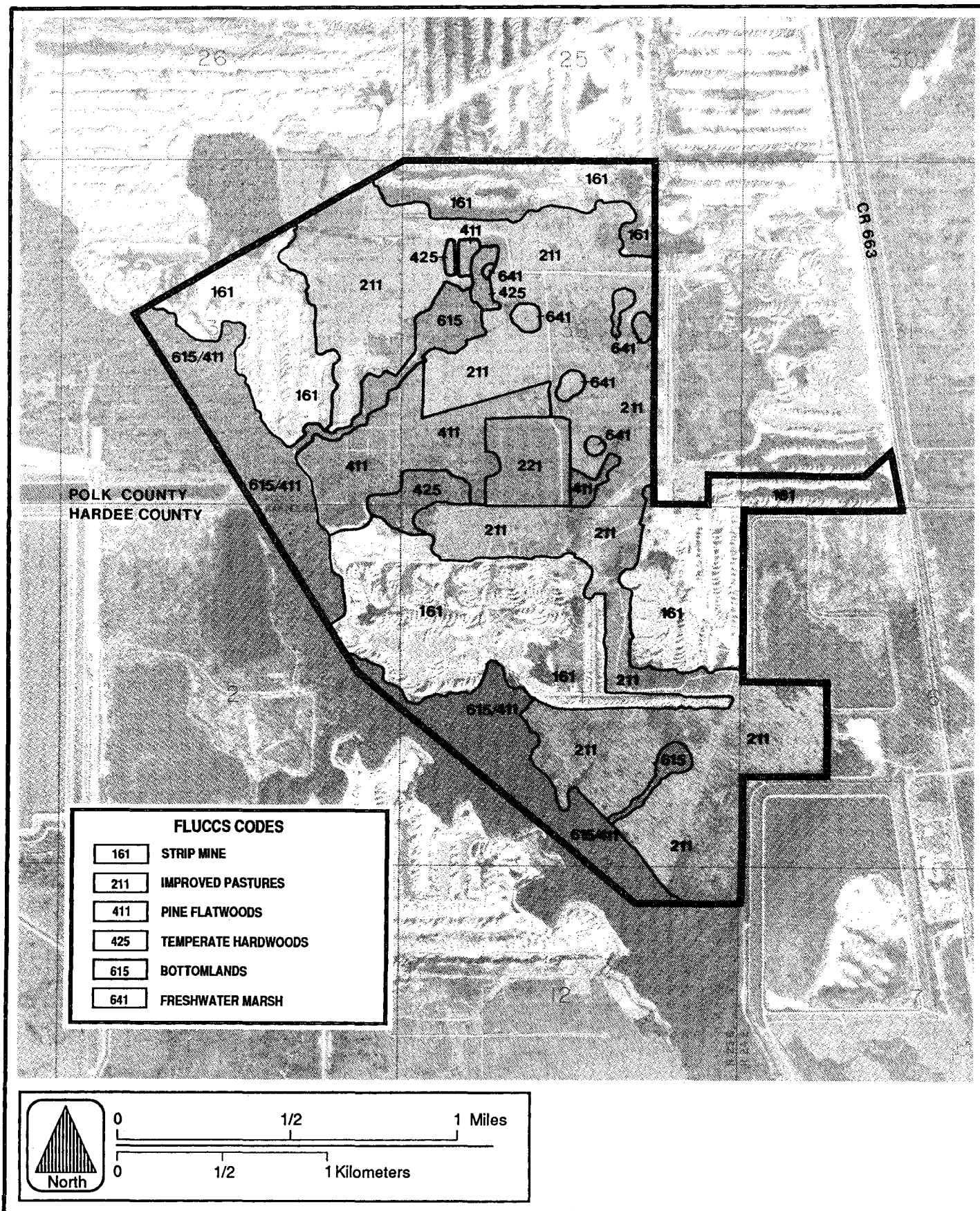


Figure 2.3.5-1 LAND USE AND VEGETATION OF PLANT SITE AND ASSOCIATED FACILITIES

**Hardee
Power Station**

Table 2.3.5-1. Species Observed on the Hardee Power Station Site
(Page 1 of 3)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands
TREES				
<u>Acer rubrum</u>	Red maple			x
<u>Diospyros virginiana</u>	Persimmon			x
<u>Fraxinus caroliniana</u>	Pop ash			x
<u>Gordonia lasianthus</u>	Loblolly bay			x
<u>Liquidambar styraciflua</u>	Sweetgum			x
<u>Magnolia virginiana</u>	Sweetbay magnolia			x
<u>Nyssa biflora</u>	Swamp black gum			x
<u>Persea borbonia</u>	Red bay			
<u>Quercus laurifolia</u>	Swamp laurel oak			x
<u>Quercus nigra</u>	Water oak			x
<u>Quercus virginiana</u>	Live oak	x	x	
<u>Pinus elliottii</u>	Slash pine	x	x	x
<u>Pinus palustris</u>	Longleaf pine	x	x	
<u>Salix caroliniana</u>	Carolina willow			x
SHRUBS				
<u>Ampelopsis arborea</u>	Pepper vine			x
<u>Baccharis glomeruliflora</u>	Stalkless groundsel bush			x
<u>Cephalanthus occidentalis</u>	Buttonbush			x
<u>Gelsemium sempervirens</u>	Yellow jessamine			x
<u>Ilex cassine</u>	Dahoon holly			x
<u>Itea virginica</u>	Virginia willow			x
<u>Myrica cerifera</u>	Wax myrtle		x	x
<u>Osmanthus americana</u>	Wild olive			x
<u>Rhododendron viscosum</u>	Swamp honeysuckle			x
<u>Serenoa repens</u>	Saw palmetto	x	x	x
<u>Smilax auriculata</u>	Catbrier		x	x
<u>Smilax bona-nox</u>	Greenbrier		x	x
<u>Smilax laurifolia</u>	Bamboo vine			x
<u>Toxicodendron radicans</u>	Poison ivy			x
<u>Vaccinium corymbosum</u>	Highbush blueberry			x
<u>Viburnum obovatum</u>	Small viburnum			x
<u>Vitis sp.</u>	Grape			x

Table 2.3.5-1. Species Observed on the Hardee Power Station Site
(Page 2 of 3)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands
HERBACEOUS SPECIES				
<u>Andropogon glomeratus</u>	Bushy broomgrass	x		
<u>Andropogon</u> <u>brachystachyus</u>	Shortspike broomgrass		x	
<u>Andropogon virginicus</u>	Broom grass	x		
<u>Aristida spiciformis</u>	Bottlebrush grass		x	
<u>Aster subulatus</u>	Annual marsh aster	x		
<u>Blechnum serrulatum</u>	Swamp fern			x
<u>Canna flaccida</u>	Golden canna			x
<u>Cassia nictitans</u> var. <u>aspera</u>	Wild sensitive plant	x		
<u>Centella asiatica</u>	Coinwort	x		
<u>Conyza canadensis</u>	Horseweed	x		
<u>Cyperus polystachyos</u>	Texas sedge	x		
<u>Desmodium incanum</u>	Creeping beggarweed	x		
<u>Desmodium triflorum</u>	Sagotia beggarweed	x		
<u>Diodia teres</u>	Poor joe	x		
<u>Digitaria ciliaris</u>	Southern crab grass	x		
<u>Elephantopus elatus</u>	Florida elephant's foot	x		
<u>Eleocharis</u> sp.	Spikerush	x		
<u>Encyclia tampensis</u>	Butterfly orchid			x
<u>Eremochloa ophiuroides</u>	Centipede grass	x		
<u>Eupatorium capillifolium</u>	Dog fennel	x		
<u>Habenaria repens</u>	Water spider orchid			x
<u>Hypoxis juncea</u>	Yellow star grass		x	
<u>Juncus scirpoides</u>	Rush			x
<u>Ludwigia peruviana</u>	Primrose willow			x
<u>Mitchella repens</u>	Partridge berry			x
<u>Murdannia nudiflora</u>	Dove weed	x		
<u>Osmunda cinnamomea</u>	Cinnamon fern			x
<u>Panicum anceps</u>	Beaked panicum			x
<u>Panicum rigidulum</u>	Redtop panicum			x
<u>Paspalum distichum</u>	Knot grass	x		
<u>Paspalum urvillei</u>	Vasey grass	x		
<u>Phlebodium aureum</u>	Golden polypody			x
<u>Sacciolepis indica</u>	Cupscale	x		
<u>Sesbania vesicaria</u>	Bladderpod	x		
<u>Saururus cernuus</u>	Lizards-tail			x

Table 2.3.5-1. Species Observed on the Hardee Power Station Site
(Page 3 of 3)

Scientific Name	Common Name	Pasture	Flatwoods	Wetlands
<u>Tillandsia fasciculata</u>	Wild pine			x
<u>Tillandsia recurvata</u>	Ball-moss	x		x
<u>Tillandsia usneoides</u>	Spanish moss	x	x	x
<u>Urena lobata</u>	Caesar weed	x		x
<u>Woodwardia areolata</u>	Chain fern			x
<u>Woodwardia virginiana</u>	Virginia chain fern			x
<u>Xyris platylepis</u>	Broadscale yellow- eyed-grass	x		

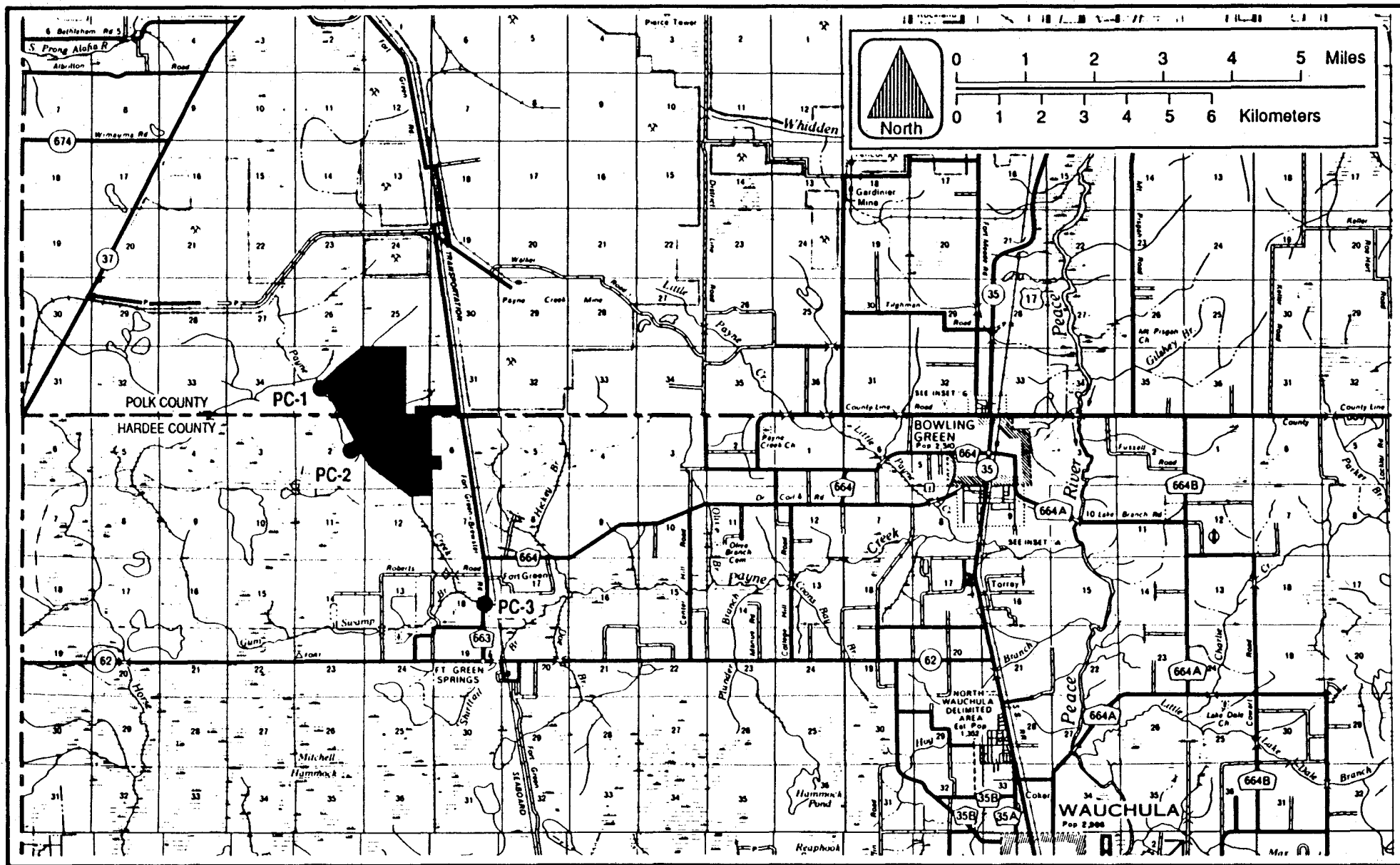


Figure 2.3.6-1 AQUATIC ECOLOGY SAMPLING STATION LOCATIONS

**Hardee
Power Station**

FISHES

Based on the results of the ichthyofaunal sampling 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 the Payne Creek. The predominance of two salt-tolerant secondary freshwater species, the flagfish (Jordanella floridae), and the sailfin molly, (Poecilia latipinna), collected in October 1988, at the upstream sampling Station (PC-1) and the presence of the walking catfish (Clarias batrachus) at this station may signal proximity to drainage ditches, which traditionally host this exotic and the previous two species.

Mosquitofishes (Gambusia holbrooki), predictably, dominated the catches numerically during the October 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 collected in October may be broken down into three major assemblages (Table 2.3.6-1). The dominant grouping involves seven species of killifishes (families Cyprinodontidae and Poeciliidae), juveniles of four species of sunfishes (Centrarchidae), and a 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 three minnows (Cyprinidae) and a silverside (Atherinidae), plus adult sunfishes. Adult centrarchids frequently assemble at the interface between vegetated habitats and open water. The third assemblage, involving two species of catfishes (Ictaluridae and Clariidae) and a darter (Percidae), is closely associated with the bottom.

Table 2.3.6-1. Fishes Collected at Three Stations in Upper Payne Creek, 6 October 1988, with Characterizations of Ecological Assemblages

Scientific Name	Common Name	Station		
		PC-1	PC-2	PC-3
<u>Lepisosteus platyrinchus</u> (1)	Florida gar		1	
<u>Notemigonus crysoleucas</u> (2)	Golden shiner	13		4
<u>Notropis emiliae</u> (2)	Pugnose minnow			1
<u>Notropis petersoni</u> (2)	Coastal minnow	12	12	14
<u>Noturus gyrinus</u> (3)	Tadpole madtom	1		
<u>Clarias batrachus</u> (3)	Walking catfish	1		
<u>Fundulus chrysotus</u> (1)	Golden topminnow	7	3	6
<u>Fundulus seminolis</u> (1)	Seminole killifish	2		1
<u>Jordanella floridae</u> (1)	Flagfish	32	7	3
<u>Lucania goodei</u> (1)	Bluefin killifish	18	2	1
<u>Gambusia holbrooki</u> (1)	Mosquito fish	162	91	275
<u>Heterandria formosa</u> (1)	Least killifish	5		11
<u>Poecilia latipinna</u> (1)	Sailfin molly	69	3	9
<u>Labidesthes sicculus</u> (2)	Brook silverside	20	54	45
<u>Lepomis gulosus</u> (1,2)	Warmouth	2	1	
<u>Lepomis macrochirus</u> (1,2)	Bluegill	3		8
<u>Lepomis marginatus</u> (1,2)	Dollar sunfish	1	1	1
<u>Lepomis microlophus</u> (1,2)	Redear sunfish	2	3	16
<u>Etheostoma fusiforme</u> (3)	Swamp darter	1		3
-----		-----		
TOTAL SPECIES		17	11	15
TOTAL INDIVIDUALS		351	178	398

Note: (1) Vegetation assemblage
 (2) Open water assemblage
 (3) Benthic assemblage

Sampling at middle Station (PC-2) resulted in relatively fewer fishes than at Stations PC-1 and PC-3. This trend mirrors diversity, as measured by the number of species captured. The most upstream Station (PC-1), yielded 17 species. Fifteen species were collected at downstream Station (PC-3), and 11 were found at the middle station (PC-2). Station PC-1 offered the most diverse habitats with riffles, pools and submergent vegetation; the high number of species present in this station was thus expected. Station PC-2 lacked any riffle habitat and Station PC-3 offered less divergent micro-habitats than the first two stations, but dense submergent and emergent vegetation provided good niche complexity, thereby allowing high faunal diversity.

Results of the February 1989 sampling effort (Table 2.3.6-2) are consistent with those obtained during October 1988. As was the case during October, number of species was higher at the upstream and downstream Stations (PC-1 and PC-3) than at the middle station (PC-2). During the February 1989 sampling, the total number of species was down at all three stations when compared to the October 1988 results; 11 species were collected at PC-1 (17 species during October 1988), 10 species at PC-2 (11 species during October 1988), and 12 species at PC-3 (15 species during October 1988). However, the total number of species collected from Payne Creek were 19 during both sampling periods. Based on the present qualitative effort, it was found that fish abundance was generally higher during February 1989 than October 1988. Four hundred and forty-three individuals were collected at the upstream station during February 1989 (351 specimens during October 1988), 190 individuals at the middle station (178 specimens during October 1988) and 180 individuals at the downstream station (398 specimens during October 1988).

Three species (Lepisosteus platyrinchus, C. batrachus, and J. floridae) collected in October were absent in February. The absence of L. platyrinchus, C. batrachus and J. floridae was not unexpected; the first two species were initially represented by only single individuals. According to Burgess (personal communication 1989), J. floridae may be an annual killifish (i.e., it lives for only one year), so its absence may

Table 2.3.6-2. Fishes Collected at Three Stations in Upper Payne Creek,
14 February 1989, with Characterizations of Ecological
Assemblages

Scientific Name	Common Name	Station		
		PC-1	PC-2	PC-3
<u>Notemigonus crysoleucas</u> (2)	Golden shiner	4		
<u>Notropis emiliae</u> (2)	Pugnose minnow		8	
<u>Notropis petersoni</u> (2)	Coastal shiner	67	38	16
<u>Ictalurus natalis</u> (3)	Yellow bullhead			1
<u>Noturus gyrinus</u> (3)	Tadpole madtom			1
<u>Fundulus chrysotus</u> (1)	Golden topminow	3	1	
<u>Fundulus seminolis</u> (1)	Seminole killifish	1		
<u>Lucania goodei</u> (1)	Bluefin killifish	9	5	2
<u>Gambusia holbrooki</u> (1)	Mosquito fish	282	69	109
<u>Heterandria formosa</u> (1)	Least killifish		1	6
<u>Poecilia latipinna</u> (1)	Sailfin molly	52	3	6
<u>Labidesthes sicculus</u> (2)	Brook silverside	13	63	
<u>Elassoma evergladei</u> (1)	Everglades pygmy sunfish			1
<u>Lepomis gulosus</u> (1,2)	Warmouth			3
<u>Lepomis macrochirus</u> (1,2)	Bluegill	5	1	2
<u>Lepomis marginatus</u> (1,2)	Dollar sunfish			29
<u>Lepomis microlophus</u> (1,2)	Redear sunfish	2		
<u>Lepomis punctatus</u> (1,2)	Spotted sunfish	5	1	
<u>Etheostoma fusiforme</u> (3)	Swamp darter			4

TOTAL SPECIES		11	10	12
TOTAL INDIVIDUALS		443	190	180

Note: (1) = Vegetation assemblage
(2) = Open water assemblage
(3) = Benthic assemblage

reflect natural mortality. New species collected in February were Ictalurus natalis, Elassoma evergladei, and Lepomis punctatus. All three species taken for the first time are typical for this type of stream and were expected to appear with additional sampling.

BENTHIC MACROINVERTEBRATES

Macroinvertebrate sampling emphasized benthic infaunal and epifaunal communities. These sampling efforts were carried out during October 1988 and February 1989, concurrent with the fish surveys. Artificial substrates were incubated for four weeks and picked up in November and March, respectively. A total of 153 macroinvertebrate taxa were collected from Payne Creek during the present study.

A total of 90 taxa collected by the artificial substrates (Appendix 11.6 Table 1). 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% of all invertebrates collected (Table 2.3.6-3). 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% of the total fauna (PC-2 in October/November and PC-1 in February/March). 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 at Stations PC-1 and PC-2 were the Endochironomus group, the Rheotanytarsus exiguus group, Tanytarsus spp., the Thienemanniella fusca group, and occasionally the Corynoneura taris group (Appendix 11.6, Tables 2-6). 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 T. fusca group and the C. taris group are considered to be sensitive to organic pollution. These data appear to indicate that areas near Stations PC-1 and PC-2 are relatively free of organic pollution, but may be rich in organic matter.

Table 2.3.6-3. 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			February/March		
	1988			1989		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
<u>Density*</u>	14,296	23,247	+	31,821	23,385	7,006
<u>Diversity</u>	3.62	3.14	+	2.74	3.58	4.11
<u>Number of Taxa</u>	32	39	+	34	39	38
<u>Percent Composition</u>						
Ephemeroptera	5	2	+	<1	4	8
Chironomidae	64	89	+	80	91	81
Mollusca	< 1	< 1	+	<1	2	4
Other	30	8	+	18	3	7

* Per meter square (m²)

+ Samples vandalized.

The hydropsychid caddisfly larvae, Cheumatopsyche sp., was also very abundant on the artificial substrates at Station PC-1. 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%), 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.

Species composition at Station PC-3 was different from that of upstream sites. Chironomids again dominated the fauna, however, species that had dominated Stations PC-1 and PC-2 no longer dominated Station PC-3 and were only collected sporadically, if at all. P. convictum which overwhelmingly dominated the fauna at PC-1 and PC-2, was not collected at PC-3, although other species of Polypedilum were found. Dicrotendipes, primarily, D. simpsoni was common. Species that had not been collected at the other creek Stations (PC-1 and PC-2) were collected at PC-3, they include: Cryptotendipes nr. pseudotener, Glyptotendipes lobiferous, Kiefferulus dux, and Paralauterborniella nigrohalteralis. The slower stream flow at PC-3 may be partially responsible for this change in species composition and for the increased enrichment. The species found at Station PC-3 do not require flowing water as do those that dominate PC-1 and PC-2. Furthermore, the reduced stream flow allows deposition of suspended matter in the downstream areas. Although Station PC-3 was vandalized during the October/November sampling period, the data gap does not affect the overall characterization of Payne Creek. The February/March sampling results indicated a typical assemblage of organisms for this habitat.

Macroinvertebrate data from the artificial substrates indicate that a relatively significant change occurred in the fauna of the upstream Station PC-1 from October/November 1988 to February/March 1989. Densities more than doubled, while percent composition of chironomids increased by 16%, and percent composition of the relatively intolerant ephemeropterans (mayflies) decreased (Table 2.3.6-3). Furthermore, diversity decreased by 25%.

A total of 82 taxa were collected by Ponar sampling from Payne Creek (Appendix 11.6, Table 1). The Ponar samples from the two upstream creek stations collected more taxa than ponar samples usually contain, and many of these taxa were insects that are not commonly found in grab samples (Table 2.3.6-4). The rich infauna benthic populations observed in the upstream stations (PC-1 and PC-2) 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 has occurred in the vicinity of both banks.

Macroinvertebrates from the dip net samples revealed that the grass shrimp, Palaemonetes paludosus, and chironomids dominated the vegetation, leaf packs, submerged roots and sticks in the streams (Table 2.3.6-5). Cambarid crayfish were also abundant, especially at the upstream stations.

In summary, the present evaluation of the macroinvertebrate communities in Payne Creek indicates that the two upstream stations of the creek are typical of central Florida small sandy bottom streams. A considerable load of suspended organic matter is indicated by the population parameters studied using the artificial substrates (i.e., the taxonomic composition, the high total densities and the proliferation of typical suspension feeders). The epifaunal communities at the upstream station (PC-1) changed between the October/November 1988 and February/March 1989 sampling periods, more so than at any other site. The amount of suspended organic material in the water may have increased during the course of the study, as implied by

Table 2.3.6-4. Density, Diversity, and Number of Taxa of Macroinvertebrates Collected from Payne Creek by Ponar Grab Samples in October 1988 and February 1989.

	<u>October 1988</u>			<u>February 1989</u>		
	PC-1	PC-2	PC-3	PC-1	PC-2	PC-3
<u>Density</u> *	13,090	12,090	3,636	27,270	26,906	2,818
<u>Diversity</u>	3.38	4.50	2.07	4.02	4.14	3.75
<u>Number of Taxa</u>	35	47	11	32	35	18
<u>Percent Composition</u>						
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

* per meter square (m²)

Table 2.3.6-5. 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
<u>Turbellaria</u>	Flatworm		F	F			
<u>Prostoma rubrum</u>	Proboscis worm			P			
<u>Lumbriculidae</u>	Aquatic earthworm						P
<u>Tubificidae</u>	Aquatic earthworm		P	P			
<u>Hirunidea</u>	Aquatic earthworm						P
<u>Batrachobdella phalera</u>	leech	P		P			
<u>Hyaella azteca</u>	Scud	F	C	C		F	C
<u>Gammaridae</u>	Scud	P					
<u>Cambarinae</u>	Crayfish		C	P		F	
<u>Palaenometes paludosus</u>	Shrimp	P	C	AA	C	C	AA
<u>Perlidae</u>	Stonefly		P				
<u>Baetis sp.</u>	Mayfly	A	F				
<u>Callibaetis floridanus</u>	Mayfly			F			
<u>Pseudocloeon alachua</u>	Mayfly						P
<u>Caenis diminuta</u>	Mayfly	A		P			
<u>Stenacron interpunctatum</u>	Mayfly	F		C			
<u>Stenonema spp.</u>	Mayfly		P				
<u>S. exiguum</u>	Mayfly				F		
<u>Chloroterpes hubbelli</u>	Mayfly		F				
<u>Iricorythodes albilineatus</u>	Mayfly				P		
<u>Hetaerina sp.</u>	Damselfly						F
<u>Argia sedula</u>	Damselfly				F	P	F
<u>Anomalagrion hastatum</u>	Damselfly					F	
<u>Nehalennia sp.</u>	Damselfly	A		P	F	P	F
<u>Aeschnidae</u>	Dragonfly			P			
<u>Gomphus minutus</u>	Dragonfly		P		P		
<u>Hagenius brevistypus</u>	Dragonfly				P		
<u>Brachymesia gravida</u>	Dragonfly	F			P	F	
<u>Macromia sp.</u>	Dragonfly		P			F	F
<u>M. taeniolata</u>	Dragonfly				F	F	
<u>Cheumatopsyche sp.</u>	Caddisfly	AA			AA		
<u>Hydropsyche sp.</u>	Caddisfly						F
<u>Hydroptilidae</u>	Caddisfly						
<u>Cynellus sp.</u>	Caddisfly		F				
<u>Polycentropus sp.</u>	Caddisfly			P		F	
<u>Homoptera</u>	True Bug			P			
<u>Pelocoris sp.</u>	True Bug			F			
<u>Ranatra sp.</u>	True Bug					C	F
<u>Lepidoptera</u>	Aquatic Caterpillar		F	P		F	F
<u>Chrysomelidae</u>	Weevil Beetle		F				
<u>Dubiraphia sp.</u>	Riffle Beetle	C					
<u>Heterelmis vulnerata</u>	Riffle Beetle	P				P	
<u>Stenelmis fusca group</u>	Riffle Beetle						
<u>Gyrinidae</u>	Whirligig Beetle	F					

Table 2.3.6-5. Macroinvertebrates Collected in Qualitative Dip Net
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
<u>Dineutus</u> sp. (larvae)	Whirligid beetle	F					P
Haliplidae	Crawling beetle		F	C			
Helodida	Beetle			P	C	F	
Noteridae	Burrowing water beetle						F
Ceratopogonidae	Biting Midges						
Chironomidae	midges	AA	AA	AA	AA	AA	A
<u>Simulium</u> sp.	Blackflies						P
Stratiomyidae	soldier flies			F			
Tabanidae	horseflies		F				
Tipulidae	crane flies			P		P	
<u>Laevipex</u> <u>floridana</u>	eimpet		P	P			
<u>Pseudosuccinea</u> <u>columella</u>	pond & snail		P				
<u>Planorbella</u> <u>scalaris</u>	mesa rams-horn	P		P			
<u>Pomacea</u> <u>paludosa</u>	apple snail			P			P
<u>Corbicula</u> <u>fluminea</u>	asiatic clam		F		P	F	P

Notes: AA = very abundant (>20 organisms)
A = abundant (10-20)
C = common (6-10)
F = few (2-5)
P = present (1)

the increase in total densities and the dominance of a few taxa in March over those in November. The macroinvertebrate communities at this station did not change substantially between sampling periods, as indicated by only minor changes in such community parameters as densities, diversities, number of taxa, and dominance.

At the most downstream station (PC-3), the river broadens and the flow slows down considerably. This station is affected by the apparent load of suspended material from upstream tributaries. In fact, this site is quite eutrophic, and the organisms collected by Ponar grab particularly reflected this. Macroinvertebrates collected by the artificial substrates samplers at this station contained both taxa that had apparently drifted downstream from areas of higher environmental quality and taxa that were quite tolerant to enrichment and more representative of this station.

TERRESTRIAL SYSTEMS - FLORA

Mined Lands--Mined lands are on the north and northwestern part of the site (Figure 2.3.5-1 FLUCCS Code 161). These lands consist of bare, scarified land, spoil piles of material which has been scraped from the surface, and excavated areas which are filled with water. There is no vegetation on these lands except for the occasional ruderal species that have managed to establish on the spoil piles. Ditches and berms that border the mined areas keep runoff from draining into Payne Creek.

Improved Pasture with Scattered Pine--The pasture is the dominant community on the unmined portion of the site. The pasture in the southeastern corner of the site below the mined lands (Figure 2.3.5-1, FLUCCS Code 211) represents lands that will not be mined. The power block associated facilities will be built on this land. The dominant grass in the pasture is bahia grass (Paspalum notatum). The soil underlying most of the pasture is Smyrna sand, a nearly level, poorly drained soil with moderate permeability and moderate natural fertility. The southeastern corner of the pasture on site, adjacent to an intact forested tributary, is underlain by Myakka fine sand, a nearly level poorly drained soil with low natural fertility. Its permeability is rapid in the surface layer and substratum and moderate to

moderately rapid in the subsoil. The water table recedes to a depth greater than 1 m (40 inches) in very dry seasons (Robbins, et al., 1984). These soil types and the species types that are colonizing the pasture indicate that its original native vegetation was flatwoods.

Although planted grass dominates the herbaceous layer, many native species and weedy aliens are present throughout the pasture (Table 2.3.6-6). Mature slash pine (Pinus elliottii) occurs scattered throughout the area; mature longleaf pine (Pinus palustris) can be found in the southwestern and western portion of the site. The trees range in diameter from 12 to 30 cm with a mean diameter of 23 cm. Their density on the site is approximately 5 per ha (2 per acre). Most trees bear cones, but young pines were seen only in the southern border near the Payne Creek floodplain. Remnant saw palmetto (Serenoa repens) clumps surround the pine trunks. Live oak (Quercus virginiana) clumps or individual trees occur in the southern pasture which is closer to the floodplain. Spanish moss (Tillandsia usneoides) and to a lesser extent, ball moss (Tillandsia recurvata) are common epiphytes on the pasture trees.

Dog fennel (Eupatorium capillifolium) has invaded much of the improved pasture. Bluestem grass (Andropogon virginicus) is also abundant here. Centipede grass (Eremochloa ophiuroides) which may either have been planted with the bahia grass or invaded afterward is common. Many species are indicative of wet poorly drained conditions in parts of the pasture, e.g., Aster subulatus, Boltonia diffusa, and Centella asiatica. If left undisturbed, the open pasture would eventually be reclaimed by flatwoods or hardwood forest, depending upon the frequency of wildfire.

Forested Wetland--One unmined tributary (0.9 ha or 2.3 acres) occurs in the southeastern pasture (Figure 2.3.5-1, FLUCCS Code 615) of the site. The forested headwaters of this tributary has a rich flora. Water spider orchid (Habenaria repens), goldfoot fern (Phlebodium aureum), and partridge berry (Mitchella repens) were some of the herbaceous species observed in addition to the more dominant groundcover of poison ivy (Toxicodendron radicans), lizard tail (Saururus cernua), and ferns (Osmunda cinnamomea, Woodwardia

Table 2.3.6-6. Plant Species Abundance in Improved Pasture
at Hardee Power Station Site (Number of Plots = 20)

	*Mean Percent Cover	Mean Percent Frequency	Importance Value
<u>Species**</u>			
<u>Paspalum notatum</u>	80.0	100.0	26.6
<u>Desmodium triflorum</u>	59.1	55.0	17.4
<u>Sacciolepis indica</u>	29.2	40.0	10.2
<u>Desmodium incanum</u>	37.5	20.0	9.1
<u>Eupatorium capillifolium</u>	29.0	30.0	8.9
<u>Centella asiatica</u>	6.0	50.0	7.4
<u>Eremochloa aphiuroides</u>	30.0	10.0	6.5
<u>Richardia scabra</u>	5.0	30.0	4.7
<u>Cyperus polystachyos</u>	3.3	20.0	3.1
<u>Diodia teres</u>	3.3	15.0	2.5
<u>Conyza canadensis</u>	4.0	10.0	2.0
<u>Murdannia nudiflora</u>	2.0	10.0	1.7

* Mean percent cover in plots where the species occurred.

Importance Value = (Relative Mean Percent Cover + Relative Mean Percent Frequency) divided by 2

** See table 2.3.5-1 for common names

spp.) The overstory consists of red maple (Acer rubrum), water oak (Quercus nigra), sweetbay magnolia (Magnolia virginiana), black gum (Nyssa biflora), and loblolly bay (Gordonia lasianthus) (Table 2.3.6-7). Red maple is dominant with an importance value of 45.7%. Average basal area of red maple trunks is 914.3 cm². Total basal area of the tree canopy is 210 m²/hectare. Epiphytes are common on canopy trees in this community and buttonbush (Cephalanthus occidentalis), swamp honeysuckle (Rhododendron viscosum), and Virginia willow (Itea virginica) were abundant in the shrub stratum with importance values of 14.0, 9.5, and 17.0%, respectively. Redbay (Persea borbonia), sweetbay magnolia and water oak (Quercus nigra) were the most common saplings. South of the forested headwater area the tributary was narrow (1-3 m wide), deep in some areas, and shallow in others. Trees are intermittent in this part of the drainage. Sedges and lizard-tail (Saururus cernua) occupied treeless areas. Canna (Canna flaccida) and narrow-leaf sunflower (Helianthus angustifolia) were also observed in open areas of the tributary.

Payne Creek Floodplain--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 FLUCCS 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.

The dominant tree in the upper floodplain is laurel oak with an importance value of 82.4% (Table 2.3.6-8). The average basal area of this species is 711.5 cm². Sweet gum (Liquidambar styraciflua) and red maple are also

Table 2.3.6-7. Plant Species* Abundance in Forested Wetland at
Hardee Power Station Site (Number of plots = 4)
(Page 1 of 2)

Stratum	Abundance Measurements			Importance ¹ Value (%)
	Total Basal area (cm ²) per M ²	Average Basal area (cm ²)	Total Density per M ²	
TREES				
<u>Acer rubrum</u>	11886	914.3	13	45.7
<u>Magnolia virginiana</u>	3534	441.8	8	19.2
<u>Quercus nigra</u>	1001	200.2	5	9.1
<u>Nyssa biflora</u>	996	332.1	3	6.4
<u>Liquidambar styraciflua</u>	1128	1127.6	1	4.0
<u>Gordonia lasianthus</u>	325	162.4	2	3.5
<u>Quercus laurifolia</u>	260	129.9	2	3.3
<u>Ilex cassine</u>	834	834.3	1	3.3
<u>Pinus elliottii</u>	740	739.9	1	3.1
<u>Persea borbonia</u>	460	459.7	1	2.4
Total	52.0		.09	

SHRUB LAYER	Total Density per m ²	Frequency	Importance ² Value (%)
<u>Itea virginica</u>	30	50	17.0
<u>Cephalanthus occidentalis</u>	15	100	14.0
<u>Vitis spp.</u>	12	100	12.7
<u>Rhododendron viscosum</u>	13	50	9.5
<u>Magnolia virginiana</u>	12	50	9.0
<u>Liquidambar styraciflua</u>	8	50	7.2
<u>Persea borbonia</u>	7	50	6.8
<u>Osmanthus americana</u>	5	25	4.1
<u>Serenoa repens</u>	4	25	3.6
<u>Myrica cerifera</u>	1	25	2.3
<u>Quercus nigra</u>	1	25	2.3
<u>Ilex cassine</u>	1	25	2.3
<u>Smilax laurifolia</u>	1	25	2.3
<u>Vaccinium corymbosum</u>	1	25	2.3
<u>Smilax auriculata</u>	1	25	2.3
Total	1.1		

Table 2.3.6-7. Plant Species Abundance in Forested Wetland at
Hardee Power Station Site (Number of plots = 4)
(Page 2 of 2)

Stratum	Abundance Measurements		
	Percent Cover per m ² plot	Frequency	Importance ³ Value (%)
GROUND LAYER			
<u>Osmunda cinnamomea</u>	40	100	38.5
<u>Saururus cernuus</u>	30	75	29.2
<u>Toxicodendron radicans</u>	8	50	13.1
<u>Myrica cerifera</u>	10	25	9.6
<u>Acer rubrum</u>	10	25	9.6

1. Importance value of trees = (Relative Basal Area + Relative Density)
divided by 2
2. Importance value of shrub layer = (Relative Density + Relative
Frequency) divided by 2
3. Importance value of ground layer = (Relative Percent Cover + Relative
Frequency) divided by 2

* See Table 2.3.5-1 for common names

Table 2.3.6-8. Plant Species* Abundance in Payne Creek
Floodplain at Hardee Power Station Site (Number of
plots = 4)

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

SHRUBS LAYER	Total Density	Frequency	Importance ² Value (%)
<u>Serenoa repens</u>	57	100	32.6
<u>Smilax bona-nox</u>	47	50	22.5
<u>Baccharis glomeruliflora</u>	13	75	14.4
<u>Smilax auriculata</u>	23	50	14.4
<u>Liquidambar styraciflua</u>	5	75	11.6
<u>Quercus laurifolia</u>	3	25	4.5
Total	1.5		

GROUND LAYER	Percent Cover per m ² plot	Frequency	Importance ³ Value (%)
<u>Panicum rigidulum</u>	80	25	39.1
<u>Urena lobata</u>	50	25	29.1
<u>Acer rubrum</u>	10	25	15.9
<u>Pteridium aquilinum</u>	10	25	15.9

1. Importance value of trees = (Relative Basal Area + Relative Density)
divided by 2

2. Importance value of shrub layer = (Relative Density + Relative
Frequency) divided by 2

3. Importance value of ground layer = (Relative Percent Cover + Relative
Frequency) divided by 2

** See Table 2.3.5-1 for common name

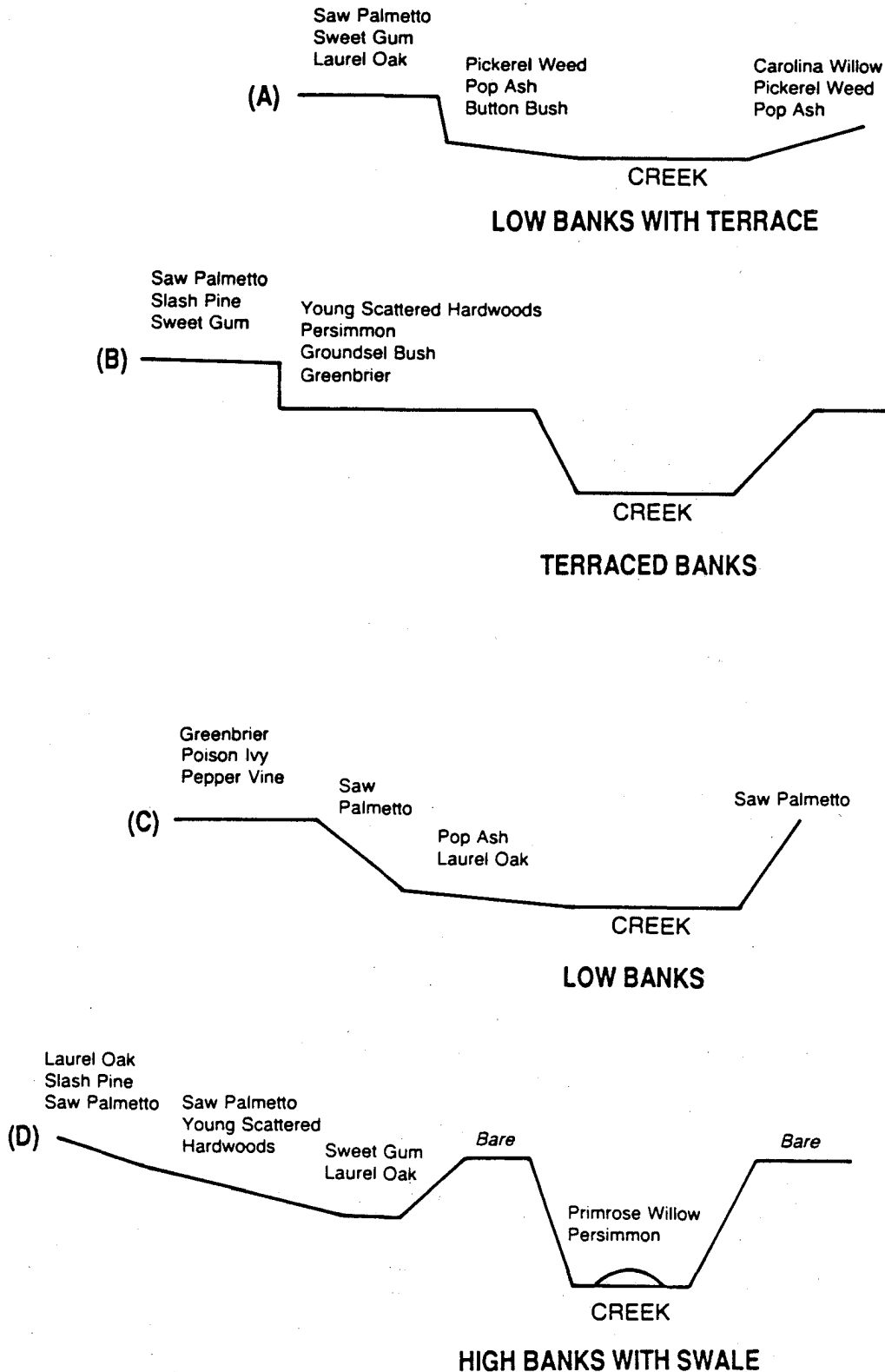
abundant. Total basal area of the tree canopy is 42.5 cm/m². Saw palmetto with an importance value of 32.6% is the most abundant shrub. Greenbrier (Smilax spp.) and groundsel tree (Baccharis glomeruliflora) are also abundant in the shrub layer. Redtop panicum (Panicum rigidulum) is a common groundcover in open areas of the floodplain. Epiphytes are common in the canopy trees and include Spanish moss, ball-moss, wild pine (Tillandsia fasciculata), and butterfly orchid (Encyclia tampensis). Red maple and sweetgum saplings are 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 vary 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 is characterized as low banks with a terrace. The vegetation in this type of area is comprised of pickerelweed, redtop panicum, pop ash, and buttonbush. Adjacent to this is an area approximately one meter higher with saw palmetto, sweetgum and laurel oak, festooned with yellow jessamine. In areas with terraced banks (Cross-section B) the vegetation pattern is 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 are live oak and sweet gum. This zone is approximately 7 m (23 ft) wide. Adjacent to it the bank rises 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 indicate occasional flooding here.

Parts of the floodplain have low banks flat (Cross-section C). 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).

WEST

EAST



(Not drawn to scale)

Figure 2.3.6-2 GENERALIZED RELATIONSHIP OF PLANT SPECIES TO PAYNE CREEK FLOODPLAIN CONFIGURATIONS

**Hardee
Power Station**

Cross-section 2.3.6-2-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 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.

Lands to be Mined--Agrico is permitted to mine the northern part of the site for phosphate. This area contains the site of the cooling reservoir for the Hardee Power Station. Much of it will have been excavated by Agrico before construction of the power plant begins. This area is predominantly pasture. It also contains an abandoned citrus orchard, logged pine plantation, and a

small oak woodland. The land was originally flatwoods before citrus and pasture were planted and some remnant flatwoods areas remain.

Wetlands in this area include several isolated marshes and a central forested wetland that drains into Payne Creek. The marshes have formed in depressions in the flatwoods and are dominated by maidencane (Panicum hemitomon), juncus (Juncus effusus), and pickerelweed. One of these marshes drains into a small pond. A sawgrass (Cladium jamaicense) marsh borders the forested wetland.

The forested wetland has been altered by filling, logging, and other disturbances that have favored weedy vegetation in some areas. Water oak, live oak, red maple, black gum, and saw palmetto are the dominant woody species. A large isolated wetland that will not be mined lies offsite to the northwest.

TERRESTRIAL SYSTEMS - FAUNA

Lands That Have Been Mined--The region surrounding the Agrico site has been severely altered by strip mining operations. The barren spoil piles and bare ground of mined land support virtually no wildlife species. Moreover, these mined areas isolate non-mined wildlife habitat from larger habitat areas. However, the ditches, excavated ponds and settling ponds support many wading birds and waterfowl.

Lands Not to be Mined--Remnant areas of important wildlife habitats, including forested wetland along Payne Creek and improved pasture with pine and upland oak-palmetto, still remain in the southern portion of the site (Figure 2.3.5-1). The most productive of these habitats are 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 2.3.6-9, 2.3.6-10 and 2.3.6-11).

Ubiquitous species (those species actually observed in all habitats), included the feral hog, nine-banded armadillo, downy woodpecker, and the blue jay (scientific names are listed in Tables 2.3.6-9 and 2.3.6-10). Feral hogs were abundant in all habitats and their foraging created much disturbance, particularly along forest edges.

Forested Wetland--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 accounted for much of the avian activity in this habitat.

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 Aquatic Systems Section).

Gray squirrels occur in the forested wetlands. Amphibians including green anoles and frogs including the green tree frog, bullfrog, and southern leopard frog were observed.

Flatwood Habitat--Birds were much less common in this habitat than in the forested wetland. Wildlife observed in the flatwoods included the downy woodpecker, tufted titmouse, blue-gray gnatcatcher, ruby crowned kinglet,

Table 2.3.6-9. Mammal Species Observed (O) or Which Potentially Occur (P) on the Hardee Power Station Site

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

Table 2.3.6-10. Birds Observed (O) or Which Potentially Occur (P) on the Hardee Power Station Site (Page 1 of 2)

Common name	Scientific name	Mesic Hardwoods	Open Pine- Pasture	Upland Oak-Palmetto	Flying Overhead	Seasonal Status*
Double-crested cormorant	<u>Phalacrocorax auritus</u>				O	P
White pelican	<u>Pelecanus erythrorhynchos</u>				O	W
Wood stork	<u>Mycteria americana</u>				O	R
Killdeer	<u>Charadrius vociferus</u>		O			RW
Red-shouldered hawk	<u>Buteo lineatus</u>	O	O	P		R
Red-tailed hawk	<u>Buteo jamaicensis</u>	P	O	P		R
American kestrel	<u>Falco sparverius</u>		O			RW
Black vulture	<u>Coragyps atratus</u>	P	P	P	O	RW
Northern bobwhite	<u>Colinus virginianus</u>	O	P	P		RW
Belted kingfisher	<u>Megasceryle alcyon</u>	O				W
Red-bellied woodpecker	<u>Melanerpes carolinus</u>	O	O	P		R
Downy woodpecker	<u>Picoides pubescens</u>	O	O	O		R
Pileated woodpecker	<u>Dryocopus pileatus</u>	O				R
Yellow-bellied sapsucker	<u>Sphyrapicus varius</u>	O		P		W
Great crested flycatcher	<u>Myiarchus crinitus</u>	O				S
Eastern phoebe	<u>Sayornis phoebe</u>	O				W
Tree swallow	<u>Iridoprocne bicolor</u>	O		O		R
Blue jay	<u>Cyanocitta cristata</u>	O	O	O		R
Tufted titmouse	<u>Parus bicolor</u>	O		O		R
Carolina wren	<u>Thyrothorus ludovicianus</u>	O		P		R
House wren	<u>Troglodytes aedon</u>	O	O			W
Ruby crowned kinglet	<u>Regulus calendula</u>	O		O		W
Blue-gray gnatcatcher	<u>Polioptila caerulea</u>	O		O		RW
Brown thrasher	<u>Toxostoma rufum</u>	O				R
Northern mockingbird	<u>Mimus polyglottos</u>	O	O	P		R
Gray catbird	<u>Dumetella carolinensis</u>	O	O			W
Loggerhead shrike	<u>Lanius ludovicianus</u>		O			R
White-eyed vireo	<u>Vireo griseus</u>	O	O			R
Black-and-white warbler	<u>Mniotilta varia</u>	O				W
Yellow-throated warbler	<u>Dendroica dominica</u>	O				W

Table 2.3.6-10. Birds Observed (O) or Which Potential Occur (P) on the Hardee Power Station Site (Page 2 of 2)

Common name	Scientific name	Mesic Hardwoods	Open Pine- Pasture	Upland Oak-Palmetto	Flying Overhead	Seasonal Status *
Yellow-rumped warbler	<u>Dendroica coronata</u>	O				W
Palm warbler	<u>Dendroica palmarum</u>	O	O	P		W
Common yellowthroat	<u>Geothlypis trichas</u>	O				R
Red-winged blackbird	<u>Agelaius phoeniceus</u>		O			R
Eastern meadowlark	<u>Sturnella magna</u>		O			R
Northern cardinal	<u>Cardinalis cardinalis</u>	O		O		R
Rufous-sided towhee	<u>Pipilo erythrophthalmus</u>	O	P	P		RW
Henslow's sparrow	<u>Ammodramus henslowii</u>		O			W

* 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.

Table 2.3.6-11. Terrestrial Reptiles and Amphibians Observed (O) or Which Potentially Occur (P) on the
on the Hardee Power Station Site (Page 1 of 2)

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

Table 2.3.6-11. Terrestrial Reptiles and Amphibians Observed (O) or Which Potentially Occur (P) on the Hardee Power Station Site (Page 2 of 2)

Common name	Scientific Name	Mesic Hardwoods	Open Pine- Palmetto	Upland Oak-Palmetto
Barking treefrog	<u>Hyla gratiosa</u>	P		
Green treefrog	<u>Hyla cinerea</u>	O		
Squirrel treefrog	<u>Hyla squirella</u>	P		
Pine woods treefrog	<u>Hyla femoralis</u>	P		
Florida chorus frog	<u>Psuedracris negrita verrucosa</u>	P		
Bullfrog	<u>Rana catesbeiana</u>	O		
Pig frog	<u>Rana grylio</u>	P		
Southern leopard frog	<u>Rana sphenoccephala</u>	O		
Florida gopher frog	<u>Rana areolat aesopus</u>	P		

blue jay, and cardinal. Adult and juvenile hogs, and gray squirrels were also seen.

Improved Pasture with Pine Habitat -- The most prominent birds in ^{the pasture area} ~~this habitat~~ ^{are} ~~were~~ the American kestrel, loggerhead shrike, Eastern meadowlark, and the killdeer, all of which are typical species of pasture land and/or open pine. Another grassland species observed was a granivore, the Henslow's sparrow.

Other birds observed included the red-bellied and downy woodpecker, red-tailed hawk, and the mockingbird, all of which, like the shrike and kestrel, utilized the scattered pines as perch sites. 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 in the scattered pines and on the ground.

THREATENED AND ENDANGERED SPECIES - ~~FLORA AND FAUNA~~

Species designated by the U.S. Fish and Wildlife Service (USFWS) as listed or under review, listed as endangered or threatened by the Florida Game and Fresh Water Fish Commission (FGFWFC), Florida Department of Agriculture and Consumer Services (FDACS), and on the Special Plants List by the Florida Natural Areas Inventory (FNAI) were included in ^{the threatened or} ~~this category~~ ^{endanger} ~~species category~~.

Sources used to identify threatened and endangered plant and animal species that could potentially occupy the unmined areas of the site included the FNAI data base, Florida Committee on Rare and Endangered Plants and Animals (FCREPA) reports, and DRI applications for the Agrico site and the CFI mine south of the Agrico site. The descriptions and flowering or fruiting seasons for plant species were reviewed and herbarium specimens were observed before a field search for the species was conducted. The following species listed as threatened on the FDA list were found on the Hardee County Power Plant site: water spider orchids and golden polypodie, both plants were in the pasture tributary, and shown in Table 2.3.6-12.

Flora--Threatened and endangered plant species were not found on the Agrico property (which includes the area of the plant site) in February 1976 during preparation of the DRI (Agrico 1977). However, as pointed out in the DRI,

Table 2.3.6-12. Threatened and Endangered Plant Species that Could Potentially Occur on or Near Hardee Power Station Site

Scientific Name	Common Name	Status	Habitat	Source	Prob. on Site
<u>Gymnopogon floridanus</u>	Florida beardgrass	UR2	Pinelands	USFWS	M
<u>Habenaria repens</u>	Water spider orchid	T	Wetlands	FDA	P
<u>Hartwrightia floridana</u>	Hartwrightia	T/UR2	Marsh grassland or boggy swales Blooms Sept-Nov	FDA/USFWS	L
<u>Phlebodium aureum</u>	Golden polypody	T	Epiphytic in hammocks	FDA	P
<u>Pteroglossapsis ecristata</u>	Wild coco	T	Dry sandy pinelands Blooms in Fall	FDA/USFWS	L
<u>Tillandsia setacea</u>	Wild pine	T	Epiphytic in hammocks	FDA	M
<u>Vittaria lineata</u>	Shoestring orchid	T	Epiphytic in hammocks	FDA	M

T = threatened according to FDA

UR2 = under review for listing by FWS, but substantial evidence of biological vulnerability and/or threat is lacking.

P = present on site

L = low probability of presence

M = moderate probability of presence

FCREPA - Florida Committee on Rare and Endangered Plants and Animals

FDA - Florida Department of Agriculture and Consumer Services list published in Preservation of Native Flora of Florida Act, Section 581.185-187 F.S.

USFWS - United States Fish and Wildlife Service.

the season was not optimum for identification of such species. Several listed species were reported on the CFI mine site, south of the Agrico Payne Creek mine, in 1985 and these were considered to potentially occur on the Agrico site.

Species that could potentially occur on the site are listed in Table 2.3.6-12 and the probability of their occurrence is assessed. Detailed descriptions and the results of the search for these species follow in this section.

Florida beardgrass [Gymnopogon floridanus, (G. chapmanianus in Wunderlin 1982)]

This grass is under review (Category 2) for listing by USFWS and is on the FNAI Special Plants List. It was found on the CFI site in flatwoods. The plant flowers in the fall and would have been recognized if seen. Although it was not observed, it is listed as having a moderate probability of being present because of the large area of flatwoods and pasture in which it could have possibly occurred.

Water spider orchid (Habenaria repens)

Water spider orchid occurs in the understory of the tributary forest and is common on site along the eastern part of the Payne Creek floodplain. It was in flower when observed. It is listed only by the FDACS with a designation of threatened. Wunderlin (1982) states that it is common throughout Central Florida.

Hartwrightia (Hartwrightia floridana)

Hartwrightia is under review (Category 2) for listing by USFWS and is listed as threatened by the FDACS. It is not reported from the area by FNAI or in CFI (1985). However, Ward (1978) reported it as occurring in Hardee County and Dr. Hall (personal communication) said that it could occur in wet open areas in the region. It produces pinkish lavender florets in fall and its achenes has resinous glands. Favorable habitats were thoroughly searched for this species, but it was not found. The probability of occurrence is, therefore, listed as low.

Golden polypody (Phlebodium aureum)

Golden polypody is an epiphytic fern listed as threatened by FDACS. Wunderlin (1982) refers to this species as frequent in hammocks. Three plants were observed in the pasture tributary on fallen red maple trees.

Wild coco (Pteroglossapsis ecristata)

This orchid is listed as under review (Category 2) by USFWS and as threatened by FDA. It was reported in the Payne Creek State Park by FNAI and on the CF site (CF 1985). Wunderlin (1982) states that it is frequent on sand pine scrub and sandhills. It is a tall plant that blooms in the fall and would be conspicuous. It was not observed on the site. The probability of the plant's occurrence is listed as low.

Wild pine (Tillandsia setacea)

This epiphyte is listed as threatened by FDACS. It was observed on the CFI site (CFI 1985) in swamp forest. Wunderlin (1982) states that it is common in Central Florida except for the northernmost counties. It could have been unobserved in canopy trees in the Payne Creek floodplain and therefore it is given a moderate probability of occurrence.

Shoestring fern (Vittaria lineata)

This epiphytic fern is listed as threatened by FDACS. It is listed as frequent by Wunderlin (1982). CFI (1985) reported that it occurred in the swamp forest. It has a moderate probability of occurrence in the Payne Creek floodplain, although it was not observed.

Fauna--No federally or state listed species have been observed onsite either during the Agrico DRI studies or this study (Table 2.3.6-13). For a number of species their range includes the site and potentially suitable habitat occurs in the site area. The following describes those species whose range include the site area.

Burrowing owl (Athene cunicularia)

The burrowing owl, listed as a species of special concern by the FGFWFC, was not observed during the survey. Suitable habitat (open pine-pasture) is

Table 2.3.6-13. Threatened and Endangered Faunal Species that Occur or Could Potentially Occur on or Near Hardee Power Station Site

Scientific Name	Common Name	Status	Habitat	Source	Prob. on Site
<u>Athene cunicularia</u>	Burrowing owl	SSC	Open pine-pasture	FGFWFC	L
<u>Falco sparverius paulus</u>	Southeastern American kestrel	T UR2	Open-pine pasture	FGFWFC USFWS	M
<u>Haliaeetus leucocephalus</u>	Bald eagle	T E	Open pine-pasture with tall trees	FGFWFC USFWS	L
<u>Polyboros plancus audobonii</u>	Audubon's crested caracara	T T	Prairie's open pasture	FGFWFC USFWS	L
<u>Mycteria americana</u>	Wood stork	E E	Wetlands	FGFWFC USFWS	L
<u>Felis concolor coryi</u>	Florida panther	E E	Large habitat areas	FGFWFC USFWS	L
<u>Mustela frenata peninsulae</u>	Florida long-tailed weasel	UR2	Forested stream borders	USFWS	M
<u>Gopherus polyphemus</u>	Gopher tortoise	SSC UR2	Upland areas with abundant herbaceous ground cover	FGFWFC USFWS	L
<u>Rana areolata</u>	Gopher frog	SSC UR2	Associated with gopher tortoise	FGFWFC USFWS	L
<u>Drymarchon corais couperi</u>	Eastern indigo snake	T T	Wooded areas	USFWS FGFWFC	M
<u>Pituophis melanoleucus mugitus</u>	Florida pine snake	SSC UR2	Upland oak-palmetto open pine-pasture	FGFWFC USFWS	M
<u>Stilosoma extenuatum</u>	Short-tailed snake	T UR2	Upland oak-palmetto	FGFWFC USFWS	M

L = low probability

P = present

M = moderate probability

SSC = Species of Special Concern

T = Threatened

E = Endangered

UR2 = Under review

USFWS = U.S. Fish and Wildlife Service

FGFWFC = Florida Game and Fresh Water Fish Commission

present but the likelihood of occurrence is low because of past and present mining activities.

Southeastern American kestrel (Falco sparverius paulus)

The Southeastern American kestrel is listed as threatened by the FGFWFC, under review for listing by the USFWS but substantial evidence of vulnerability is lacking (UR2). 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 open pine habitats. American kestrels (Falco sparverius sparverius) were found to be fairly common in the open pine-pasture of the site, but their subspecies could not be determined.

Bald eagle (Haliaeetus leucocephalus)

The bald eagle is listed as threatened by the FGFWFC and endangered by the USFWS. The closest nest is 4.8 km (3 miles) west of the Hardee Power Station site. Some of the pines on the site may be large enough to be used for occasional roosting sites. The likelihood of occurrence is low because of the mining activity and lack of open water on site for feeding.

Audubon's crested caracara (Polyboros plancus audobonii)

The crested caracara is listed as threatened by both the FGFWFC and the USFWS. It was not observed during the survey, but has been recorded within three miles of the study site and suitable habitat onsite is present. The likelihood of occurrence for feeding is low because of mining activities.

Wood stork (Mycteria americana)

Listed as endangered by both the FGFWFC and the USFWS. Several birds were observed circling overhead during surveys. A rookery occurs several miles to the north of the site. Suitable feeding or nesting habitat does not appear to be present on the site, but is present in the immediate vicinity.

Florida panther (Felis concolor coryi)

The Florida panther is listed as endangered by both the FGFWFC and the USFWS, and was not observed during the survey. Adequate prey may be present

in the area, but habitat is presently too fragmented for panthers. However a radio-collared panther was reported located within 24 km (15 miles) of study site.

Florida long-tailed weasel (Mustela frenata peninsulae)

The long-tailed weasel is listed as UR2 by USFWS, and was not observed. However, mesic hardwood forest along creeks may provide suitable habitat.

Gopher tortoise (Gopherus polyphemus)

Listed as a species of special concern by the FGFWFC and as UR2 by USFWS, gopher tortoise burrows were observed in open flatwoods on the lands to be mined. Although the upland oak-palmetto and open pine-pasture may also provide suitable habitat, the likelihood of occurrence in most areas is low because of the mining activities which have fragmented habitats.

Gopher frog (Rana areolata)

The gopher frog is listed as a species of special concern by the FGFWFC and as UR2 by the USFWS. It was not observed, but the upland oak-palmetto and open pine-pasture may provide suitable habitat. The gopher frog is found in association with the gopher tortoise.

Eastern indigo snake (Drymarchon corais couperi)

The eastern indigo snake is listed as threatened by both the FGFWFC and the USFWS. 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 upland oak-palmetto and mesic hardwood forest provide suitable habitat.

Florida pine snake (Pituophis melanoleucus mugitus)

The Florida pine snake, listed as a species of special concern by the FGFWFC and as UR2 by USFWS, was not observed, but the upland oak-palmetto and open pine-pasture are suitable habitat.

Short-tailed snake (Stilosoma extenuatum)

The short-tailed snake is listed as threatened by the FGFWFC and as UR2 by

the USFWS. It was not observed during the survey, but the upland oak-palmetto may provide adequate habitat.

2.3.6.2 Pre-existing Stresses

AQUATIC SYSTEMS

Payne Creek is located in an area of extensive phosphate mining. At the time these studies were conducted, mining was taking place north and east of the study site on either side of Payne Creek. Historically, Payne Creek has been altered by ditching of its tributaries for agricultural operations, and, more recently, by the elimination of the tributaries as a result of mining.

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 on site and in the vicinity of the site. Areas north and west of the site are being or have been reclaimed. Reclamation land uses consist predominantly of pasture land, lakes, and wetlands.

Agriculture is the predominant industry influencing natural vegetation and wildlife in both counties, with the exception of phosphate mining, and is likely to be the dominant industry when mining operations are complete. Cattle ranching, citrus and vegetable farming are the major agricultural enterprises (Stricker, 1988).

South and southeast of the site are productive citrus groves. These groves are south of the area where citrus was killed by 1984-1985 freezes. The foliage of the trees observed appears healthy. Foliage of natural vegetation not adjacent to phosphate mining activities was also healthy and showed no sign of disease or unusual insect herbivory.

2.3.6.3 Measurement Programs

AQUATIC ECOLOGY

The purpose of the measurement program was to collect and analyze macroinvertebrates and fish samples for estimating existing and future biological communities in Payne Creek. This information was supplemented by DRI studies conducted in the area. The sampling program was described in the environmental licensing plan of study (KBN, et al., 1988) and was approved by reviewing agencies.

Selected components of the aquatic biological system (i.e., fish and macroinvertebrates) were studied on a seasonal basis to biologically characterize the present status of Payne Creek in the vicinity of the proposed cooling reservoir discharge. The fish and macroinvertebrate communities were sampled at three stations in Payne Creek during October 1988 (wet season) and February 1989 (dry season).

Station locations in Payne Creek were selected based on preliminary design information regarding the location of the cooling reservoir outfall. Three stations were studied in Payne Creek, they were PC-1, PC-2, and PC-3. These stations were selected to encompass areas upstream, near, and downstream of the proposed cooling reservoir discharge. Figure 2.3.6-1 shows the aquatic ecology sampling stations, which coincide with the surface water stations. All biological sampling was conducted concurrent with water quality sampling. Due to variability in stream depth and current, similar areas were selected upstream and downstream, whenever possible to characterize habitats.

The following is a description of the sampling stations.

Station PC-1 is the most upstream sampling site in Payne Creek; it is located near the northern boundary of the Hardee Power Station property. This station offered the most diverse micro-habitats with riffles, pools, and submergent and overhanging vegetation present. The area sampled was shallow, less than 0.9 m (3 ft) deep, and completely covered by a tree canopy. The substrate was a mixture of sand, silt and detritus. It is

important to note that Agrico mining activities were ongoing in proximity to PC-1 during the October 1988 sampling period. The area surrounding PC-1 had been mined when the February 1989 sampling effort took place.

PC-2 is located downstream from the proposed outfall of the cooling reservoir. This section of the stream is relatively undisturbed, except for a small bridge and a downstream man-made pool (possibly used as a cattle watering hole in the past). All samples were taken from locations upstream of the man-made pool. This area of the creek was about 1.2 m (4 ft) deep, the water was clear brown, and the stream bottom was covered with heavy leaf litter over sand. Station PC-2 lacked any riffle habitat.

Station PC-3 was the most downstream site of Payne Creek sampled. It is located south of the property and upstream of the CR 663 bridge. The creek in this area is very wide, slow flowing, not covered by a tree canopy, and with a depth of approximately 1.8 m (6 ft). At this point, several tributaries have joined Payne Creek giving it the above characteristics. The bottom was covered with about 0.6 m (2 ft) of black soil containing decaying matter (muck) over sand. Station PC-3 had less divergent microhabitats than the first two stations, but dense submergent and emergent vegetation provided excellent niche complexity. The following is a discussion of the October 1988 and February 1989 Payne Creek sampling efforts.

All biological samples collected were fixed and labeled in the field. The samples were then taken to the laboratory for taxonomic identification. A voucher collection of representative specimens was prepared concurrent with the taxonomic work up of samples. A macroinvertebrate reference collection was prepared and is maintained by KBN's taxonomists. The ichthyological specimens were deposited as part of the collection of the Florida Museum of Natural History in Gainesville, Florida.

The objective of fish sampling effort was to gather baseline qualitative data on the composition of the ichthyofaunal community. Thus, a seine was chosen as the most appropriate method of fish capture in Payne Creek. A 9.1

meter (m) by 1.8 m, 6 millimeter (mm) mesh flat nylon minnow seine was employed at all three stations. The net was often rolled shorter to accommodate varying stream widths at Stations PC-1 and PC-2, while the maximum length was usually used at Station PC-3. Sampling efforts varied according to the habitat complexity of individual stations; Stations PC-1 and PC-2 offered more complex microhabitats than did Station PC-3, so more hauls were made at these first two stations to ensure coverage of all available niches. Captured fish were preserved immediately in 10% formalin and returned to the laboratory for sorting, identification, and quantification.

The macroinvertebrate surveys consisted of two phases:

1. A semiquantitative (artificial substrates) and qualitative (dip nets) assessment of epifaunal species, and
2. A quantitative survey of infaunal macroinvertebrate communities.

Artificial Substrates--Epifaunal macroinvertebrates were sampled using Hester-Dendy artificial substrate samplers which were incubated in Payne Creek from October to November 1988 and February to March 1989. The samplers were incubated for four weeks; three replicates were analyzed.

Ponar Grab Samples--Infaunal communities were sampled quantitatively using a petit Ponar. Six replicate samples were taken from the natural sediment. Four replicate samples were processed. Samples of infaunal macroinvertebrates were collected from Payne Creek during October 1988 and February 1989. These data and specific discussion are included in Appendix 11.6, Tables 7-12.

Dip Net--Organisms on vegetation, sticks, logs, and other substrates are collected qualitatively using a dip net. Organisms in dip net samples were identified to the lowest taxon readily discernible (e.g., order of family level). Samples were collected at all stations.

TERRESTRIAL ECOLOGY

Existing information was reviewed and field studies were conducted in order to determine 1) the nature of the regional and the onsite biota, 2) pre-existing environmental stresses, 3) effect of existing land uses on site biota, and 4) the potential occurrences of threatened and endangered species onsite.

Flora--Major onsite vegetation communities, defined as communities with an area of at least 2 ha (5 acres) or with significant functional value, e.g., wetlands, were delineated on aerial photographs. Dominant vegetation was identified during field surveys conducted in autumn of 1988 and early spring, 1989. Species composition and abundance in each community were sampled in representative plots. The number of replicate plots was proportional to the size of the community sampled.

Trees ≥ 5 cm trunk diameter were identified, counted, and the diameter recorded in 10 x 10 m plots. Shrub stems and trees < 5 cm trunk diameter that were ≥ 1 m tall, were counted in 5 x 5 m plots. Percent cover projected by the canopy of herbaceous species and woody species that were < 1 m tall were counted in 1 x 1 m plots. Smaller plots were nested in the larger plots in the communities sampled that had tree, shrub, and ground cover.

Regional vegetation was characterized through literature review, aerial photography, and road surveys. Existing environmental stress was identified through personal observation and consultation with Hardee and Polk County agricultural extension agents and the Polk County forester. Potential and/or actual occurrences of threatened and endangered species were determined by: consultation with FNAI and Dr. David Hall, curator of the Florida State Museum of Natural History herbarium; review of DRI applications, and FCREPA reports, 1978; and field surveys in likely habitats. These surveys were conducted in October and November, 1988 and in February 1989.

Fauna--Wildlife surveys were conducted on November 1 and December 28, 1988 and March 22 and 23, 1989. Mammals, birds, reptiles and amphibians were recorded as they were encountered in the field (Tables 2.3.6-9, 2.3.6-10 and 2.3.6-11). No trapping or quantitative surveys were conducted. Birds were qualitatively surveyed by walking through all habitats in the study area and recording each species seen or heard. Medium and large sized mammals were surveyed by searching for their sign (tracks, scat, foraging, trails, scrapes, etc). Direct observations of mammals were also recorded. Reptiles and amphibians were surveyed by searching under logs and other debris.

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 Power Station. The closest existing meteorological station to the proposed plant 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. The 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.

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 22°C (72°F) with monthly temperatures varying from a maximum of 32.4°C (90.3°F) to a minimum of 9.7°C (49.5°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.

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

Month	Temperatures*			Extremes ⁺	
	Mean	Maximum	Minimum	Maximum	Minimum
January	59.8	70.0	49.5	84	21
February	60.7	71.0	50.4	88	24
March	66.2	76.2	56.1	91	29
April	71.5	81.9	61.1	93	40
May	77.2	87.9	67.2	98	49
June	80.9	89.5	72.3	99	53
July	82.1	90.0	74.2	97	63
August	82.3	90.3	74.2	98	67
September	80.8	88.9	72.8	96	57
October	74.4	83.7	65.1	94	40
November	66.7	76.9	56.4	90	23
December	61.3	71.6	50.9	86	18
Annual	72.0	81.4	62.5	99	18

* 30-year period of record, 1951 to 1980.

⁺ 39-year period of record, 1947 to 1985.

Source: NOAA, 1985.

RELATIVE HUMIDITY AND PRECIPITATION

Relative humidity, an indication of the amount of moisture in the air at a given temperature, is 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% of the annual precipitation falls during the six warmest months, May through October. The mean annual precipitation is 119 cm (47 inches), but this has varied from as little as 74 cm (29 inches) to over 193 cm (76 inches) in the last 35 years. The majority of rain is in the form of short-lived convection showers.

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 in with strong land heating producing local onshore winds (i.e., wind with a westerly component). Annual and seasonal wind roses 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.

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

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

Month	Precipitation (inches)			Humidity** (%) hour (LT)			
	Mean*	Maximum+	Minimum+	0100	0700	1300	1900
January	2.17	8.02	T	84	86	59	73
February	3.04	7.95	0.21	83	85	56	69
March	3.46	12.64	0.06	82	86	55	67
April	1.82	6.59	T	82	87	51	62
May	3.38	17.64	0.17	81	86	53	62
June	5.29	13.75	1.86	84	87	60	68
July	7.35	20.59	1.65	85	88	63	73
August	7.64	18.59	2.35	87	91	64	76
September	6.23	13.98	1.28	86	91	62	75
October	2.34	7.36	0.16	85	89	57	71
November	1.87	6.12	T	85	88	57	74
December	2.14	6.66	0.07	84	87	59	74
Annual	46.73	76.57	28.89	84	88	58	70

Note: T - trace amount.

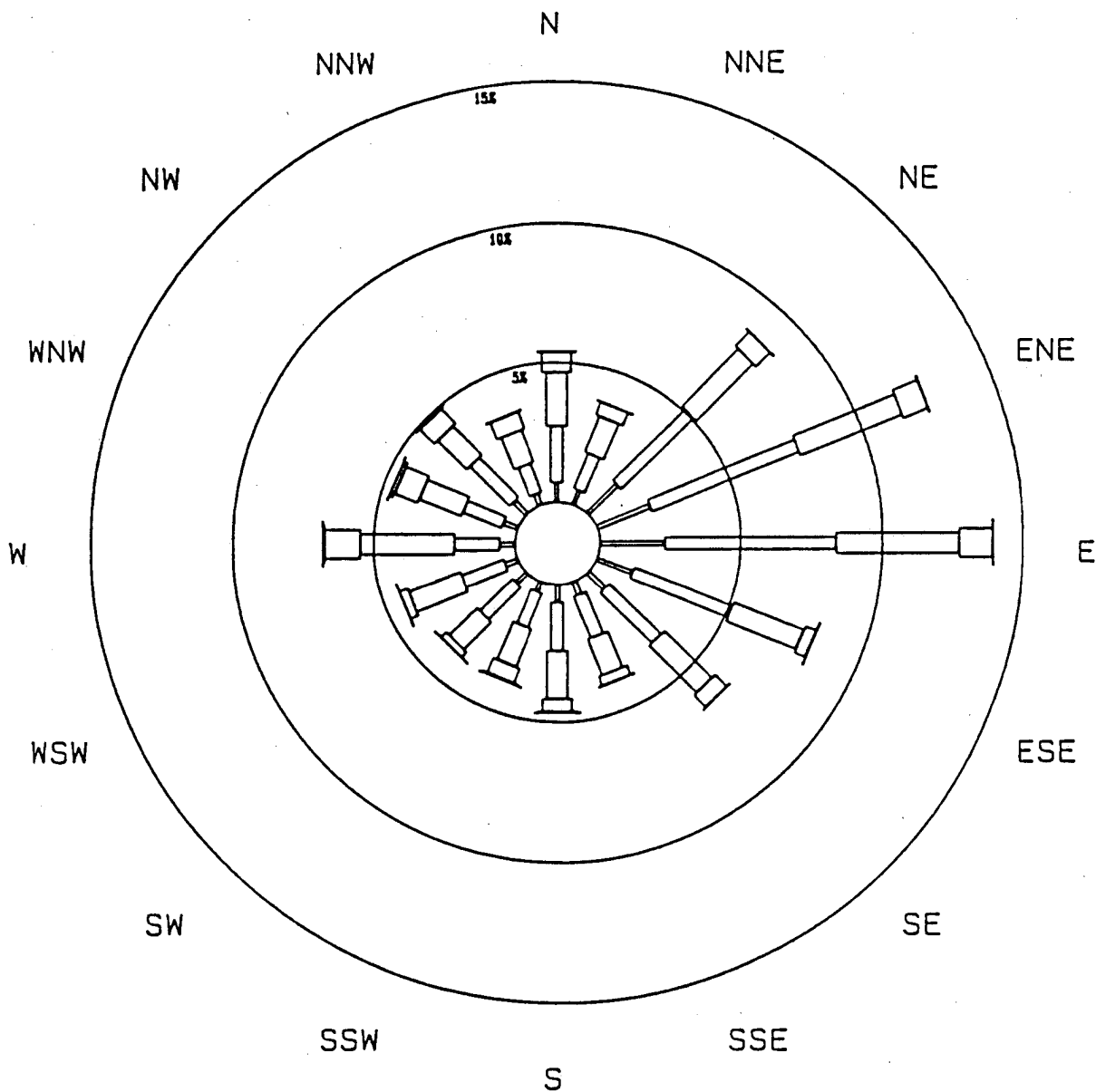
LT - Local Time

* 30-year period of record, 1951 to 1980.

+ 39-year period of record, 1947 to 1985.

** 22-year period of record, 1964 to 1985.

Source: NOAA, 1985.



SCALE (KNOTS)

1-3 4-6 7-10 11-16 17-21 >21

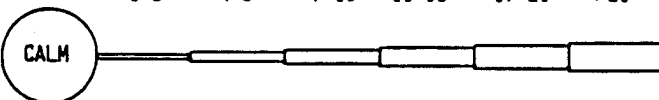


Figure 2.3.7-1 ANNUAL AVERAGE WIND FREQUENCY DISTRIBUTION (1982 THROUGH 1986)
MEASURED AT THE NATIONAL WEATHER SERVICE STATION IN TAMPA, FLORIDA

**Hardee
Power Station**

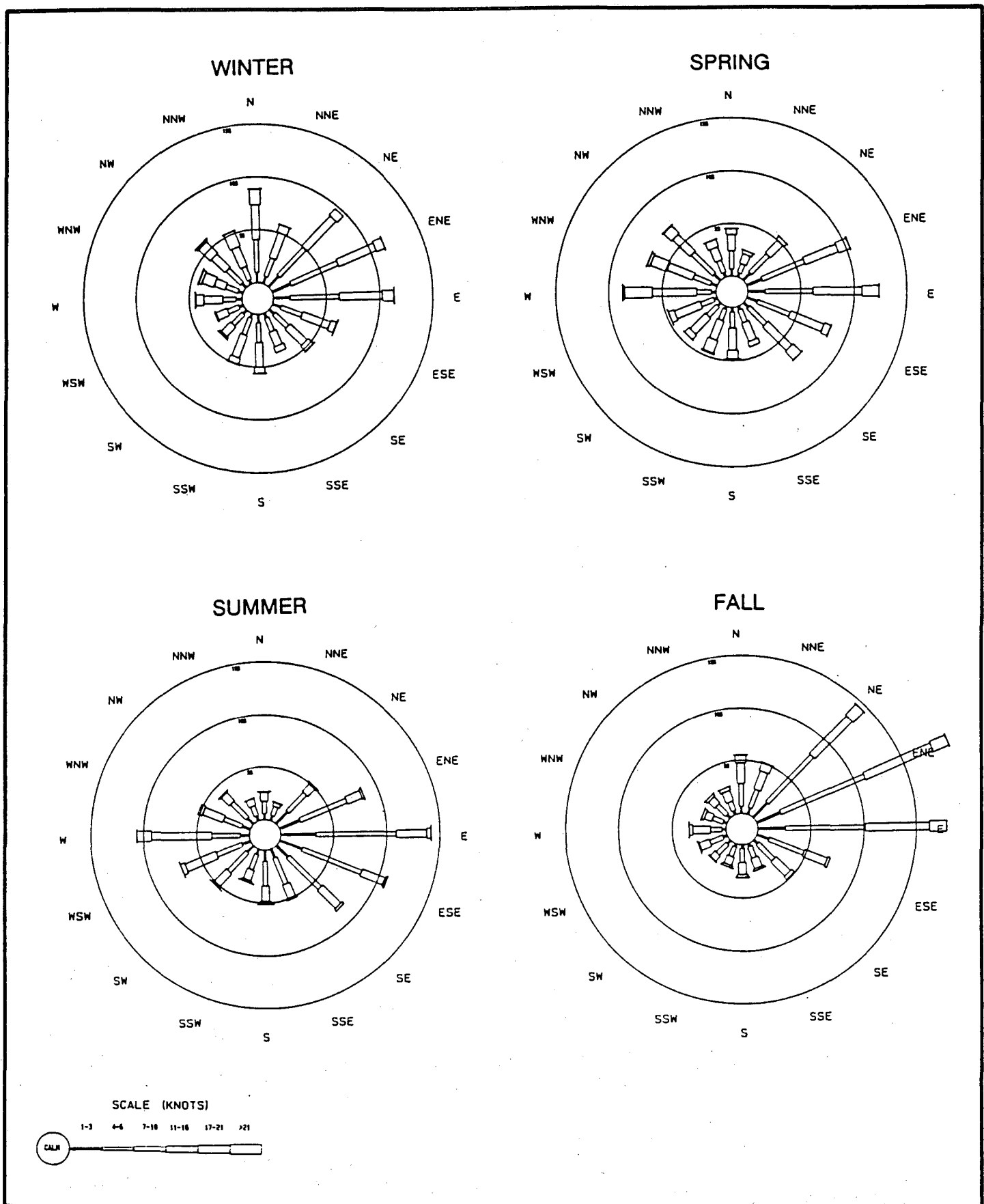


Figure 2.3.7-2 SEASONAL AVERAGE WIND FREQUENCY DISTRIBUTION (1982 THROUGH 1986) MEASURED AT THE NATIONAL WEATHER SERVICE STATION IN TAMPA, FLORIDA

**Hardee
Power Station**

Table 2.3.7-3. Wind Direction and Speed Measured at Tampa International Airport*

Season	Average Wind Speed (mph)	Calm (%)	<u>Prevailing Wind Direction</u>	
			Direction	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

* 5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

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. Frequent and strong sea breezes cause a predominance of neutral and stable air (neutral and stable stabilities), counteracting the effect of high incidence of sunshine over Tampa.

During the summer months, unstable stability occurs nearly 40% of the time due to strong insolation, while occurring only 16% 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. Stable stability occurs nearly uniform throughout the year, with a maximum occurrence of approximately 47% in the fall.

MIXING HEIGHT

The mixing height is a parameter used to define the vertical height to which pollutants can disperse and, therefore, 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.

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% occur from May through October.

Table 2.3.7-4. Occurrences of Atmospheric Stability Classes Determined at Tampa International Airport, Tampa, Florida*

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

* 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, Tampa, Florida*

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

* 5-year period of record, 1982 to 1986.

Source: NOAA, 1986.

In the 80 km (50-mile) coastal strip from above Pinellas County to Tampa Bay, there is less than a 10% 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%) with a one 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 2 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

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 affects 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.

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 the USEPA or

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

Pollutant	Averaging Time	AAQS (ug/m ³)		
		Federal		State of Florida
		Primary Standard	Secondary Standard	
Particulate Matter (PM ₁₀)	Annual Arithmetic Mean	50	50	50
	24-Hour Maximum ⁺	150	150	150
Sulfur Dioxide	Annual Arithmetic Mean	80	N/A	60
	24-Hour Maximum*	365	N/A	260
	3-Hour Maximum*	N/A	1,300	1,300
Carbon Monoxide	8-Hour Maximum*	10,000	N/A	10,000
	1-Hour Maximum*	40,000	N/A	40,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100
Ozone	1-Hour Maximum ⁺	235	235	235
Lead	Calendar Quarter	1.5	1.5	1.5

Notes: N/A = Not applicable.

ug/m³ = micrograms per cubic meter

PM₁₀ = particulate matter with nominal diameter ≤10 um.

* Maximum concentration not to be exceeded more than once per year.

⁺ Maximum concentration not to be exceeded more than an average of 1 calendar day per year.

Sources: 40 CFR, Parts 50 and 52.

Florida Administrative Code (FAC), Chapter 17-2.

an agency delegated with PSD review authority. In Florida, the FDER has been delegated PSD review authority by USEPA.

In promulgating the 1977 CAA Amendments, Congress specified that certain increases above an air quality "baseline concentration" level of sulfur dioxide (SO₂) 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 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. USEPA then promulgated as regulations the requirements for classifications and area designations.

On October 17, 1988, the USEPA promulgated regulations to prevent significant deterioration due to NO_x emissions and established PSD increments for NO₂ concentrations. The USEPA class designations and allowable PSD increments are presented in Table 2.3.7-7. Florida has adopted the USEPA allowable increments for PM and SO₂, but has not yet adopted the NO₂ increments.

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:

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

Pollutant/Averaging Time	Allowable Increment (ug/m ³)		
	Class I	Class II	Class III
Particulate Matter (TSP)			
Annual Geometric Mean	5	19	37
24-Hour Maximum*	10	37	75
Sulfur Dioxide			
Annual Arithmetic Mean	2	20	40
24-Hour Maximum*	5	91	182
3-Hour Maximum*	25	512	700
Nitrogen Dioxide ⁺			
Annual Arithmetic Mean	2.5	25	50

Note: TSP - total suspended particulate.

* Maximum concentration not to be exceeded more than once per year.

⁺ Not yet adopted by the state of Florida.

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

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources which commenced construction before January 6, 1975 for SO₂ and total suspended particulates (TSP) concentrations and February 8, 1988 for NO₂ concentrations, 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 emissions from any major stationary source on which construction commenced after January 6, 1975 for SO₂ and TSP concentrations and February 8, 1988 for NO₂ concentrations; 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 SO₂ and TSP concentrations and February 8, 1988 for NO₂ 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.

AMBIENT AIR QUALITY DATA

The FDER 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, 1988) with FDER's recommendation for monitoring exemption in September 1988 (FDER, 1988). The exemption is appropriate because:

1. The site is not located near [i.e., within 10 km (6.2 miles)] any major sources of pollutant emissions;
2. Background concentrations are expected to be low and near the PSD monitoring de minimis impact levels; and
3. Data from existing monitors will provide conservative background concentrations because these sites are located in more industrial areas than the project site.

Because of the rural area and minimal amount of air pollution sources in Hardee County, the FDER does not operate any monitoring stations in the county. Existing air quality data were obtained from monitoring stations operated by the FDER in Polk County, which has monitoring stations closest to the proposed project site. The closest ambient air monitoring stations to the proposed project site that measure SO_2 concentrations are located in Nichols, about 25 km (16 miles) north-northwest of the site, and in Lakeland, about 50 km (31 miles) north of the site. These stations use continuous methods to measure SO_2 concentrations. TSP concentrations are measured using Hi-volume samplers at 5 locations in Polk County. These stations are located 17.5 km to 50 km (11 to 31 miles) from the proposed site. A summary of observed TSP and SO_2 concentrations measured at these stations during 1986 and 1987 is given in Table 2.3.7-8.

The TSP and SO_2 concentrations observed at these stations are within the federal and state AAQS. Because these monitors are located in urban 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. Data from a rural monitoring network 5-6 km (3-4 miles) south of Ona, located in Hardee County, confirm this conclusion. This network was operated for Farmland Industries and consisted of one continuous SO_2 concentration for 5,649 hourly observations averaging 4 ug/m^3 , with maximum 3- and 24-hour concentrations of 157 ug/m^3 and 69 ug/m^3 respectively. Observed TSP concentrations averaged from 24 to 32 ug/m^3 over the year with maximum 24-hour concentrations ranging from 74 to 58 ug/m^3 .

Table 2.3.7-8. Ambient Air Concentrations of Sulfur Dioxide (SO₂) and Total Suspended Particulate Matter (TSP) for Stations Located in Polk County

Pollutant	Location	Site Number	UTM Coordinates (km)*		Year	Observations*		Concentration (ug/m ³)				
			East	North		Number	%	3-Hour		24-Hour		Annual
								1st	2nd	1st	2nd	
SO ₂	Lakeland	2160-001-F01	407.5	3107.5	1987	8444	96.4	200	162	86	55	10
			(3 ^o , 50 km)		1986	6520	74.4	267	178	81	71	13
	Nichols	3680-010-F02	399.5	3081.3	1987	8571	97.8	697	267	115	51	11
			(348 ^o , 24.5 km)		1986	4994	57.0	203	162	38	35	7
TSP	Lakeland	2160-001-F-01	407.5	3107.5	1987	58	95.1	-	-	87	86	50
			(3 ^o , 50 km)		1986	58	95.1	-	-	109	87	47
	Nichols	3680-010-F02	399.5	3081.3	1987	58	95.1	-	-	73	73	38
			(348 ^o , 24.5 km)		1986	58	95.1	-	-	119	81	38
	Bartow	0180-010-0	418.4	3084.05	1987	42	68.9	-	-	74	71	40
			(27 ^o , 29.9 km)		1986	57	93.4	-	-	70	70	37
	Mulberry	2860-003-F02	404.993	3085.497	1987	42	68.9	-	-	75	75	43
			(360 ^o , 28 km)		1986	54	88.5	-	-	74	74	38
	Bradley	3680-011-F02	403.1	3074.8	1987	61	100.0	-	-	110	91	45
			(354 ^o , 17.5 km)		1986	60	98.4	-	-	94	80	41

* Direction and distance from the site listed in parentheses.

⁺ For TSP, based on observations every 6 days (61 per year).

Source: FDER, 1987/88.

The rural nature of the site also suggests that for other criteria pollutants, i.e., carbon monoxide (CO), ozone (O₃), NO₂ and lead (Pb), the observed concentrations are well below the AAQS. Hardee County is classified as an attainment area for all criteria pollutants.

EXISTING AIR POLLUTANT SOURCES

The proposed plant location is in a rural area with minimal amount of air pollution sources. The nearest major air pollution source is located about 12 km (7 miles) from the site in Polk County. Although phosphate rock mining and a beneficiation plant are located within 10 km (6.2 miles) of the site, air pollutant emissions from these sources, in the form of fugitive dusts, are not significant.

Because SO₂, NO₂, and PM concentrations were determined to be significant due to emissions from the Hardee Power Station (see Section 5-6), a detailed review was conducted to determine SO₂, NO₂ and PM emission sources located within 50 km (31 miles) of the proposed source. The FDER supplied a list of 305 facilities within a 100 km (62 miles) square centered on the proposed site. A list of major facilities that are within 50 km (31 miles) of the site and have SO₂, NO₂, or PM emissions greater than 100 tons per year (TPY) are presented in Tables 2.3.7-9 through 2.3.7-11, respectively.

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 not located near any major sources of SO₂, PM, and NO_x 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).

Table 2.3.7-9. SO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum SO2* Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	1,173
Imperial Phosphate	404.8	3069.5	0.0	12.1	12.1	0	275
Agrico Chemical Co. (S. Pierce)	407.5	3071.5	2.7	14.1	14.4	11	4,557
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	569
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	44	2,933
Wachula City Power Plant	418.4	3047.0	13.6	-10.4	17.1	127	180
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	1,547
Agrico Chemical Co. (Pierce)	403.7	3079.0	-1.1	21.6	21.6	357	417
Mobil-Electrophosphate Division+	405.6	3079.4	0.8	22.0	22.0	2	1,428
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	2,877
IMC	396.7	3079.4	-8.1	22.0	23.4	340	10,168
IMC/Noralyn Mine Road	414.7	3080.3	9.9	22.9	24.9	23	505
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	8	8,443
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	385
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	198
Conserv. Chemicals	398.7	3084.2	-6.1	26.8	27.5	347	1,597
Royster Co.	406.8	3085.1	2.0	27.7	27.8	4	1,231
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	899
IMC/Praire	402.9	3087.0	-1.9	29.6	29.7	356	137
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	8,171
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	1,575
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	85,305
Tricil Recovery Services	422.7	3091.9	17.9	34.5	38.9	27	240
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	3,302
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	364,554
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	597
Columbus Company	361.9	3077.8	-42.9	20.4	47.5	295	167
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	5,181
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	4,014
Lakeland City Power	409.2	3106.2	4.4	48.8	49.0	5	30,176
Adams Packing	421.7	3104.2	16.9	46.8	49.8	20	172
Total							542,973

* Maximum facility emissions from APIS, or other available information on facility.

Table 2.3.7-10. NO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum NO2* Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	176
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	139
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	156
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	131
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	610
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	226
IMC	396.7	3079.4	-8.1	22.0	23.4	340	322
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	100
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	134
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	528
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	28,233
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	534
Sherex Polymers	410.7	3098.9	5.9	41.5	41.9	352	617
Juice Bowl Products	409.4	3099.9	4.6	42.5	42.7	354	109
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	391
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	82,624
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	1,382
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	466
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	3,978
Total							120,856

* Maximum facility emissions from APIS, or other available information on facility.

Table 2.3.7-11. PM Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum PM * Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	132
Imperial Phosphates	404.8	3069.5	0.0	12.1	12.1	0	162
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	1,692
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	263
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	871
Biochemical Energy, LTD	418.3	3048.0	13.5	-9.4	16.5	125	281
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	679
IMC	398.2	3075.7	-6.6	18.3	19.5	340	168
Agrico Chemical	403.7	3079.0	-1.1	21.6	21.6	357	631
C&M Products	405.5	3079.1	0.7	21.7	21.7	358	162
Mobil-Electrophos Division	405.6	3079.4	0.8	22.0	22.0	358	555
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	977
IMC	396.7	3079.4	-8.1	22.0	23.4	340	162
IMC	414.7	3080.3	9.9	22.9	24.9	337	1,018
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	352	788
IMC/ Uranium Recovery	408.4	3082.8	3.6	25.4	25.7	8	831
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	180
Conserv Chemical	398.7	3084.2	-6.1	26.8	27.5	13	1,620
Royster	406.8	3085.1	2.0	27.7	27.8	4	210
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	433
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	636
Ridge Pallets	418.6	3084.1	13.8	26.7	30.1	27	180
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	182
Allsun Products	413.5	3093.8	8.7	36.4	37.4	13	317
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	6,672
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	740
Pavers, Inc.	414.0	3098.2	9.2	40.8	41.8	347	114
Rinker Cencon Corp.	412.4	3099.0	7.6	41.6	42.3	350	159
Quikrete	412.8	3099.0	8.0	41.6	42.4	349	253
Landia Chemical	403.7	3101.8	-1.1	44.4	44.4	1	2,313
Kraft Citrus	399.0	3101.8	-5.8	44.4	44.8	353	108
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	102
Jahna Concrete, Inc.	450.0	3052.2	45.2	-5.2	45.5	97	139
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	7,699
Agrico Chemical Co.	362.1	3076.1	-42.7	18.7	46.6	66	184
Macasphalt	451.1	3050.0	46.3	-7.4	46.9	99	165
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	166
FPL Avon Park	451.4	3050.5	46.6	-6.9	47.1	98	212
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	863
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	14,705
Coca Cola Citrus	421.6	3103.7	16.8	46.3	49.3	20	334
Adams Packing Association	421.7	3104.2	16.9	46.8	49.8	20	129
Total							23,591

* Maximum facility emissions from APIS, or other available information on facility.

For SO₂ concentrations, data collected at the monitoring stations in Nichols and Lakeland were reviewed and used in estimating background concentrations. The nearest station to the proposed site is located in Nichols, approximately 24.5 km (15 miles) to the north-northwest. During 1987, the second highest 3- and 24-hour and annual average concentrations were 267, 51, and 11 ug/m³, respectively. These concentrations were assumed to represent background concentrations.

There are no stations within 50 km (31 miles) of the proposed site location that measure NO₂ concentrations. The nearest station to the proposed site is located in Ybor City, Hillsborough County, approximately 60 km (37 miles) to the west-northwest. This station is in a highly urbanized area and has a significant impact from vehicular traffic. During 1987, this station (No. 4360-052-G01) measured an annual average concentration of 45 ug/m³, based on 69 percent data capture. This concentration was used to represent a conservative estimate of the background concentration.

TSP concentration data collected at the monitoring station in Bradley were used in estimating background PM₁₀ concentrations. These values were the second highest 24-hour and annual average concentrations of 91 and 45 ug/m³, respectively. The data from this station were selected because this is the closest station to the project site with TSP concentrations. It should be noted that the AAQS for particulate matter is based on PM with a nominal diameter of 10 microns (u) or less (PM₁₀). TSP concentrations include particles with diameters of approximately 30 u or less. Therefore, the use of TSP concentrations to estimate PM₁₀ background concentrations will provide an additional conservative factor in determining compliance with AAQS.

2.3.7.3 Measurement Programs

Since the Hardee Power Station project was exempted by FDER from ambient air quality monitoring, all information (i.e., meteorology and air quality data) were compiled from off-site monitoring stations maintained and operated by cooperating governmental agencies. Ambient air quality data were obtained from the FDER and which operate a total of 7 monitoring stations in Polk

County. No significant changes in these programs are anticipated after plant operation has begun.

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.

2.3.8 Noise

2.3.8.1 Background

The proposed facility is located in an isolated, undeveloped area of open-pit phosphate mining. The unmined topography of woodland/grassland area is predominately flat with the exception of overburden spoil mounds that range in length from a few to hundreds of meters. Directly east of the proposed site are two retention ponds enclosed by a levee system approximately 10 m (32 ft) in height. Most of the phosphate mining area is undeveloped with the closest residential receptor a little more than a mile to the south of the proposed facility. Neither Polk nor Hardee Counties have noise ordinances for receiving lands.

2.3.8.2 Noise Measurement Procedures

The continuous ambient noise monitoring was performed using slow response mode to obtain A-weighted sound levels. A windscreen was used since 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 meters operation during monitoring. Hourly sound pressure level (SPL) data were collected at each location and consisted of three noise parameters.

- Leq - The sound pressure level averaged over the measurement period; this parameter is as the continuous steady sound pressure level which 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) above grade. 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 from the 8th through the 10th of February, 1989. SPL data were collected at six different locations (Figure 2.3.8-1) using ANSI measurement techniques. The noise monitoring equipment used during the survey included:

Continuous Noise Monitoring Equipment

- Bruel & Kjaer Type 2230 Precision Integrating Sound Level Meter
- Bruel & Kjaer Type 2639 Microphone Preamplifier
- Bruel & Kjaer Type 4155 Prepolarized Condenser Microphone
- Primeline Model 6723 Two-Pen Portable Strip Chart Recorder
- Windscreen, Tripod and Various Cables

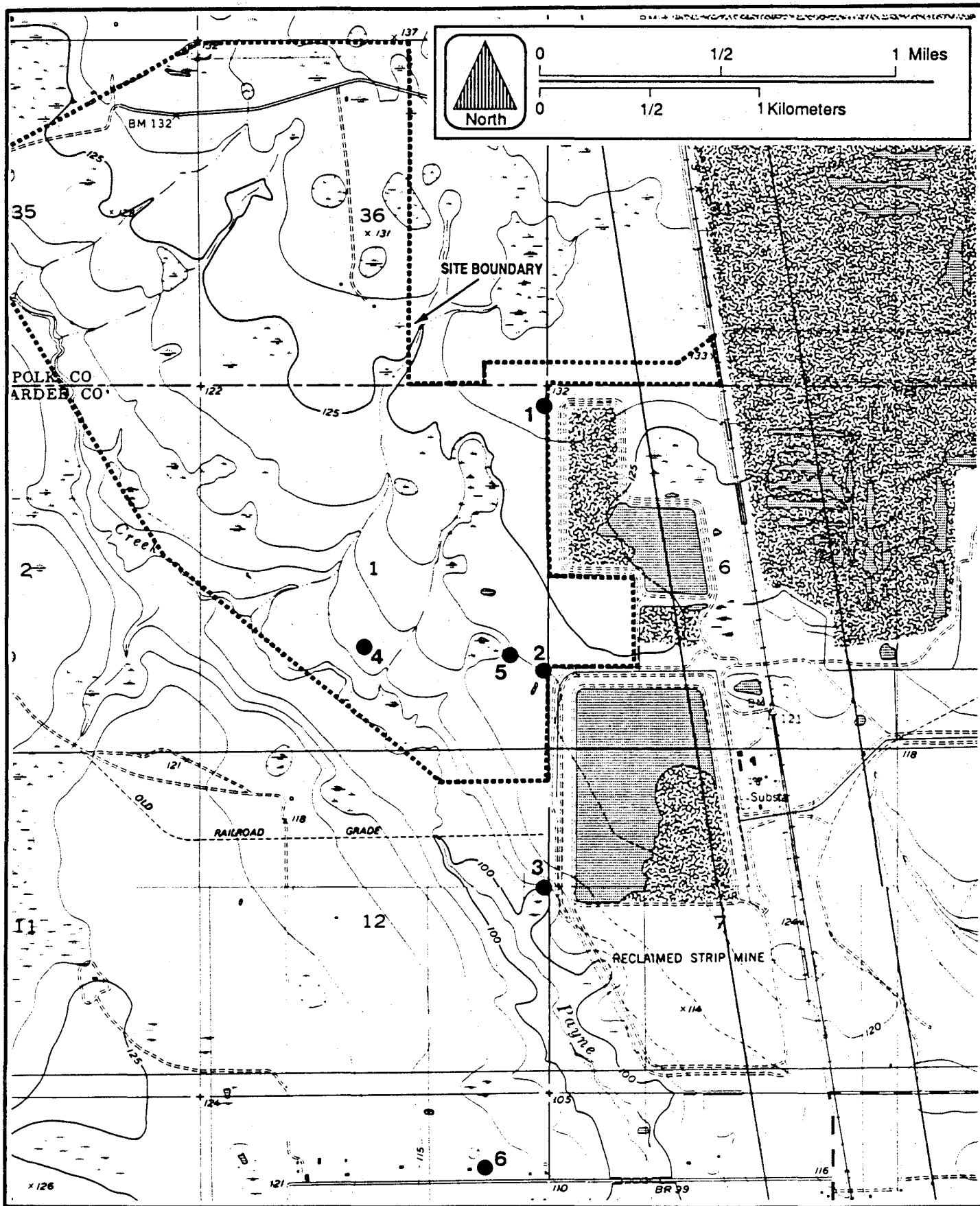


Figure 2.3.8-1 NOISE MONITORING LOCATIONS

**Hardee
Power Station**

Sound Level Meter Calibration Unit

Bruel & Kjaer Type 4230 Sound Level Calibrator, 94 decibels (dB)
@ 1000 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 sound level meter was recently purchased and is under manufacturer's original calibration. The specifications for this equipment are presented in Appendix 11.7.

The six monitoring locations represent sites that are: 1) at the proposed property boundaries relative to human populations (Sites 1, 2 and 3); 2) at maximum noise impact area (next to proposed facility location, Sites 4 and 5); and 3) at the closest residential receptors relative to the facility (Site 6). Site 1 is located at the extreme northwest corner of Section 6, Range 24 East/Township 33 South. Site 2 is just off the access road at the northwest corner of CFI's South Pond. This site is the closest monitoring site to a commercial receptor, CFI's Hardee Plant, about 900 m (3,000 ft) to the east-southeast. Site 3 is located at the southwest corner of CFI's South Pond. Site 4 is located in Section 1, Range 23 East/Township 33 South at the western corner of the property line. Site 5 is situated approximately 60 m (200 ft) west of the fence line that runs from the southwest corner of CFI's North Pond. Site 6 is located approximately 2,400 m (7,800 ft) due south of the proposed plant site on the north side of Roberts Road. The homes on Roberts Road are the closest non-commercial (residential) receptors to the plant site.

Ambient SPLs were measured at various times during the day and night time for 60 consecutive minutes at each of the six sites. The Leq (equivalent sound pressure level averaged for 60 minutes) 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 Leq SPL for each site was calculated. The SPL averages are calculated using the

Table 2.3.8-1. Ambient Sound Pressure Level Data for the Hardee Power Station Site

SITE NO.	DATE/TIME	WIND SPEED(mph)	AIR TEMP(F)	MIC ANGLE(deg)	SOUND PRESSURE LEVELS			COMMENTS
					MIN	MAX	Leq	
1	2/09/89--1702	5	64	278	32.5	60.9	43.0	Airplane & birds
	2/10/89--1425	4	74	278	<u>29.9</u>	<u>76.2</u>	<u>51.9</u>	Airplane (2)
					Ave. 31.4	73.3	49.4	
2	2/09/89--1425	4	72	268	37.2	69.8	44.9	None
	2/09/89--2345	4	52	268	<u>34.5</u>	<u>54.3</u>	<u>40.7</u>	None
					Ave. 36.1	66.9	43.3	
3	2/09/89--1541	1	72	258	28.0	56.5	42.8	Airplane & birds
	2/10/89--0935	7	52	258	<u>35.3</u>	<u>63.0</u>	<u>40.8</u>	Jet & airplane (3)
					Ave. 33.0	60.9	41.9	
4	2/10/89--1100	2	64	130	50.2	62.3	60.9	Dragline operations
	2/10/89--1204	2	71	130	<u>35.3</u>	<u>60.3</u>	<u>45.3</u>	Dragline operations
					Ave. 47.3	61.4	58.0	
5	2/09/89--2225	1	52	282	32.8	65.2	41.4	Airplane (2)
	2/10/89--1315	4	74	282	<u>34.4</u>	<u>57.7</u>	<u>42.1</u>	Jet
					Ave. 33.7	57.7	41.8	
6	2/10/89--0808	6	48	004	37.3	74.0	49.0	Car (2) & truck (3)

following formula:

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

where: SPL_i - sound pressure level in data set

Also included in Table 2.3.8-1 are the wind speed, temperature, microphone direction and comments 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 ambient Leq SPLs in the area of the proposed facility ranged from a low of 40.7 dBA at Site 2 to a high of 60.9 dBA at Site 4. The minimum ambient values varied from 29.9 dBA to 50.2 at Sites 1 and 4, respectively. Sound sources in the proposed area included dragline mining operations, aircraft traffic, vehicular traffic at the residential area (Site 6) and various types of songbirds. The intensity of these various noise sources can vary significantly both spatially and temporally.

The major on-site noise sources currently are the drag-line cranes and to a lesser degree, drag-line operations support equipment (bulldozers, trucks, etc.). These sources will move in direction and distance, relative to the proposed facility, as the mining operations continue to follow the phosphate-bearing seams.

2.3.9 Other Environmental Features

The previous section described the environmental features of the Hardee Power Station site.

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HARDEE
POWER
STATION

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 3

**THE PLANT AND
DIRECTLY
ASSOCIATED
FACILITIES**

CHAPTER 3

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3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

3.1 BACKGROUND

The Hardee Power Station is proposed to consist of a combined cycle power plant and directly associated facilities. The combined cycle facility will be constructed in modular units that will consist of combustion turbines and associated electric generator, and heat recovery steam generators (HRSG). The HRSG will utilize the waste heat from the combustion turbines to generate steam for producing additional electricity in a steam turbine. Each unit (Figure 3.1-1) will have a nominal generating capacity of 220 MW (net) and would consist of two combustion turbines and associated electric generators, two HRSGs and one steam electric generator.

By utilizing the otherwise wasted heat from the combustion turbines, the combined cycle plant will be more efficient than either simple cycle combustion turbines or steam cycle power plants. The use of modular unit configuration provides flexibility in adding plant capacity. Directly associated facilities would include: switchyard, water treatment building, administrative building, fuel oil unloading and storage facilities, warehouse and cooling reservoir.

Site certification is being sought for an ultimate capacity of 660 MW (nominal net); however, the facility will be constructed in phases (Figure 3.1-1). Phase 1-A will consist of a 295 MW capacity facility, which will be placed in operation in January 1993. The Phase 1-A facility will consist of a nominal 220 MW combined cycle unit and a stand-alone combustion turbine. Phase 1-B will add 145 MW of generating capacity through the addition of a combustion turbine, two HRSGs and one steam electric generator. The expected service date for Phase 1-B is 2003. Phases 1-A and 1-B will result in two 220 MW combined cycle units. Phase 2 will consist of a third 220 MW unit to be added at an unspecified future date.

The combustion turbines would be capable of both combined cycle and simple cycle operation; the latter is possible by using by-pass stacks. It is anticipated that the combustion turbines will use natural gas as the primary fuel and distillate oil as the backup fuel. Gas will be transported to the

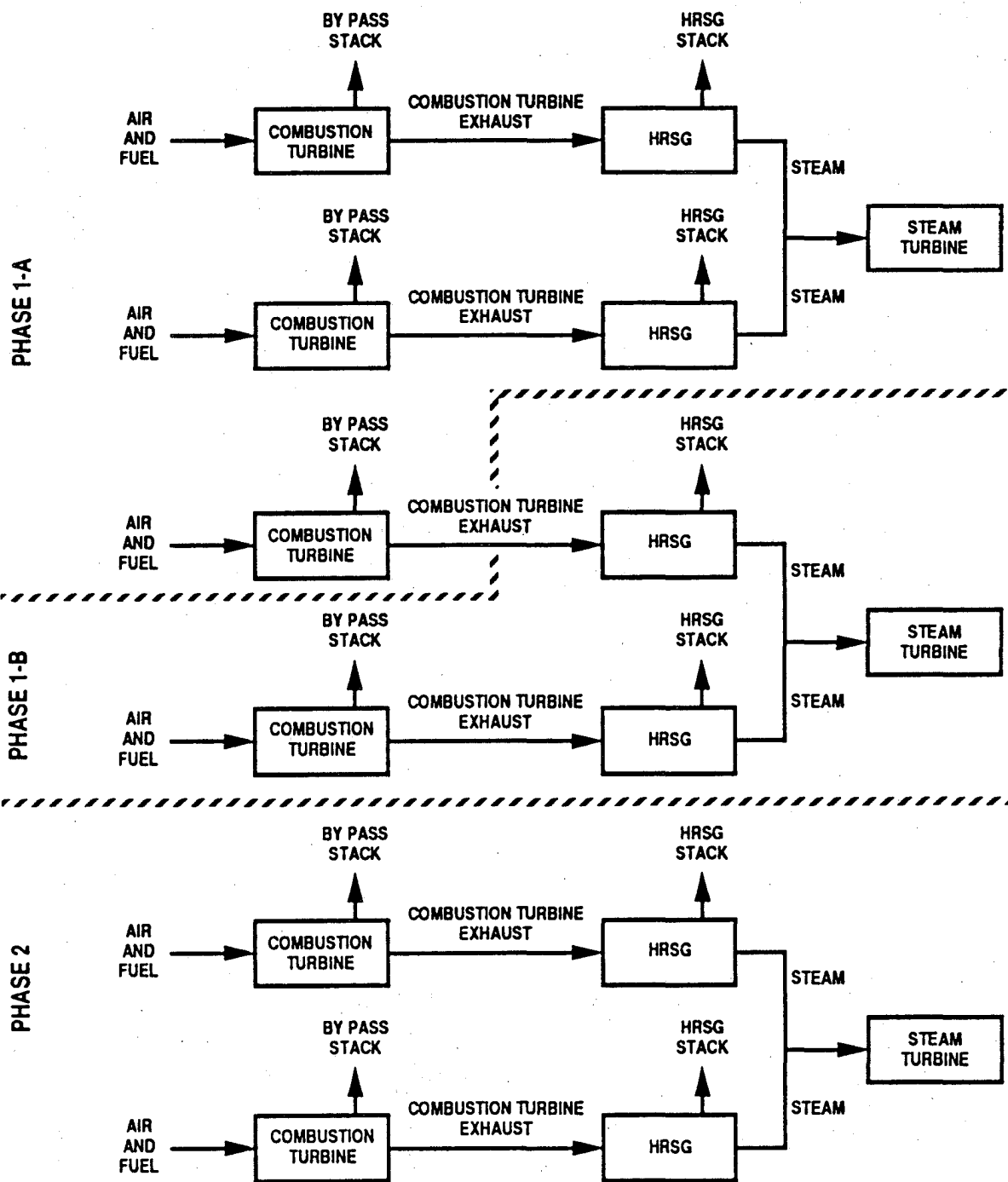


Figure 3.1-1 SIMPLIFIED FLOW DIAGRAM OF HARDEE POWER STATION

**Hardee
Power Station**

site via pipeline while oil will be trucked and/or piped to the site. The natural gas pipeline [48 centimeters (18 inches)] will connect the plant to Florida Gas Transmission (FGT) system at a location north of Polk City. An 8-inch liquid fuels pipeline, which will originate from Port Manatee, will supply distillate oil when completed.

Primary water uses will be for makeup to the 231 ha (570 acres) cooling reservoir, air pollution control and steam cycle makeup. The cooling reservoir will be constructed from reclaimed phosphate lands that are adjacent to the power plant facilities. This cooling option provides an alternative use of previously impacted lands and provides for the reclamation of existing mining operations (refer to Section 8.2.1 for further details on alternative designs). Circulating water lines will be connected to the cooling reservoir by intake and discharge structures. Wells in the Floridan Aquifer will supply plant makeup water.

Air pollution emission control will consist of water injection in the combustion turbines for nitrogen oxides (NO_x) control. This design alternative minimizes air pollutant emissions and minimizes economic, environmental and energy impacts [refer to Section 3.4 for the analysis of Best Available Control Technology (BACT)].

The facility has been designed to eliminate direct discharge to surface waters. Stormwater runoff from non-equipment areas will be collected and routed to a stormwater detention pond which has been designed to meet Southwest Florida Water Management District (SWFWMD) requirements. All wastewaters such as plant water pretreatment backwash water, sanitary treatment system wastewater, plant and equipment drains and neutralization basin effluent, will be treated, as appropriate, and routed to the cooling reservoir. The cooling reservoir will be constructed with a spillway to route excess water resulting from extremely significant rainfall events to Payne Creek. Such events are expected to occur less than one time in ten years.

Associated linear facilities include the natural gas pipeline, a liquid fuels pipeline from Port Manatee and approximately 64 km (40 miles) of 230 kV transmission line that will connect the plant to existing distribution systems (refer to Chapter 6, which presents design, location and environmental impact information on the transmission line, the gas pipeline and the liquid fuels pipeline).

3.2 SITE LAYOUT

The proposed layout for Phase 1-A (i.e., 295 MW) of the Hardee Power Station site is presented in Figure 3.2-1. The power plant and associated facilities will be located on 510 ha (1,259 acres). Power plant facilities, not including the cooling reservoir, occupy approximately 40 ha (100 acres) of the site. The facilities and their approximate areas, at the ultimate site capacity (i.e., 660 MW), are:

Power Block	3 ha - (7 acres)
Switchyard	2 ha - (6 acres)
Water Treatment Building	0.2 ha - (0.5 acres)
Administration Building	0.1 ha - (0.3 acres)
Fuel Oil Storage Tank & Containment	0.8 ha - (2 acres)
Warehouse	1 ha - (3 acres)
Site Runoff Detention Pond	2 ha - (6 acres)
Cooling Reservoir	230 ha - (570 acres)
Construction Offices	0.8 ha - (2 acres)
Construction Lay Down	3 ha - (8 acres)

A profile of the new facilities is shown in Figure 3.2-2, with elevations and dimensions presented in Table 3.2-1. The elevations and dimensions are preliminary and may change as detailed engineering design proceeds.

The location of discharge to surface waters, i.e., Payne Creek, are at the cooling reservoir and site runoff detention pond (see Figure 3.2-1). As previously stated, discharges will be infrequent.

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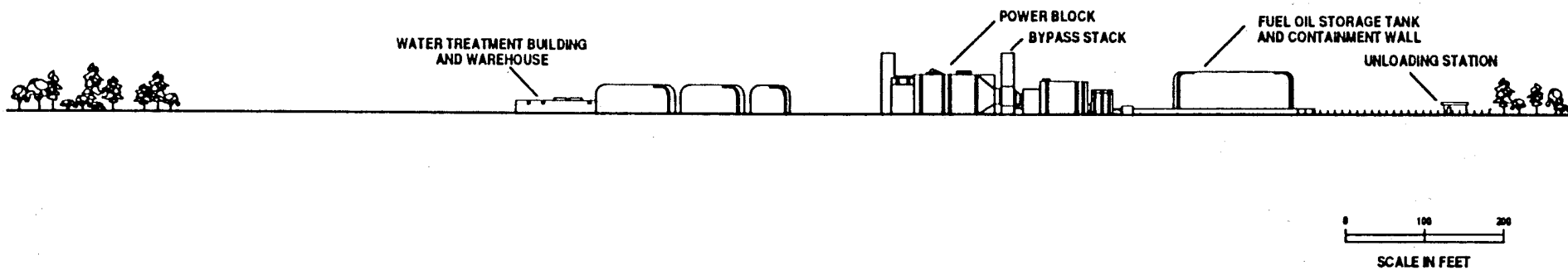


Figure 3.2-2 CONCEPTUAL PROFILE OF HARDEE POWER STATION

**Hardee
Power Station**

Table 3.2-1. Approximate Elevations and Dimensions of Major Plant Facilities for the Hardee Power Station*

Facility ⁺	Elevation** (feet)	Length (feet)	Width (feet)
Combustion Turbine Enclosure (6)	30	110	30
By-Pass Stack (6)	75	15	15
Inlet Air Filter (6)	40	45	30
HRSG (6)	55	50	25
HRSG Stack (6)	90	--	14.5 ⁺⁺
Steam Turbine (6)	45	80	40
Raw Water Tank (2)	43	--	48 ⁺⁺
Demineralizer Tank (2)	48	--	64 ⁺⁺
Condensate Tank	43	--	22 ⁺⁺
Fuel Oil Storage Tank (3) (4.4 million gallons)	40	--	140 ⁺⁺

Note: Air quality impact analyses were performed using worst cast facility dimensions and HRSG stack height; refer to Table 5.6.1-5 and the PSD application (Appendix 11.1.4) for further information.

* For 660 MW facility.

+ Number in parenthesis shows the maximum number of each facility.

** Above ground surface.

++ Diameter.

Air pollutants will be emitted from a stack associated with each HRSG exhaust and each combustion turbine bypass stack. The latter would only be operated when the HRSG and associated steam cycle are not in operation, or when simple cycle operation is desired.

3.3 FUEL

The primary fuel used by the combustion turbines will be natural gas, piped to the plant. Typical properties of pipeline grade natural gas are shown in Table 3.3-1. The heat content is typically 20,870 Btu/lb (LHV) with a maximum sulfur content of 20 grains per 100 standard cubic foot (SCF) of gas. The secondary fuel will be distillate fuel oil, furnished to the plant by truck deliveries and/or through a liquid fuels pipeline. Typical properties of the fuel oil are shown in Table 3.3-2. The fuel oil will have a heat content of 17,870 Btu/LB (LHV) with a maximum sulfur content of 0.5%.

No storage will be provided for natural gas. Fuel oil will be stored onsite in one 4.4 million gallon 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 included with the site drainage system.

The combustion turbines 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, a discussion of coal gasification alternatives and the site 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 electric output. Greater fuel consumption will occur at lower ambient temperatures. For the purpose of calculating maximum fuel use quantities, the following operating conditions for the combustion turbine were used:

Table 3.3-1. Typical Natural Gas Specification*

Constituents, Percent by Volume

Hydrogen (H ₂)	--
Methane (CH ₄)	83.40
Ethylene (C ₂ H ₄)	--
Ethane (C ₂ H 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 ₂ S), MAX.	1 grain/100 SCF
Water (H ₂ O) Vapor, max.	4 lb/10 ⁶ SCF
Synthetic Lubricants (Phosphate-Ester Based)	Trace
Specific Gravity (relative to air)	0.636

Ultimate, Percent by Weight

Sulfur (S), max.	20 grains/100 SCF
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
Btu/lb of Fuel (HHV)	23,170
(LHV)	20,870

* Pipeline grade.

Table 3.3-2. Typical Distillate Fuel Oil Specification*

Specific gravity, 60°F	0.82 - 0.86
Viscosity, cSt, 100°F, min.	0.5
Pour point, max, °F	0
Gross heating value, kcal/kg	10,500 - 10,950
Gross heating value, Btu/lb	19,000 - 19,600
Filterable dirt, mg/100 ml	4
Carbon residue (10% Bottoms), %, max.	0.25
Carbon residue (100% Sample), %, max.	1.0
Sulfur, %, maximum	0.5
Nitrogen, %	0.005 - 0.015
Hydrogen, %	12.2 - 13.2
Ash (fuel as delivered), ppm, 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

* Specification is typical of American Society of Testing and Materials (ASTM) Grade of No. 2 (ASTM D-398).

- o 32°F dry bulb ambient temperature
- o 80% relative humidity
- o 125 ft mean sea level (MSL) elevation
- o 4 inches H₂O inlet pressure drop
- o 42 ppmvd (at 15% O₂) NO_x emission level when firing natural gas
- o 65 ppmvd (at 15% O₂) NO_x emission level when firing distillate fuel oil
- o 20,870 Btu/lb heating value (LHV) of natural gas
- o 17,870 Btu/lb heating value (LHV) of distillate fuel oil.

At these conditions the maximum heat input, for the nominal 660 MW facility, is 6,342 and 6,562 million Btu/hr when firing natural gas and distillate fuel oil, respectively.

The corresponding maximum fuel use is 303,900 lb/hr of natural gas and 367,180 lb/hr of distillate fuel oil.

3.4 AIR EMISSIONS AND CONTROLS

3.4.1 Air Emissions Types and Sources

Air pollutant emissions will be emitted from the combustion turbines when firing either natural gas or fuel oil. Emissions will emanate from either the by-pass or HRSG stack.

The types of emissions result from either the combustion process itself or impurities in the fuel. Table 3.4.1-1 presents the maximum estimated emission rates of regulated pollutants. The maximum estimated emission rates were determined using manufacturers' information for the equipment being considered for the project. Those design parameters which produced the maximum emission for each combustion turbine were used to produce a conservative design envelope for the plant. The Prevention of Significant Deterioration (PSD) application (see Appendix 11.1.4) presents the basis for the emission rates and maximum annual emissions of regulated and non-regulated pollutants.

Table 3.4.1-1. Maximum Estimated Air Pollutant Emissions from the Hardee Power Station

Pollutant	Fuel	Maximum Emission Rate* (lb/hr)
Particulate/PM 10	Gas	6.3
	Oil	57.1
Sulfur Dioxide	Gas	35.8
	Oil	734.4
Nitrogen Oxides	Gas	215.9
	Oil	383.8
Carbon Monoxide	Gas	128.3
	Oil	46.7
Volatile Organic Compounds	Gas	17.9
	Oil	20.5
Lead	Gas	negligible
	Oil	0.0117
Fluorides	Gas	negligible
	Oil	0.0427
Sulfuric Acid Mist	Gas	1.6
	Oil	33.7
Mercury	Gas	0.0144
	Oil	0.0039
Beryllium	Gas	negligible
	Oil	0.0033
Inorganic Arsenic	Gas	negligible
	Oil	0.0055

Notes: Refer to prevention of significant deterioration (PSD) application contained in Appendix 11.1.4 for bases for emission rates.

* Based on 32°F operating conditions for one combustion turbine.

The largest quantities of potential emissions when firing natural gas are NO_x and carbon monoxide (CO). When firing fuel oil the largest quantities emitted are NO_x and sulfur dioxide (SO_2).

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. Nitrogen oxides 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).

Carbon monoxide is formed by incomplete combustion of the fuel. High combustion temperatures, adequate excess air and good fuel/air mixing during combustion will minimize CO emissions. Carbon monoxide formation is limited by ensuring complete efficient combustion of the fuel in the turbines. Therefore, staging combustion and lowering combustion temperatures for NO_x emissions control can be counterproductive with regard to CO emissions.

Emissions of NO_x are proposed at concentrations of 42 ppm and 65 ppm corrected to 15% oxygen (O_2), dry conditions, for natural gas and fuel oil firing, respectively. Maximum estimated NO_x emissions for fuel oil firing are based on a maximum fuel bound nitrogen concentration of 0.015%; higher fuel bound nitrogen concentrations would concomitantly increase NO_x emissions. At a fuel bound nitrogen concentration of 0.05%, NO_x would increase to about 77 ppm (corrected conditions).

Emission rates of CO were established by the level of NO_x control, since wet injection, the proposed control technique, affects the combustion process. Maximum emission rates for the project would be 41 ppm and 13 ppm (corrected to 15% O_2 , dry conditions), respectively for natural gas and fuel oil firing.

Maximum SO₂ emission rates are dictated by the amount of sulfur in the fuels.

3.4.2 Air Emission Controls

The use of clean fuels, i.e. natural gas and No. 2 fuel oil, and combustion controls will be used to minimize air emissions and comply with applicable emission limiting standards. Using clean fuels will minimize emissions of SO₂, particulate matter/PM₁₀ and other fuel bound contaminants. Combustion controls will minimize the formation of NO_x, by water injection, and the formation of CO and volatile organic compounds (VOC) by combustor design. These techniques are proposed as Best Available Control Technology (BACT) for this project based on an evaluation of economic, energy and environmental impacts. The following subsection presents a summary of the BACT analysis.

3.4.3 Best Available Control Technology (BACT)

Emissions of NO_x, CO, VOC, SO₂, particulate matter/PM₁₀, beryllium, mercury, inorganic arsenic (As) and sulfuric acid mist are subject to BACT review. The pollutant specific applicability is discussed in detail in Chapter 3 of the PSD application which is contained in Appendix 11.1.4. Under the federal Clean Air Act (CAA), BACT represents the maximum degree of pollutant reduction determined on a case-by-case basis after consideration of energy, environmental, and economic factors. However, BACT cannot be less stringent than the emission limits established by any applicable new source performance standard (NSPS).

3.4.3.1 Nitrogen Oxides

The alternative for obtaining the maximum amount of control for NO_x emissions from combustion turbines is wet injection in combustor combined with selective catalytic reduction (SCR) in the HRSG. Wet injection alone provides the next greatest level of control. These control techniques were evaluated in the BACT analysis.

SCR is a post combustion method for control of NO_x emissions. In the SCR process, vaporized ammonia is reacted with NO_x in the presence of a catalyst

to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The reaction takes place between 600 and 700°F and to achieve these conditions the catalyst must be placed in the HRSG.

The economic, environmental and energy impacts of installing SCR with wet injection were determined for the BACT analysis based on an exhaust concentration of 9 ppm when firing natural gas and 14 ppm when firing fuel oil (concentrations corrected to 15% O₂ dry conditions). These exhaust concentrations represent 80% NO_x removal and are the lowest concentrations being established as BACT for large combustion turbines.

SCR with wet injection was rejected as BACT based on technical considerations as well as significant economic and environmental impacts. SCR has not been technically demonstrated on simple cycle operation, cycling combustion turbines or combined cycle plants firing fuel oil. Proven and dependable equipment and technology are requirements of the Hardee Power Station and are necessary to provide reliable, on-demand, electric power.

Exhaust temperatures from combustion turbines (about 1000°F) are much higher than that required for reacting NH₃ and NO_x. All current SCR applications have the catalyst placed in the HRSG to achieve proper reaction conditions. When operating in simple cycle mode, i.e., using the by-pass stack, SCR operation is therefore not feasible.

SCR has only been installed on base loaded, natural gas fired, combined cycle co-generation facilities; experience with facilities that perform cycling duty, which is projected for the Hardee Power Station, is limited. Cycling the combustion turbines will cause variable exhaust conditions, i.e., temperature and flow, which can damage the catalyst. Operation under such variable conditions will require frequent catalyst replacement and significantly increase the cost of SCR.

When firing fuel oil, the sulfur and other trace constituents in the gas stream will poison the catalyst during prolonged operation. Experience with

fuel oil firing has found significant catalyst damage occurring after only about 500 hours of operation. To resolve these problems, operational limits on oil firing have been recommended by catalyst manufacturers and have been allowed by permit conditions.

Economic impacts of installing SCR would be significant as demonstrated by the capital and annual costs for an SCR system installed for a 660 MW plant. An SCR system would add approximately \$57.0 million (1993 dollars) to the capital cost and \$22 million to the annual cost of the 660 MW plant. Capital costs for the selective catalytic reduction system include catalytic reactors, ammonia additive injection system, balance of plant costs, and incremental turbine costs. Annual costs include fixed charges on capital investment, operating personnel, maintenance, ammonia additive, spent catalyst replacement, and steam and electric energy.

The levelized annual cost difference for an SCR System as compared to the next level of control, i.e., an improved combustor design, is about \$16.8 million and results in an incremental removal cost of between \$4,600 and \$8,250 per additional ton of NO_x reduction. The energy requirements of the SCR system would reduce the output of the combustion turbines by approximately 1%.

The use of an SCR system would result in a negative environmental impact by releasing significant quantities of unreacted ammonia to the atmosphere. This is due to reaction rate inefficiencies resulting in NH_3 exhaust concentrations of up to 50 ppm which have been reported from SCR systems. In addition, catalytic elements are toxic. Because they have to be replaced periodically, hazardous waste disposal procedures must be followed. Environmental benefits from installing SCR are small since the predicted impacts are much less than the PSD increment and AAQS.

SCR is the only effective post combustion NO_x reduction alternative control technology available. The temperatures at the outlet of a combustion turbine are too low ($1,000^\circ\text{F}$) for selective non-catalytic reduction systems (Thermal De NO_x). A Thermal De NO_x system requires gas temperatures of at

least 1,500°F for NO_x reduction. Since this would require supplemental heating of the flue gas, thereby increasing total emissions from the plant due to increased fuel usage, this alternative was judged unacceptable for application on a combined cycle facility.

WET INJECTION

Use of water or steam injection in the combustion zones of a combustion turbine can limit the amount of NO_x formed. Thermal NO_x formation is minimized by lowering combustion temperatures through the water or steam injection. Water injection into the combustor will be used for this project. The degree of reduction in NO_x formation is somewhat proportional to the amount of water injected into the turbine.

Since the combustion turbine NSPS was last revised in 1982, combustion turbines have improved their tolerance to the water or steam necessary to control NO_x emissions below the NSPS requirement. Some manufacturers have begun to market an improved low NO_x burner design with steam injection only. These burners provide improved air/fuel mixing and reduced flame temperatures in conjunction with steam injection, resulting in lower concentrations of NO_x as compared to a standard combustion chamber design (with water or steam injection). Design improvements have reported an emission rate of 25 ppmvd as compared to 42 ppmvd with a standard combustor design when firing natural gas. The principal disadvantage of these low NO_x combustion chamber designs compared to the manufacturer's standard design is the lack of operating experience and the increased capital cost of the turbines. Approximately 25 gpm of additional demineralized water per turbine would be required for injection into the combustion chamber. Because of the increase in steam, CO concentrations increase substantially over the standard combustor design. However, low NO_x burner designs are not available for several of the manufacturers. In addition, current designs require steam injection. Water injection is a requirement of the project since the facility will be cycled and rapid start-ups will be necessary. An independent source of steam for steam injection would be required and would increase the air emissions of other pollutants.

The estimated annualized cost for the improved combustor is \$5.2 million compared to the standard combustor of \$2.5 million; a difference of \$2.7 million. The incremental cost effectiveness for the improved combustor ranges from \$915 to \$1,626 per ton of pollutant removed, which is over three times that of a standard combustor. In addition, installation of the improved combustor will increase CO emissions. To bring CO emissions for the improved combustor to a comparable level as a standard combustor design, the total annualized cost would exceed \$10 million with a total cost effectiveness ranging from \$2,800 to \$5,000 per ton of NO_x removed. This cost effectiveness is about ten times that of the standard combustor, which ranges from \$176 to \$504 per ton of pollutant removed. Because of the economic impacts and technical constraints, i.e., availability and lack of operating experience on water injection, low NO_x burner designs are considered infeasible for the project.

With standard combustion chamber design, there is a point where the amount of water or steam injected into the turbine seriously degrades its reliability and operational life. This generally occurs at NO_x emission levels of about 65 ppmvd (with no heat rate adjustment) on oil and 42 ppmvd on natural gas. These NO_x emission levels can be achieved at moderate additional cost (i.e., annualized cost of \$2.5 million) and with limited impact on reliability or power output.

The consideration of environmental factors also supports the selection of water injection combustion controls as BACT for NO_x. Areas surrounding the proposed location of the combustion turbines are all classified as attainment for ambient NO₂ levels. In addition, modeling analysis at the proposed NO_x emission rates resulted in a maximum predicted impact well below the NO_x standard. Therefore, lower NO_x emissions from using SCR or advanced combustors will not result in any significant environmental benefits for the project.

3.4.3.2 Carbon Monoxide and Volatile Organic Compounds

CO and VOC emissions from the project will be minimized through combustion control. The installation of an oxidation catalyst, the technology with the

greatest level of control, was rejected based on economic and technical grounds. Installing an oxidation catalyst would have an annualized cost of about \$5.7 million with a cost effectiveness of greater than \$2,600 per ton of pollutant removed. Oxidation catalysts have not been demonstrated on fuel oil firing facilities. Poisoning of the catalyst could potentially result and the formation of SO_3 would cause corrosive damage to the back end of the HRSG and stack. In addition, plant cycling would potentially damage the catalyst.

3.4.3.3 Sulfur Dioxide and Sulfuric Acid Mist

The proposed BACT for controlling SO_2 emissions is the use of low sulfur fuel, i.e., natural gas and No. 2 fuel oil. SO_2 emissions can be reduced by specifying a lower sulfur content fuel of fuel oil or mixing No. 2 fuel oil with a higher grade of distillate oil, e.g., No. 1 fuel oil or kerosene. The estimated annualized cost to lower the maximum sulfur content from 0.5% to 0.2% would be about \$21 million. The cost effectiveness of this alternative would exceed \$2,000 per ton of potential pollutant removed and more likely exceed \$6,500 per ton of actual pollutant removed.

Therefore, a lower sulfur fuel is not considered economically feasible and limiting the fuel sulfur content to 0.50% by weight is proposed as BACT for SO_2 and sulfuric acid mist.

3.4.3.4 Particulate Emissions and other Regulated Pollutants

The emission of particulates/ PM_{10} , beryllium, mercury, fluorides and inorganic arsenic from the facility will be controlled by using clean fuels; and for particulates by ensuring as complete combustion of the fuel as possible. Post combustion particulate control technologies have not been installed on gas/oil fueled combustion turbines for these pollutants. The natural gas and distillate oil fuels to be used in the proposed combustion turbines will only contain trace quantities of these constituents.

3.4.4 Design Data for Control Equipment

Combustor design, water injection and the use of clean fuels will be used to control air emissions. Combustor design is manufacturer-specific. The

maximum amount of water injected into the combustion turbine based on maximum fuel use rates (i.e., at 32°F conditions) would be approximately 76,000 lb/hour for natural gas firing and, approximately 97,000 lb/hour for fuel oil firing.

3.4.5 Design Philosophy

Air quality control system will be designed to provide a continuous level of emission reduction that maintain a level of performance equal or better than the proposed emission rates. Adequate spare parts will be available to ensure the operating reliability of the plant.

Control of NO_x emissions from the combustion turbines will be accomplished by regulating the amount of water and fuel injected into the combustion turbines. Based on the amount of fuel being burned in the combustion turbines, the required water injection rates will be established based on correlation factors which relate water flow requirements to NO_x emissions. These correlation factors, calibrated and validated by the results from performance tests, will ensure compliance with NO_x emission requirements.

3.5 PLANT WATER USE

The primary water demands and uses at the proposed Hardee Power Station Project include condenser cooling water, potable water, general plant service water, emergency (fire control) water, NO_x injection water, and steam cycle makeup water.

Condenser cooling water demands will be satisfied through the use of a surface cooling reservoir constructed on reclaimed phosphate mines. Other water demands will be satisfied through direct withdrawal and use of Lower Floridan Aquifer water.

Overall plant water balances for the maximum daily makeup, maximum daily discharge, and average annual makeup conditions are presented in Figures 3.5-1, 3.5-2, and 3.5-3, respectively. Maximum daily makeup is based on a plant load of 100% and worst case monthly climatological data for April (i.e., the driest month) over the past 51 years, which results in the

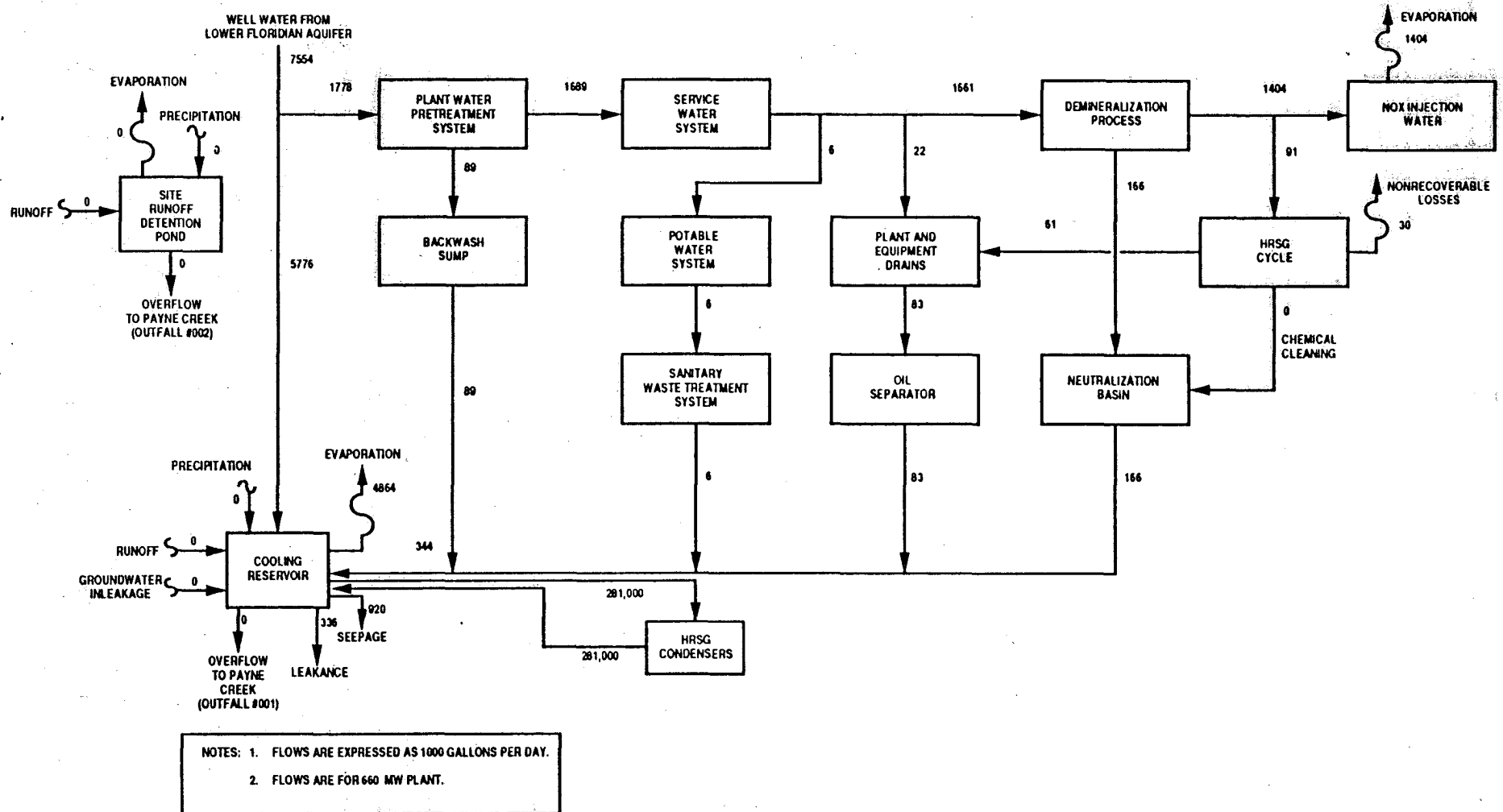


Figure 3.5-1 WATER MASS BALANCE:
MAXIMUM DAILY MAKEUP

**Hardee
Power Station**

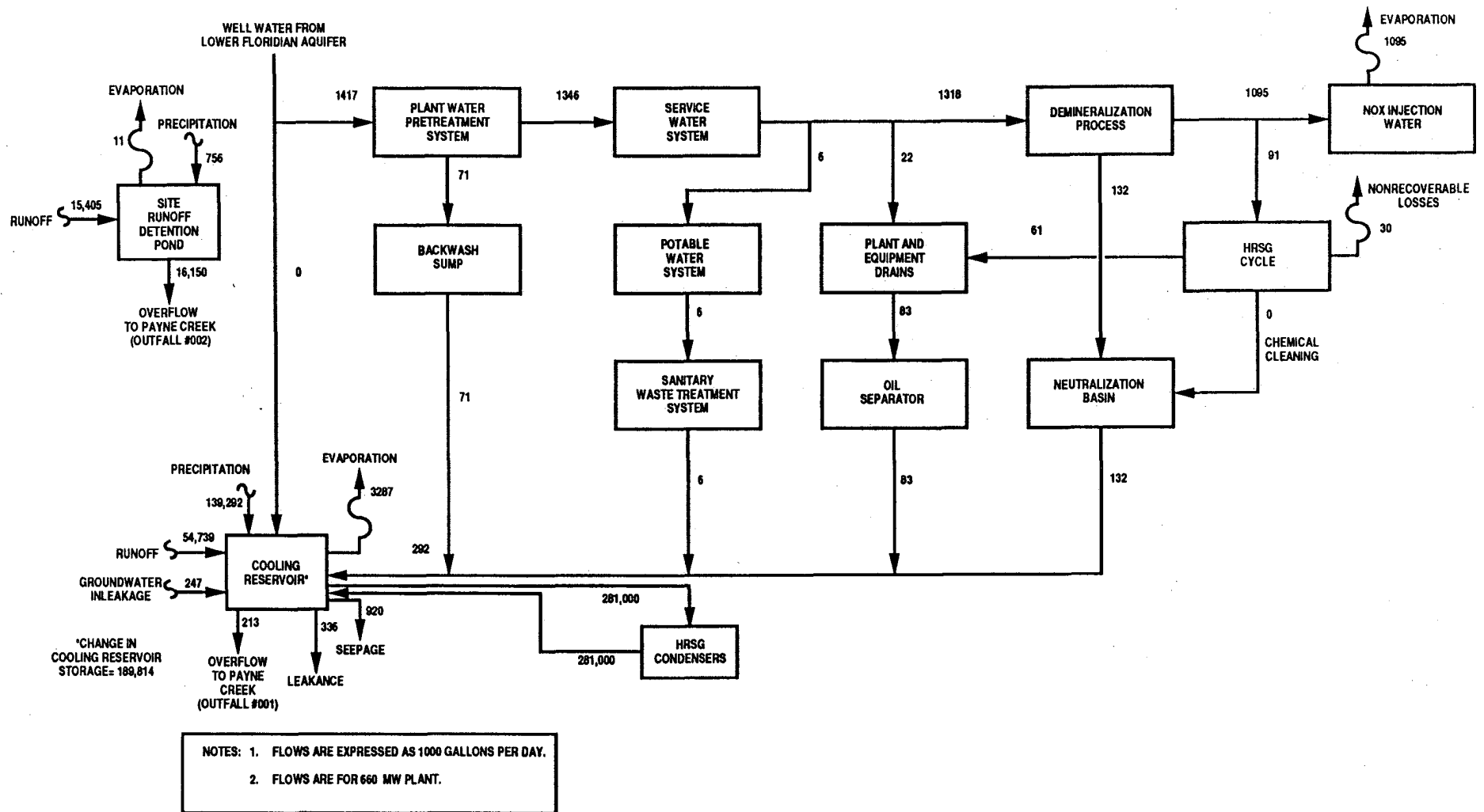


Figure 3.5-2 WATER MASS BALANCE:
MAXIMUM DAILY DISCHARGE
(25 YEAR - 24 HOUR STORM)

**Hardee
Power Station**

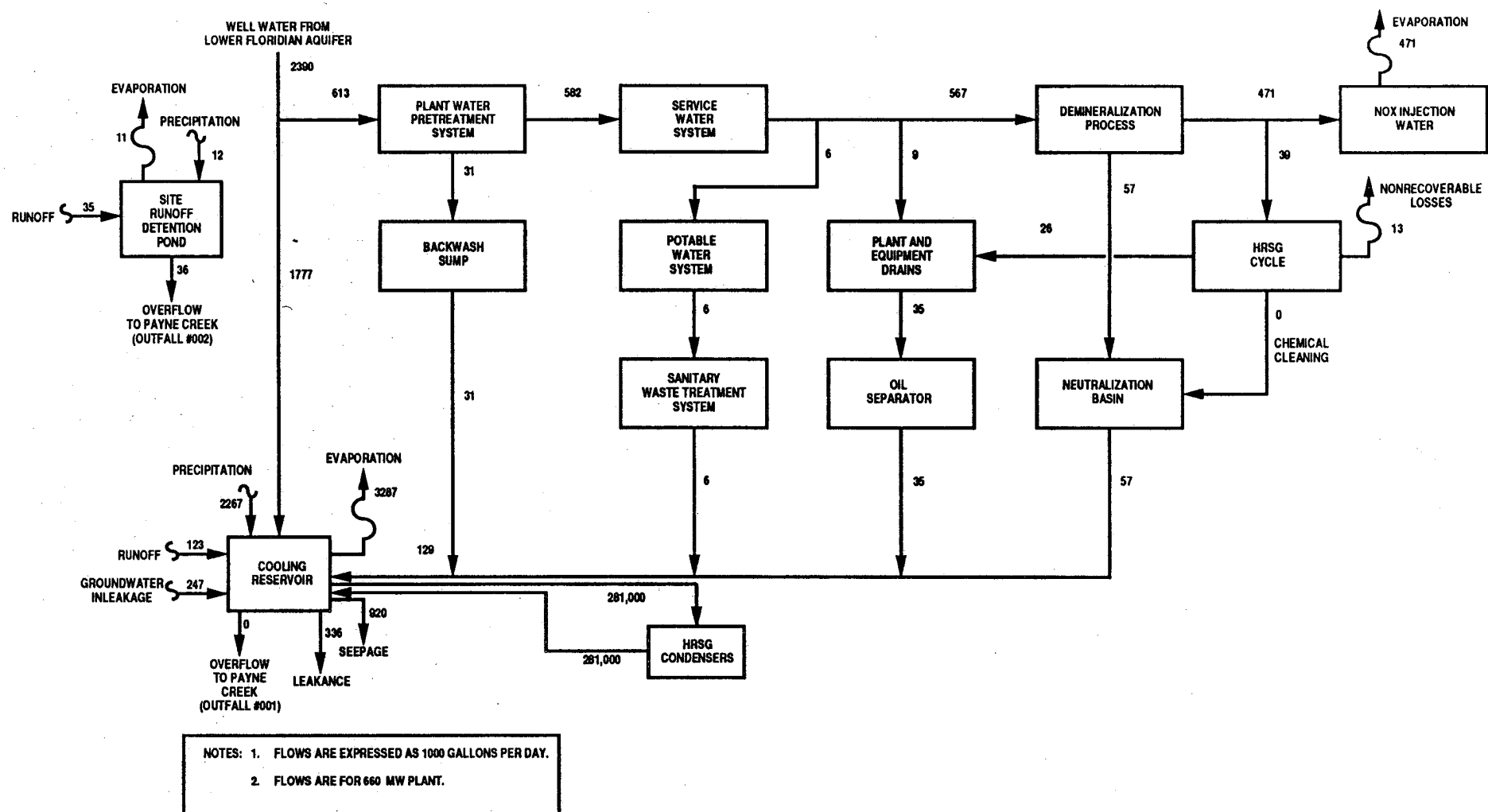


Figure 3.5-3 WATER MASS BALANCE:
ANNUAL AVERAGE MAKEUP

**Hardee
Power Station**

conditions. Average annual makeup is based on annual average climatological data and the average annual plant load. Each component of these water balances are discussed in detail below. (Refer to Section 3.5.5 for a discussion of plant size on water use; e.g., a 295 MW configuration.)

Design water quality characteristics for surface runoff, surficial aquifer seepage and Lower Floridan aquifer makeup of the Hardee Power Station are presented in Table 3.5-1. Lower Floridan aquifer will be a source of plant service water and cooling reservoir makeup; surficial aquifer water and surface runoff will be contributing flows to cooling reservoir water balance. Three 2,000 (gpm) wells will be installed to supply Lower Floridan aquifer water.

3.5.1 Cooling Reservoir and Heat Dissipation Systems

3.5.1.1 System Design

For the proposed power plant, the largest single water use is for condenser cooling/heat rejection for the steam portion of the proposed combined cycle station. Based on the current plant design, the following cooling system engineering design criteria were used:

1. The cooling system shall be capable of rejecting 1.95×10^9 BTH/hour continuously.
2. The cooling system shall be optimize 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 95°F or cooler to the condenser at all times under design ambient conditions and 100% load. Additionally, the condenser back pressure shall not exceed 4.5 inches Hg.
4. Cooling system water quality shall be maintained at satisfactory quality to allow continuous condenser cooling operation.

Based on current designs, a 570 acre recirculating cooling reservoir will be constructed to satisfy these engineering design and operational criteria (e.g., sufficient water supply and heat rejection capabilities). A viable

Table 3.5-1. Design Water Quality Characteristics for the Hardee Power Station (Page 1 of 2)

Parameter	Surface Runoff	Surficial Aquifer Seepage	Lower Floridan Aquifer Makeup
Calcium, mg/L as CaCO ₃	63	83	113
Magnesium, mg/L as CaCO ₃	39	30	49
Sodium, mg/L as CaCO ₃	17	30	37
Potassium, mg/L as CaCO ₃	0	1	8
Total Hardness, mg/L as CaCO ₃	102	113	162
Alkalinity, mg/L as CaCO ₃	61	83	160
Sulfate, mg/L as CaCO ₃	37	30	26
Chloride, mg/L as CaCO ₃	21	34	21
Silica, mg/L	5.4	17	27
Fluoride, mg/L	1.0	0.57	2.0
Cyanide, mg/L	<0.004	<0.004	<0.005
MBAS, mg/L	0.040	0.040	<0.180
Oil and Grease, mg/L	<5	<5	<5
Turbidity, NTU	1.7	51	14
pH, units	7	7.5	7.5
Total Dissolved Solids, mg/L	190	158	342
Specific Conductivity, umhos/cm	173	225	320
Total Kjeldahl Nitrogen, mg/L	0.74	0.14	0.39
Ammonia Nitrogen, mg/L	0.11	0.07	0.20
Organic Nitrogen, mg/L	0.65	0.07	0.19
Nitrate+Nitrite-Nitrogen, mg/L	0.50	0.085	0.031
Total Nitrogen, mg/L	1.24	0.24	0.421
Orthophosphorus, mg/L	0.41	0.47	0.20
Total Phosphorus, mg/L	0.44	2.08	0.20
Arsenic, ug/L	<5	<9	<10
Barium, ug/L	<10	<10	75
Beryllium, ug/L	<3	10	<0.9
Cadmium, ug/L	<0.4	6	<0.7
Chromium, ug/L	<10	<10	13
Copper, ug/L	7	65	7
Iron, ug/L	293	1700	420
Lead, ug/L	6.1	<67	14

Table 3.5-1. Design Water Quality Characteristics for the Hardee Power Station (Page 2 of 2)

Parameter	Surface Runoff	Surficial Aquifer	Lower Floridan Aquifer
Manganese, ug/L	7.9	28	28
Mercury, ug/L	0.24	0.24	<0.2
Nickel, ug/L	16	16	23
Selenium, ug/L	<5	<5	16
Silver, ug/L	<0.08	<0.08	<0.4
Strontium, ug/L	100	100	300
Zinc, ug/L	7.4	<50	143
Alpha, Gross (pC/L)	1.7	30	8.4
Radium 226 (pC/L)	0.7	2.0	3.0

and feasible alternative to this cooling reservoir is the construction and operation of mechanical draft cooling tower with blowdown discharge to the Peace River. This alternative is discussed in detailed in Chapter 8 and the SECI Combine Cycle Environmental Licensing Plan of Study.

This cooling reservoir will be constructed on reclaimed phosphate mines and will be constructed as part of reclamation efforts by Agrico for their approved and on going mining operations (Figures 3.5.1-1, 3.5.1-2 and 3.5.1-3). The inside slope of the reservoir edge will be 4:1 (horizontal:vertical). The northeastern portion of the reservoir will be below grade (i.e., the reservoir water surface will be below the adjacent reclaimed ground surface). The south and western edges of the reservoir will be above grade (i.e., the reservoir water surface will be above the adjacent reclaimed and/or undisturbed ground surface). In these areas, the reservoir will be created and maintained by the construction of a wide berm. The outside slope will be 20:1 and the inside slope will be 4:1. This very flat, outside slope was selected to create a very 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 average cooling reservoir water depth will be greater than 10 ft.

In addition to the condenser cooling water supply, the cooling reservoir will function as the fundamental component of the heat dissipation/rejection system. In the recirculating cooling reservoir system, cooling water from the cooling reservoir is pumped through the condenser to condense the turbine exhaust steam. This heated water is discharged back to the reservoir, where it is cooled through evaporative, radiant and other cooling mechanisms as it flows through the reservoir. After cooling, the water is then reused for additional condenser cooling.

The cooling reservoir provides two critical functions: (1) to collect, store and supply water for use in condenser cooling; and (2) to reject heat through evaporative, radiant and other cooling mechanisms.

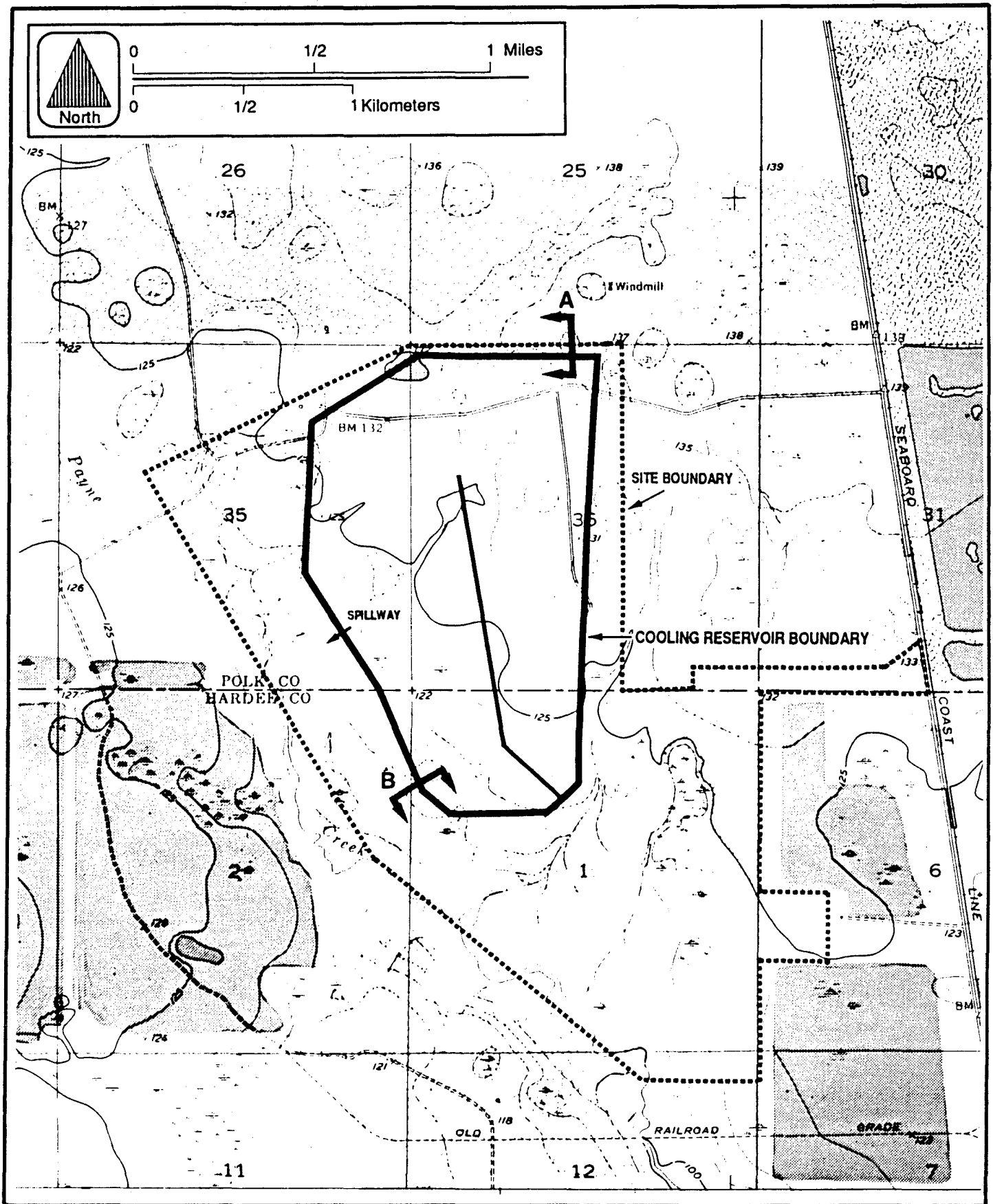


Figure 3.5.1-1 PLAN LOCATION OF COOLING RESERVOIR EDGE CROSS-SECTIONS

**Hardee
Power Station**

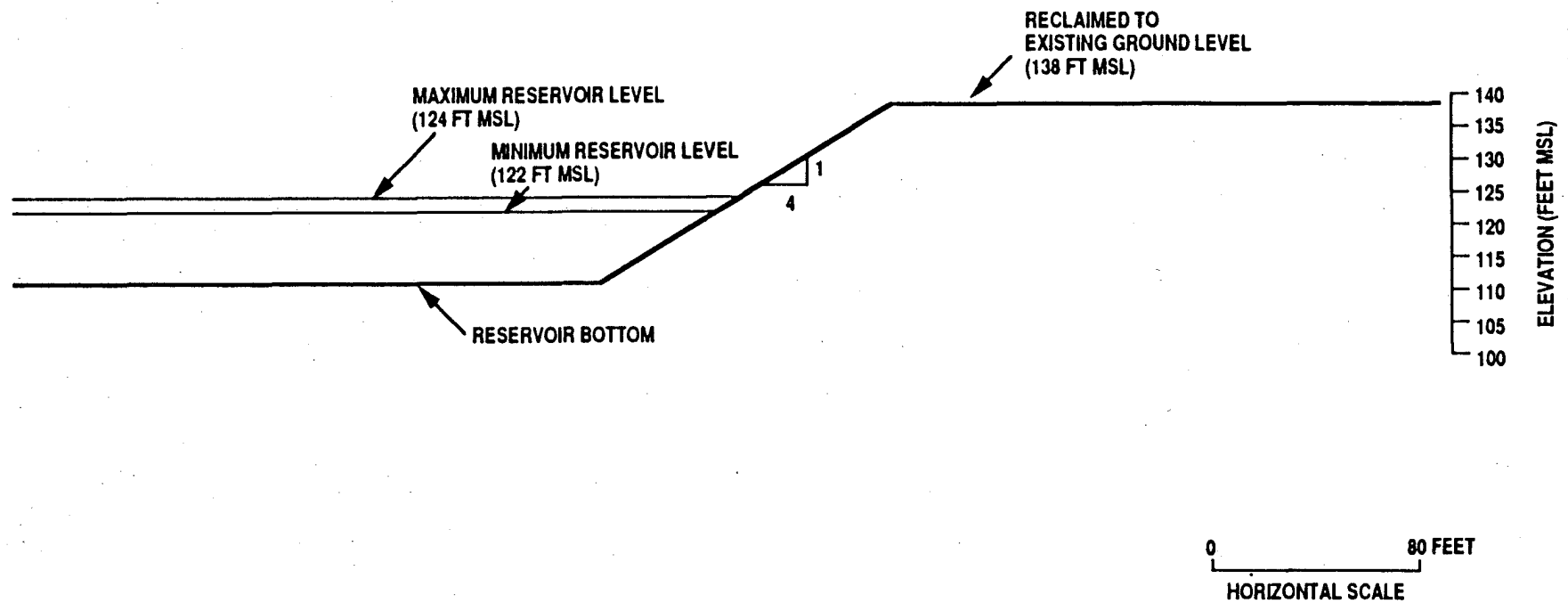


Figure 3.5.1-2 CROSS-SECTION A -
TYPICAL BELOW GRADE EDGE OF RESERVOIR

**Hardee
Power Station**

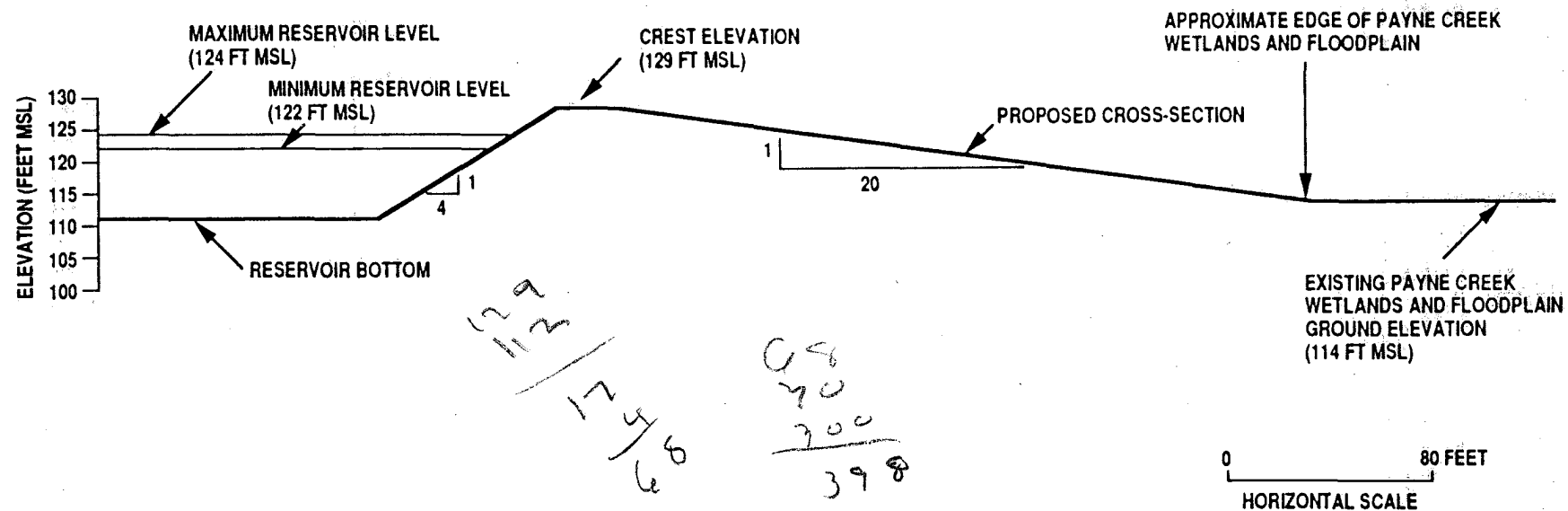


Figure 3.5.1-3 CROSS-SECTION B -
TYPICAL ABOVE GRADE EDGE OF RESERVOIR
(ADJACENT TO PAYNE CREEK)

**Hardee
Power Station**

Within the 660 MW facility, the circulating water system consists of three heat recovery cycle condensers (one for each 220 MW module), circulating water pumps, and supply and return circulating water piping to withdraw and return cooling water to the cooling reservoir (described above). The condensers will be single pressure, surface condensers. In addition to the surface condensers, an auxiliary cooling water system for equipment cooling will be installed. This system consists of water-to-water heat exchangers and receives cooling water from the circulating water system.

3.5.1.2 Sources of Cooling Reservoir Water Makeup

Water makeup of the reservoir will include direct rainfall, runoff and seepage from the upland watershed, plant discharges to the reservoir and, as necessary to maintain the reservoir water balance, pumped Lower Floridan Aquifer well water. Plant discharges to the reservoir include 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 3.5-1 through 3.5-3). Lower Floridan Aquifer well water will not be treated before use as makeup to the cooling reservoir. The three Lower Floridan Aquifer wells will be approximately 1,300 feet deep, and will be located on the plant site (see Figure 3.2-1).

The expected maximum daily well water makeup to the cooling reservoir for the 660 MW facility will be approximately 5.8 mgd (see Figure 3.5-1). The expected average annual water well makeup to the cooling reservoir for a 660 MW plant is estimated to be about 1.7 mgd (see Figure 3.5-3). Estimated long term circulating water quality, based on annual average climatological data and average annual load conditions, are shown in Table 3.5.1-1. The expected maximum annual well water makeup rate for the cooling reservoir based on worst case meteorological conditions is estimated to average 3.8 mgd for a 660 MW plant. The maximum daily and average well water makeup volumes are being proposed as operating limits for the project.

3.5.1.3 Cooling Reservoir Water Discharges

Water losses from the reservoir include seepage through the berm, leakage into lower aquifers, evaporation and infrequent discharges to Payne Creek

Table 3.5.1-1. Estimated Cooling Reservoir Water Quality for the Hardee Power Station (Page 1 of 2)

Parameter	Cooling Reservoir Quality ¹ (660 MW)
Calcium, mg/L as CaCO ₃	240
Magnesium, mg/L as CaCO ₃	100
Sodium, mg/L as CaCO ₃	200
Potassium, mg/L as CaCO ₃	16
Total Hardness, mg/L as CaCO ₃	340
Alkalinity, mg/L as CaCO ₃	260
Sulfate, mg/L as CaCO ₃	250
Chloride, mg/L as CaCO ₃	50
Silica, mg/L	60
Fluoride, mg/L	4.1
Cyanide, mg/L	0.01
MBAS, mg/L	0.36
Oil and Grease, mg/L	<5
Turbidity, NTU	31
pH, units	7.5
Total Dissolved Solids, mg/L	860
Specific Conductivity, umhos/cm	1080
Total Kjeldahl Nitrogen, mg/L	0.9
Ammonia Nitrogen, mg/L	0.4
Unionized Ammonia, mg/L (2)	0.014
Organic Nitrogen, mg/L	0.4
Nitrate+Nitrite-Nitrogen, mg/L	0.1
Total Nitrogen, mg/L	1.0
Orthophosphorus, mg/L	0.5
Total Phosphorus, mg/L	0.8
Arsenic, ug/L	20
Barium, ug/L	150
Beryllium, ug/L	4.0
Cadmium, ug/L	2.6
Chromium, ug/L	28
Copper, ug/L	27
Iron, ug/L	980
Lead, ug/L	29

Table 3.5.1-1. Estimated Cooling Reservoir Water Quality for the
Hardee Power Station (Page 2 of 2)

Parameter	Cooling Reservoir Quality ¹ (660 MW)
Manganese, ug/L	47
Mercury, ug/L	0.5
Nickel, ug/L	49
Selenium, ug/L	32
Silver, ug/L	0.8
Strontium, ug/L	610
Zinc, ug/L	280
Alpha, Gross (pC/L)	22.2
Radium 226 (pC/L)	6.2

- Note:
1. Reservoir effluent estimates are based on mass balances and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which may occur in the reservoir and act to remove material from the water column and thus reduce reservoir concentrations.
 2. Unionized ammonia concentrations are based on a worst case reservoir water temperature of 95°F (35°C).

(i.e., discharges 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 function to preclude the accumulation of adverse levels of dissolved solids within the reservoir. To accommodate the infrequent discharges which may occur during extreme (wet) meteorological conditions, a reservoir overflow to Payne Creek is proposed. The cooling reservoir overflow/discharge will be directed from the reservoir surface to edge of the Payne Creek floodplain/wetlands by a large wide swale. As necessary, this swale will be protected with rip-rap. At the upland edge of the Payne Creek floodplain/wetlands, the swale will be widened and/or a spreader swale used to allow the cooling reservoir overflow/discharge by sheet flow into Payne Creek.

3.5.2 Domestic/Sanitary Wastewater

Domestic/sanitary wastewater generated within the proposed plant will be treated in a package sewage treatment plant. Effluent from the sewage treatment plant will be routed to the cooling reservoir. The expected average sanitary wastewater flow is approximately 6,000 gallons/day for a 660 MW facility.

3.5.3 Potable Water

Potable water uses at the plant will include water for drinking, washing, and toilets. Potable water for the plant will be from the service water system, which will be supplied by deep well water which has been treated in the service water pretreatment system and chlorinated prior to use. The average expected potable water usage is approximately 6,000 gallons/day for a 660 MW facility.

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 combustion turbines to reduce NO_x emissions; (2) makeup to replace blowdown from the HRSG (necessary to maintain a low dissolved solids content in the

HRSG); and (3) makeup to replace miscellaneous steam losses in the heat recovery cycles.

Service water (i.e., pretreated Lower Floridan Aquifer well water) will be demineralized in ion exchange demineralizer trains. Each train will consist of a cation and anion exchanger. A forced draft type degasifier will be located between the primary cation and anion exchange vessels in each train for reduction of carbon dioxide (CO₂). The demineralizer ion exchange vessels will be regenerated with dilute solutions of sulfuric acid and sodium hydroxide (NaOH). The resulting regenerant waste streams will be treated as described in Section 3.6. The treated regenerant wastewater will be discharged to a neutralization basin and recycled to the cooling reservoir for use as cooling reservoir makeup.

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 15 gpm for a 660 MW facility and will be supplied from the service water pretreatment system.

3.5.4.3 Plant Drains

Separate collection systems will be used to collect miscellaneous plant drains. Miscellaneous drains will be directed to an oil separator and then routed to the cooling reservoir for reuse as cooling water.

3.5.5 Water Use Variations

Maximum daily water requirements discussed in the preceding sections are based on a 660 MW facility operating at 100% load and when ambient meteorological conditions would necessitate the greatest overall consumption of water. For the major plant water uses (i.e., cooling water and demineralized water for NO_x injection water and steam cycle makeup), water use is proportional to plant size and operating load. Thus, reduction in plant size or load would result in a proportional reduction in water demand. The balance of plant water uses (potable and general service uses) is less dependent of plant size and 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 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 wells. Similarly, periods of low temperature and/or high humidity will cause the evaporation in the cooling reservoir to decrease, and the cooling reservoir makeup from Lower Floridan wells to decrease proportionally.

Given its size and volume, the proposed cooling reservoir will substantially dampen 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 will be small. Cooling reservoir makeup can be maintained at a relative constant rate, independent of the short-term variations in plant and meteorological conditions. The proposed cooling reservoir will function 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.

The well water will be obtained from three onsite wells (2,000 gpm capacity each for full 660 MW buildout). Makeup to the cooling reservoir will be untreated. Water for all other plant uses will be treated in the service water pretreatment system.

3.6 CHEMICAL AND BIOCIDES WASTE

Overall water/wastewater flow scheme has been previously presented in Figures 3.5-1 through 3.5-3. All wastewaters generated within the proposed plant will be discharged to the cooling reservoir, after appropriate treatment, for reuse as cooling reservoir makeup and condenser cooling water. The principal water/wastewater discharges to the cooling reservoir include: circulating cooling water return flow; plant water pretreatment system backwash water; sanitary treatment system wastewater; plant and equipment drains; and neutralization basin effluent.

The principal uses of chemicals and biocides at the proposed project 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 cycle piping systems, and miscellaneous chemical drains. These chemical wastes and related water/wastewater flows will be treated and routed as described in the following sections.

3.6.1 Cooling Reservoir Circulating Water Treatment

Intermittent shock chlorination will be used to prevent biofouling of the circulating water system. Chlorine will be fed within the intake structure at the circulating water pumps intake. The feed rate will be adjusted as necessary.

Additional biocides, both oxidizing and nonoxidizing, may be used for control of aquatic vegetation in the cooling reservoir or other biological growth in the system depending on the conditions present in the reservoir and circulating water system.

3.6.2 Steam Cycle Water Treatment

The steam cycle water will be treated to prevent HRSG corrosion or scaling. 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 may also be fed to the cycle; residual phosphate will react with calcium hardness in the HRSG to form a nonadherent precipitate.

3.6.3 Sanitary Wastewater Treatment

During plant operation, the sanitary wastewater produced by the plant will be routed to an extended aeration sewage treatment plant. The average expected flow of sanitary wastewater is 6,000 gallons per day (gpd). The average expected biological loading is 7 pounds of BOD₅ per day based on 0.075 pound of BOD₅ per employee per day. Effluent from the sanitary wastewater treatment system will be routed to the 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 off-site 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 ion exchanger type demineralizer trains. 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 tanks 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 demineralizer operation.

The wastewater from cation resin regeneration will include regenerant water containing unreacted sulfuric acid and dissolved sulfate salts of the cations removed from the resins during regeneration. The wastewater from anion resin regeneration will include regenerant water containing unreacted sodium hydroxide and dissolved sodium salts of the anions removed from the resins during regeneration.

The estimated regenerant waste flow will average approximately 166,000 gpd based on maximum makeup requirements conditions. These two waste streams will be routed to the neutralization basin for pH adjustment prior to discharge to the cooling reservoir; this neutralization basin is described in Section 3.6.7.

3.6.5 Chemical Cleaning

The heat recovery steam generator (HRSG) and feedwater 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 at the time of the schedule periodic cleanings. The chemical cleaning solutions to be used for acid and

alkaline cleaning of the HRSG will be somewhat 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:

- o Inhibited hydrochloric acid
- o Ammonium bifluoride
- o Hydroxyacetic acid
- o Formic acid
- o Disodium phosphate
- o Trisodium phosphate
- o Soda ash
- o Nonfoaming wetting agents
- o Foam inhibitors

These wastewaters will consist of the cleaning solutions and material removed during the cleaning process. The chemical cleaning contractor will either dispose of the chemical cleaning wastes offsite or treat the wastes in a portable treatment system prior to routing the treated wastewater to the cooling reservoir.

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 hosing down chemical storage areas. A floor drain collection system will be provided to route miscellaneous chemical wastes to the neutralization basin. Flows from the miscellaneous chemical drains will be intermittent and will not normally contribute to the wastewater flows.

3.6.7 Neutralization Basin

A neutralization basin will be provided for pH adjustment of chemical wastes. The basin will be sufficient to accommodate the wastewaters

produced during regeneration of the makeup demineralizers. The neutralization basin will be a reinforced concrete basin lined with chemical resistant membrane, brick, and mortar. A chemical waste mixer will be provided to hasten pH adjustment of the chemical wastes. 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 cooling reservoir. Table 3.6.7-1 presents the estimated water quality of the neutralization basin effluent.

3.6.8 Miscellaneous Plant Drains

Separate collection systems will be used to collect chemical drain wastewater and miscellaneous plant drain wastewater. Chemical drain wastewaters have been discussed previously in Section 3.6.6. Miscellaneous plant drain wastewater can result from general cleaning and maintenance, such as hosing general plant (i.e., non-chemical) areas. Miscellaneous floor drains will be directed to an oil separator and then routed to the cooling reservoir for reuse as cooling water.

3.7 SOLID AND HAZARDOUS WASTE

3.7.1 Solid Waste

Only small quantities of solid wastes will be generated by the Hardee Power Station facilities since there will be no ash or FGD waste generated or requiring disposal. Solid wastes will be limited to general trash, sanitary waste treatment sludge and infrequent replacement of demineralizer resins. The sanitary waste sludge will be disposed of by a contractor who will remove sludge in the sludge holding compartment once or twice per year. Sanitary waste sludge will be hauled off site for disposal by the contractor. Other solid wastes will be disposed off-site in a sanitary landfill.

3.7.2 Hazardous Waste

The demineralized waste streams can contain up to 10% sulfuric acid or up to 5% sodium hydroxide along with the minerals removed from the ion exchange resins. The wastes will be combined in an elementary neutralization basin

Table 3.6.7-1. Estimated Characteristics of the Neutralization Basin Effluent for the Hardee Power Station (Page 1 of 2)

Parameter	Treated Neutralization Basin Effluent
Calcium, mg/L as CaCO ₃	1130
Magnesium, mg/L as CaCO ₃	490
Sodium, mg/L as CaCO ₃	3050
Potassium, mg/L as CaCO ₃	80
Total Hardness, mg/L as CaCO ₃	1620
Alkalinity, mg/L as CaCO ₃	0
Sulfate, mg/L as CaCO ₃	4540
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	6860
Specific Conductivity, umhos/cm	12100
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
Arsenic, ug/L	0.1
Barium, ug/L	750
Beryllium, ug/L	9
Cadmium, ug/L	7
Chromium, ug/L	130
Copper, ug/L	70
Iron, ug/L	0
Lead, ug/L	140

Table 3.6.7-1. Estimated Characteristics of the Neutralization Basin Effluent for the Hardee Power Station (Page 2 of 2)

Parameter	Treated Neutralization Basin Effluent
Manganese, ug/L	0
Mercury, ug/L	2
Nickel, ug/L	230
Selenium, ug/L	160
Silver, ug/L	4
Strontium, ug/L	3000
Zinc, ug/L	1400
Alpha, Gross (pC/L)	84
Radium 226 (pC/L)	30

to take advantage of their mutual neutralizing tendencies and monitored for pH. In the event the wastewaters are not neutralized, additional acid or caustic will be added to the basin from the demineralizer regeneration system as needed to adjust the pH. This activity is exempt from hazardous waste permitting pursuant to 40 CFR 264.1(g)(6) and 40 CFR 265.1(c)(10). The neutralized wastewater will not be accumulated and will discharge from this basin to the cooling reservoir as a non-hazardous waste. Acid cleaning wastes are addressed in Section 3.6.5.

3.8 ONSITE DRAINAGE SYSTEM

Site drainage facilities will be designed in accordance with the criteria of the SWFWMD for water quality and water quantity control. The site drainage facility is designed to provide detention for runoff from the first one inch of rainfall (i.e., water quality control) and to limit the post development peak discharge to the pre-development peak rate for the 25-year, 24-hour rainfall event (i.e., water quantity control). This will be accomplished by the construction of a plant site drainage system of pipes, channels and culverts which flow to a stormwater detention pond. This stormwater detention pond will discharge to Payne Creek.

3.8.1 Stormwater Detention Pond

Surface runoff from the area disturbed for new facility construction and plant operation will be collected and directed to the stormwater detention pond. This pond will be located in the southwestern portion of the site property and will receive surface drainage from the entire plant site.

The stormwater detention pond has been sized to address both the water quality and water quantity control criteria of the SWFWMD. For water quality control, the stormwater detention pond has been designed to provide "on-line" detention for runoff from the first one inch of rainfall. Treated stormwater from the pond will be directed to Payne Creek.

For water quantity control, the stormwater detention pond has been designed to provide sufficient volume for peak attenuation so that the peak pond discharge rate will be equal to or less than the pre-development site peak

discharge rate during a 25-year, 24-hour rainfall event. The overflow weir/outfall structure is designed to pass any flows which exceed that resulting from the 25-year, 24-hour rainfall event. Design calculations are presented in the Appendix 11.5.

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 or dewatering water flow to the pond. The construction drainage system will follow the layout of the permanent ditch system where possible.

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 storm drainage system (i.e., open channel and/or storm sewer system) and directed to the stormwater detention pond, described above.

As necessary, sediment collected during the construction phase will be removed to assure adequate pond volume and filtration system operation.

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 (1% minimum) for effective drainage.

Site runoff will be conveyed to the stormwater detention pond through a drainage system of pipes, channels and culverts.

The drainage along the entrance road for the new facilities will consist of shallow swales which will provide wet detention for maintenance of water quality. As necessary, small ditch checks or "dikes" will be used to control discharge to satisfy water quantity criteria. After treatment in

these swales, this stormwater will be discharged to wetlands which drain to Payne Creek.

3.8.4 Flood Elevations

The site facilities will be designed so that no structures subject to damage by flooding will be placed at an elevation below that of the 100-year flood elevation. The grade in the area of the new facilities will be approximately at elevation 117 feet above mean sea level (MSL) with the main power block foundation at about 118 feet above MSL. These elevations will be verified during detailed plant design.

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, an access road will be constructed on the site to provide access to the plant facilities from CR 663. 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 described in Section 4.1.1. Materials will be unloaded and moved around the site using portable cranes and trucks. Some of the heaviest items such as the combustion turbines, generators, HRSGs and transformers will 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 gravel surfaced 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

Heavily loaded construction trucks will travel to the site via CR 663 and the site access road shown on Figure 3.2-1.

3.9.3 Railroad

A CSX Railroad branch-line currently runs north-south approximately 1/2 mile east of the proposed power block locations 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.

REFERENCES - Chapter 3

USEPA Memorandum from J.C. Potter (Assistant Administrator for Air and Radiation) to Regional Administrators. December 1, 1987.

**HARDEE
POWER
STATION**

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 4

**EFFECTS OF SITE
PREPARATION, AND
PLANT AND ASSOCIATED
FACILITIES
CONSTRUCTION**

CHAPTER 4

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4.0 EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

4.1 LAND IMPACT

4.1.1 General Construction Impacts

As discussed in Section 2.3.5, the land in the immediate vicinity of the Hardee Power Station site is presently used for phosphate mining and most of the land already has been disturbed. Therefore, general site preparation construction will have no significant land impacts.

The generating plant and associated facilities will be constructed on land that has not been mined, while the 231 ha (570 acre) cooling reservoir will be constructed entirely on mined lands. An access road 7.9 m (26 ft) wide with a 6.1 m (20 ft) wide paved center section and a 0.9 m (3 ft) shoulder on either side will be constructed from CR 663 west to the plant site on reclaimed lands. Local site grading and leveling will be necessary. Impacts to terrain will be minor.

No impacts from construction wastes are anticipated. Combustible construction wastes (e.g., paper, wood, etc.) will be burned on-site in accordance with applicable regulations. Construction wastes will be removed from the site for disposal at an approved facility. Any garbage (food containers, papers, etc.) will be collected in appropriate waste collection containers and disposed in accordance with FDER Regulations.

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.

Fugitive dust and impacts on the human population are addressed in Sections 4.5 and 4.6, respectively.

4.1.2 Roads

The proposed access road will connect with CR 663 but will not connect to state roads. Information required by the Department of Transportation's (DOT) "Utility Accommodation Guide" is not applicable, however, the Applicant will consult with the County.

4.1.3 Flood Zones

As part of their 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 proposed plant/cooling reservoir site was estimated, generally corresponding with the limits of the forested floodplain and related wetlands vegetation. These flood elevation study results were submitted to and approved by the regulatory agencies as part of the approval of Agrico's mining and reclamation plan.

The facilities have been designed and located so that no structures will be placed in the Payne Creek floodplain at an elevation below that of the 100-year flood.

All plant facilities have been designed to comply with all applicable SWFWMD and FDNR 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 are anticipated. In addition, the proposed power plant and adjacent cooling reservoir will not be adversely impacted by Payne Creek flood elevations or flows and will not cause any adverse flooding or related impacts to offsite property.

4.1.4 Topography and Soils

Current topographic features at the site reflect past and ongoing mining activity. There are numerous spoil piles from the mining activity which are as high as 6 to 9 m (20 to 30 ft) above grade. Along the eastern border

of the site there are two existing settling ponds with perimeter berms which rise approximately 5 and 10 m (15 and 33 ft) above the general grade. When mining is completed, the mined area will be reclaimed in accordance with approved reclamation plans. General site grading will take place by matching of cuts and fills. It is not anticipated that import or export of soil materials will be required.

After reclamation, overall subsidence of the land is not expected. A slight settlement may take place in areas of construction, but this will be localized in extent. Major structures in the power block area will be supported on pile foundations and will experience negligible settlement. Other minor structures will be founded on undisturbed land.

Bearing strengths of the fine sands are sufficient that shearing failures are not expected for the foundations or for the embankments. Where compaction is necessary for construction, a densification program will be instituted. Structures will not be constructed on unstable soils, unless adequately supported by retaining structures.

Construction runoff from the site will be collected in a detention pond up-gradient of the wetlands area. Areas not covered by the power block structures and roads will be left in a natural state so that rainfall will percolate into the surficial aquifer.

The cooling reservoir will be constructed on the western half of the site. The design of the cooling reservoir is described in Chapter 3. An impounding berm will be constructed with an average elevation of 39.3 m (129 ft) and it will impound water at an average elevation of 37.8 m (124 ft). The cooling reservoir will impound rainfall and runoff that would otherwise have flowed directly to Payne Creek. Evaporation and seepage into the groundwater will increase, as discussed in Section 5.2.1.2. Berms will be gentle slopes and will therefore be structurally stable as embankments. The design interior slopes are 4:1 (horizontal to vertical) and the exterior slopes will be at 20:1.

Roads will be constructed with primary access off CR 663 and emergency access through the CFI property located between the two existing settling ponds.

During construction, a soil erosion and sedimentation plan 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 on site. As each area is final graded, revegetation will be established to the extent possible. Areas near switchyards and permanent ditches will be protected with coarse stone.

Construction-related changes in site topography or soils should have no adverse effect on aesthetics or viewshed. The major factor in evaluating the facility viewshed are the berms east of the site around CFI phosphate ponds. These represent a major screen for the facility, and they will not be altered by construction for the Hardee Power Station.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 Impact Assessment

4.2.1.1 Surface Hydrology - Physical and Chemical

The primary potential impacts to Payne Creek from site preparation and plant construction are erosion and sedimentation impacts due to earthmoving and material placement associated with the plant and reservoir construction. Potential discharges associated with construction dewatering may also impact Payne Creek surface waters. These impacts will be controlled and minimized through proper design and placement of runoff control features.

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, 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 in the southwest portion of the property 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. A system of temporary construction ditches and piping will direct the stormwater runoff or dewatering flows to the detention pond. The construction drainage system will follow the layout of the permanent ditch system where possible.

The cooling reservoir will be constructed from mined-out lands. Reclamation and construction of the cooling reservoir will be performed by Agrico in accordance with the erosion control program specified in Agrico's approved reclamation plan.

The cooling reservoir overflow/discharge structure will consist of a concrete swale constructed at the same downstream slope (20:1). This structure will connect the reservoir with Payne Creek floodplain/wetlands. As necessary, the outer edges of this swale will be protected with rip-rap to minimize soil erosion. At the upland edge of the Payne Creek floodplain/wetlands, the swale will be widened to a spreader swale used to carry the cooling reservoir overflow/discharge by sheet flow into Payne Creek. This technique, will avoid adverse physical impacts to Payne Creek (see Sections 5.1, 5.5 and 5.8).

4.2.1.2 Ecological Systems

No direct impacts to aquatic systems of Payne Creek from such activities are anticipated, as no structures will be constructed in the flowing creek or in the floodplain. In addition, floodplain wetlands will not be affected since construction of the cooling reservoir will occur outside this area. Several small wetlands (Section 2.3.6) on site will be excavated as part of the cooling reservoir construction. Two of these wetlands are isolated marshes that are each less than 2.6 ha (6.4 acres). A larger wetland [2.4 ha (5.9 acres)] has areas of both forest and marsh drains to Payne Creek. Agrico has submitted dredge and fill applications for the mining of these wetlands. In addition, this application includes a permit application for the dredging of these wetlands as part of this project (see Appendix 11.1.3). No significant wildlife habitat will be lost onsite.

4.2.2 Measuring and Monitoring Programs

Because of the proposed erosion control measures, no anticipated water quality impacts to Payne Creek are expected. Therefore, no water quality monitoring is proposed 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:

- o Circulating water piping - approximately 1,128 m (3,700 linear ft) of 152 cm (60 inch) for one combined cycle module diameter pipe and 610 m (2,000 linear ft) of 122 cm (48 inch) diameter pipe,
- o Circulating water pump structure (intake structure), and
- o Miscellaneous underground utilities.

The circulating water piping system will require the most extensive dewatering. The dewatering flow is estimated to be 201 liters (L) per minute [53 gallons per minute (gpm)] per 30 m (100 linear ft) of pipe, regardless of pipe size. Assuming 152 m (500 linear ft) of pipe is excavated and dewatered at a time, a dewatering flow of 1,005 L per minute (265 gpm) would be anticipated, with a radius of influence of approximately 44 m (145 ft). The corresponding estimates for the 102 cm (40 inch) diameter pipe are 1,005 L per minute (265 gpm) and a radius of 29 m (95 ft). These flows would exist during the construction period, which will last approximately 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 will be constructed within a sheetpile enclosure which will minimize dewatering. The dewatering flow for the system is estimated to be approximately 1,900 L per minute (500 gpm) for a period of 6 months.

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 L per minute (100 gpm).

The amount and rates of groundwater inflow to the excavation/dewatering system are far less than the disturbance caused by adjacent strip mining activity. The primary impact of dewatering is that groundwater from the surficial aquifer will be withdrawn and the aquifer phreatic line will be depressed locally. In order to minimize the impact of dewatering, the pumpage from wellpoints 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. Due to the location of dewatering areas and the pond, seepage into the southern end of the Payne Creek wetlands will be shifted, temporarily, to the northwest.

Dewatering can cause increases in vertical stresses. In this case the increase will not be large enough to cause settlement or depressions. Foundations in the power block area will not be at risk because they are supported on piles.

Chemical effects of dewatering will result primarily from oxidation of the groundwaters. The sands of the surficial aquifer are predominantly quartzitic, although soluble calcite and phosphate are present within the strata. Dissociation of calcite will liberate calcium ions and bi-carbonate anions, which will increase the hardness of the water. Oxidation reactions in the predominantly siliceous system are practically insignificant.

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

During construction dewatering, all local, state and federal requirements will be met for on-site discharge of groundwater.

4.4 **ECOLOGICAL IMPACTS**

4.4.1 Impact Assessment

4.4.1.1 Aquatic Systems

No structures are planned in Payne Creek or its floodplain. Construction surface runoff will be routed into a detention pond and erosion prevention measures will be used (Section 4.2.1.2), thus no adverse ecological impacts to aquatic systems are anticipated.

Infrequent stormwater discharges from the detention pond are the only anticipated inputs into Payne Creek during construction. These discharges are not expected to have adverse impacts on Payne Creek.

4.4.1.2 Terrestrial Systems

The power plant, cooling reservoir, and associated onsite facilities such as parking lots, detention ponds and roads will occupy over 283 ha (700 acres) of land. Over 90% of this area will be located on recently mined land and will not replace existing vegetation communities. Approximately 8 ha (20 acres) of abandoned improved pasture will be permanently replaced. The natural vegetation communities onsite will be preserved. These include the forested wetland tributary to Payne Creek and the flatwoods/wet hardwood forest that comprises the Payne Creek floodplain. Therefore, the construction of the Hardee Power Station will have very little impact on local or regional natural vegetation communities.

Potential impacts to the preserved vegetation communities onsite due to construction activities typically include the following:

- o Sedimentation and pollution of Payne Creek due to stormwater runoff into the tributary and floodplain from laydown areas, roads, and areas under construction;

- o Damage to vegetation due to fugitive dust from roads and other areas that are being cleared; and
- o Damage to preserved areas due to human intrusion and litter.

Stormwater runoff into Payne Creek and site wetlands will be prevented by the implementation of temporary and permanent measures (Section 4.2.1.1). Erosion and sediment control measures 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. Detention basins will be used for permanent redirection of stormwater.

The Payne Creek floodplain will be identified and construction workers will not be working in that area.

Potential impacts to wildlife communities due to construction activities include the following:

- o Vegetation removal and loss of habitat,
- o Noise,
- o Increased access to wildlife areas,
- o Road traffic and road kills, and
- o Change in drainage.

Most of the wildlife habitat area has been altered by mining operations. Some wildlife habitats, including mesic hardwood forest, open pine pasture, and upland oak-palmetto still remain on site. The most productive of these habitats are the mesic hardwood forest along the Payne Creek tributary and the forest in the Payne Creek floodplain. Since these habitats will not be mined or used for construction and be preserved, the construction of the Hardee Power Plant will have no significant impact on local or regional wildlife habitats.

A loss of habitat in the areas of open pine-pasture and upland-oak palmetto will occur. The more mobile animals (birds, snakes and most mammals) will

escape to surrounding habitats. These habitats are neither important nor significant compared to similar habitats in the project area.

The increased noise from construction equipment may cause a temporary avoidance behavior in area wildlife. This behavior is expected to be minimal since existing wildlife is probably accustomed to the noise generated by existing mining operations.

Wildlife habitats are presently accessible by existing roads so that any additional roads to the site will not affect wildlife conditions in these habitats.

A temporary increase in road kills may be expected from construction and traffic. Some small mammals (e.g., opossums) and reptiles (e.g., snakes) may be killed. No important wildlife species are expected to be affected.

Runoff and subsurface seepage from areas upstream and to the west of the creek will not be affected and will continue to provide enough water so that wildlife use of the creek will be unchanged.

The three state-listed plant species (i.e., water spider orchid, wild pine and shoestring fern) that occur or potentially occur in the forested wetland tributary that will be preserved on site will not be adversely affected by construction. This area will be protected by the measures described above.

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 lost during construction.

4.4.2 Measuring and Monitoring Programs

Because of the lack of anticipated ecological impacts no biological monitoring is proposed during the construction period.

4.5 AIR IMPACT

4.5.1 Estimated Emissions

Air quality impacts during the construction phase of the project are primarily due to the land clearing and site preparation activities which include the generation of fugitive dust and exhaust emissions from construction equipment. These air quality impacts 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. Building and road construction will have the highest potential for fugitive dust emissions and impacts. Emissions during the construction of buildings or roads will be associated with land clearing, ground excavation, cut and fill operations and actual construction of the facility when approximately 13 ha (32 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. The plant site arrangements are shown in Figure 3.2-1 with the specific acreage requirements discussed in Section 3.2.

The highest potential impacts from vehicular exhaust emissions will occur during the facility construction phase when the amount of on-site equipment is greatest for concrete placement, structural and major equipment installation.

4.5.2 Control Measures

For the emissions described in the previous section, the local air quality impact from fugitive dust will be minimized by the application 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. Much of the site will be covered by the cooling reservoir water surface area by the end of the construction period.

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 promptly removed from roads and paved areas.

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. 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.

4.6 IMPACT ON HUMAN POPULATIONS

4.6.1 Noise Impacts

The nearest human population to the proposed facility is CFI's Hardee Phosphate Complex, which is a phosphate processing plant located approximately 1,830 m (6,000 ft) to the southeast. The nearest residential (non-commercial) population, relative to the proposed facility, are the homes located 2.4 km (1.5 miles) south on Roberts Road (Figure 2.3.8-1). Noise from the operation of construction equipment during the construction phase of the project will not adversely impact the surrounding area due to the already existing noise from the ongoing mining and phosphate processing operations. Also, most of the construction and associated major noise producing activities are intermittent in nature and take place during normal daylight working hours. The various construction contractors will be requested to make use of low noise level equipment and utilize noise attenuating devices (e.g., mufflers) whenever possible as well as compliance with vehicle noise regulations.

4.6.2 Transportation Impacts

The movement of construction workers, equipment and materials to and from the site may cause some short-term inconvenience to residents in the area. Because the area has a long history of movement of construction workers associated with past and present mining activities the impacts of this movement are not considered significant. An average of 225 workers will be required during the approximate 26-month construction period with a peak not expected to exceed 400 workers on-site over a 3 month period.

The primary mode of access to the 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/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 96.5 km (60 miles) of the plant site and will primarily reside in Polk and Hardee counties. For the purposes of this analysis, it is assumed that up to 80% of the construction workers will come from the large population centers of Lakeland, Winter Haven, and Plant City which are located within about 40-60 km (25-35 miles) north and northeast of the site: this also includes the smaller communities of Bartow and Mulberry, as well as Bradley Junction, and Ft. Meade. It is expected that the balance of other workers will be split about evenly (10%-10%) between those that come from the south and southeast in Hardee and DeSoto counties and the more distant coastal population centers of Hillsborough, Sarasota, and Manatee counties. These assumptions are based on population distribution in the area (refer to Table 2.2.3-1) and labor availability.

Due to the sparse development and roadway system in the area of the Hardee Power Station site, construction workers will have a limited selection of access routes from which to choose. Recent discussions with Florida DOT

(Bartow Office), and Polk and Hardee County traffic and public works personnel, indicate that while limited in number, all access roads are two lane facilities, in good to very good structural condition, and are generally carrying low volumes of traffic at acceptable speed and safety levels.

IMPACT OF CONSTRUCTION

An average of 225 workers, and a peak of approximately 400 workers, will be commuting to the site during the 26-month construction period. While some workers may carpool to the site, a one person-one car traffic scenario has been assumed for this analysis. Since major equipment deliveries to the site are expected to be by rail, truck traffic should be limited and should not conflict with car traffic.

Based on regional population distribution and workforce availability, it is anticipated that approximately 80% of the workforce will come from Polk County, and 20% from Hillsborough, Hardee, DeSoto, Manatee and Sarasota Counties. In addition, while traffic volume in some parts of Florida vary 20 to 25% above and below the ADT due to seasonal travel, it is assumed that the access roadways to the plant site will not be affected by such variations. It is also assumed that peak hour traffic was a maximum of 10% of the ADT (peak hour traffic data was not available for roads in the approach network to the plant site).

An operational capacity of about 2,000 vehicles per hour (both directions) has been assumed for the two-lane highways providing access to the site. This represents about 70% of the ideal capacity of 2,800 for two lane highways (Transportation Research Bureau Highway Capacity Manual, 1985). The adjustment to 2,000 vehicles per hour takes into account varying conditions of roadway alignment, shoulder areas, and truck traffic along the access roads.

A capacity assumption of 1,500 vehicles per lane was made for the 4-lane segment of US 17/SR 35, due to slower speeds associated with travel conditions in developed areas (Bartow and Ft. Meade).

Table 4.6.2-1 lists each of the elements of the access roadway network, along with current and projected peak hour traffic conditions, volume to capacity ratios, and projected Level of Service. Based on the assumptions used for this analysis and a comparison of anticipated traffic with current traffic volumes and road capacities, the traffic generated by the site construction workers should not have any significant adverse affect on either roadway capacity or Level of Service conditions on any of the segments of the access roadway network.

While the proposed construction effort is anticipated to have a minimal impact on local transportation networks, based on the segment analysis (Table 4.6.2-1) it was judged that the large number of construction workers anticipated to be commuting from communities to the north of the site could create minor congestion during peak hours at the following four intersections:

1. Plant site entrance and CR 663,
2. SR 37 and CR 630,
3. CR 663 and CR 630, and
4. US 17/SR 35 and CR 630 in Ft. Meade.

Some delays may occur during the evening "peak hour" at these locations as workers leave the site at one time and turn onto the primary commuting roads. These delays may cause a minor short-term nuisance. Should problems occur, however, county traffic control personnel will be utilized to keep traffic flowing smoothly and to minimize delays.

4.6.3 Housing Impacts

According to the FDLES over 75,000 construction workers reside within 96.5 km (60 miles) of the proposed site. Since a more than adequate labor supply exists within commuting distance, it is anticipated that workers will

Table 4.6.2-1. Existing and Projected Peak Hour Traffic Conditions on Site Access Roads in Polk and Hardee Counties

Roadway	Segment	EXPK	Cap	%AT	Avg	Peak	CAP	LOS
SR 37	SR 60 to CR 630	400	.20	40	490	560	.28	A
	SR 674 to CR 630	370	.19	05	380	390	.20	A
US 17/SR 35	SR 60 to CR 630 (4 LN)	1390	.23	30	1460	1510	.25	B
CR 555	SR 60 to CR 630	250	.13	05	262	270	.14	A
CR 630	SR 37 to Ft.Green	190	.10	45	290	370	.19	A
	Ft Green to CR 555	210	.11	40	310	370	.19	A
	CR 555 to US 17/SR 35	290	.15	35	370	430	.22	A
SR 674	Hills. Co. to SR 37	145	.07	05	155	165	.08	A
CR 663	CR 630 to Site	45	.02	85	240	390	.20	A
	CR 664 to Site	45	.02	15	80	105	.05	A
CR 663	CR 62 to CR 664	45	.02	10	70	85	.04	A
SR 62	Manatee Co. to CR 663	250	.13	05	262	270	.14	A
	US 17/SR 35 to CR 663	260	.13	05	272	280	.14	A
US 17/SR 35	DeSoto Co. to SR 62	1100	.55	.05	1120	1140	.57	B

Column Heading Abbreviations:

EXPK: Existing 1988 Peak Hour Traffic, based on 10% of current ADT.

Cap: Existing ratio of peak hour volume to capacity of the roadway segment (2-lane capacity = 2000 total, both ways: 4-lane = 1500 per lane).

%AT: Percentage of construction worker access traffic.

Avg: Peak hour volume on segment with traffic for average of 225 workers added.

Peak: Peak hour volume on segment with peak of 400 construction workers added.

CAP: Peak hour volume to capacity ratio at 400 worker peak traffic added.

LOS: Projected Level of Service at 400 worker traffic level.

A - Free flow traffic conditions

B - Traffic flow at 75-90% of that attainable of free flow.

LN - Lanes

Source: Transportation Research Board, Highway Capacity Manual. Special Report 209, 1985.

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 (RV) 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 over 1,000 full hook-ups for RVs 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 normal 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 which 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 vicinity of the proposed facility. Consequently, the construction of the Hardee Power Station 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 Hardee Power Station property (see Section 2.2.6). Therefore, no impact mitigation is required. 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 in consultation with the Division of Historical Resources (DHR) will determine the

significance of the find. If the site is considered significant by the 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 and residues produced during construction that will have an influence on the environment and ecological systems of the plant site and the adjacent areas.

4.10 BENEFITS FROM CONSTRUCTION

Numerous benefits will directly result from site preparation and construction activities.

Site preparation and construction will create job opportunities within Hardee and Polk counties, a region which is currently suffering from high unemployment. In addition, the state of Florida will benefit from sales taxes paid on the construction materials. A detailed description of the socioeconomic benefits associated with construction of the Hardee Power Station is presented in Section 7.

4.11 VARIANCES

A variance is sought from Section 16C-16.0051(1), F.A.C., and Section 16C-16.0051(5), F.A.C., FDNR Reclamation Standards for construction of the cooling reservoir (see Appendix 11.10 for discussion of variance). No significant or adverse impacts will result from granting this variance. No other variances from applicable standards due to construction will be sought as part of the state certification procedures.

REFERENCES - Chapter 4

Transportation Research Board. 1985. Highway Capacity Manual.
Special Report 209.

**HARDEE
POWER
STATION**

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 5

**EFFECTS OF
PLANT OPERATION**

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5.0 EFFECTS OF PLANT OPERATION

5.1 EFFECTS OF OPERATION OF THE HEAT DISSIPATION SYSTEM

5.1.1 Temperature Effect on Receiving Body of Water

As previously described in Section 3.5, a 231 ha (570 acre) cooling reservoir will be used for condenser cooling/heat dissipation for the steam portion of the Hardee Power Station. The reservoir will function as the condenser cooling water supply, condenser cooling point of discharge and heat dissipation system. The cooling reservoir has been designed to

- (1) collect, store and supply water for use in condenser cooling and
- (2) reject heat through evaporative, radiant and other cooling mechanisms.

As a recirculating/recycling cooling system, the reservoir is designed to maximize water reuse and thereby minimize groundwater withdrawals. Water makeup of the reservoir 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 which may occur during extreme (wet) meteorological conditions, a reservoir overflow to Payne Creek is proposed.

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.

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., air temperature, dew point, relative humidity, wind speed, etc.).

The temperature within the reservoir was evaluated 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, respectively. During average anticipated operating conditions the predicted maximum temperature on the cold side is 32°C (89°F) during July; during the maximum, worst case conditions, the predicted maximum temperature on the cold side is 34°C (93°F) during July. These are monthly average temperatures; daily variations within these months may occur and result in slightly higher temperatures.

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 cm/yr (49.6 inches/year) corresponds with the various estimates of lake evaporation in the region ranging from 119 to 130 cm (47 to 51 inches) year. 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 proposed cooling reservoir.

To evaluate the frequency of discharge, a reservoir water balance analysis was conducted. Water flows into the reservoir include: rainfall into the reservoir; surface runoff and surficial aquifer seepage from the upland basin; treated wastewater discharged to the reservoir; and makeup water pumped from the Floridan Aquifer. Water flows out of the reservoir include:

Table 5.1.1-1. Estimation of Evaporation from the Proposed Hardee Power Station Cooling Reservoir at the Average Annual Load Conditions
(Page 1 of 2)

Item	Units	Jan	Feb	Mar	Apr	May	Jun	Jul
Average Air Temperature	Degrees F	61.8	63.1	67.1	72.1	76.6	80.2	81.3
Average Dew Point Temperature	Degrees F	53	54	57	60	67	72	73
Relative Humidity	%	73	72	70	66	72	76	76
Daily Average Wind Speed	mph	7	8	9	8	7	6	6
Wind Speed Function		104.3	114.8	126.7	114.8	104.3	95.2	95.2
Net Short Wave Radiation	BTU/ft ² /day	1,210	1,447	1,754	1,994	2,205	2,124	1,976
Cloud Cover Fraction	%	53	47	48	47	46	58	63
Net Incoming Radiation	BTU/ft ² /day	3,669	3,911	4,335	4,709	5,039	5,133	5,048
Water Vapor Pressure	mm Hg	10.2	10.6	11.8	13.2	16.8	19.9	20.6
Equilibrium Temperature	degrees F	64.2	65.7	68.5	72.2	77.8	87.1	89.0
Saturated Vapor Pressure	mm Hg	15.2	16.1	17.7	20.1	24.2	32.6	34.7
Evaporation at Equilibrium Temperature	Gal per day Inches/month	1,482,870 2.9	1,795,370 3.5	2,125,580 4.2	2,252,370 4.4	2,194,650 4.3	3,437,870 6.8	3,816,850 7.5
Plant Operational Load Factor	%	27	27	27	100	51	27	27
Reservoir Hot Side Temperature	degrees F	84.5	85.9	88.6	96.7	98.8	107.2	109.0
Reservoir Cool Side Temperature	degrees F	64.5	65.9	68.6	76.7	78.8	87.2	89.0
Saturated Vapor Pressure	mm Hg	17.6	18.2	19.7	28.1	29.3	35.8	37.9
Evaporation at Heated Temperature	Gal per day Inches/month	2,194,650 4.3	2,480,870 4.9	2,846,120 5.6	4,863,820 9.6	3,707,180 7.3	4,304,110 8.5	4,683,090 9.2

Note: Maximum delta T across condenser = 20 degrees F
Maximum Circulating Water Pump Rate = 195,000 gallons/minute
Cooling Reservoir Size = 570 acres
Climatological/Meteorological data from the National Oceanic and Atmospheric Administration
Methodology Based on Sonnichsen (1975)

Table 5.1.1-1. Estimation of Evaporation from the Proposed Hardee Power Station Cooling Reservoir at the Average Annual Load Conditions
(Page 2 of 2)

Item	Units	Aug	Sep	Oct	Nov	Dec	Total	Average
Average Air Temperature	Degrees F	81.6	80.2	74.7	67.4	62.7	--	--
Average Dew Point Temperature	Degrees F	73	72	66	58	54	--	--
Relative Humidity	%	75	76	74	72	73	--	--
Daily Average Wind Speed	mph	6	6	7	7	8	--	--
Wind Speed Function		95.2	95.2	104.3	104.3	114.8	--	--
Net Short Wave Radiation	BTU/ft ² /day	1,828	1,672	1,480	1,317	1,110	--	--
Cloud Cover Fraction	%	61	60	47	46	52	--	--
Net Incoming Radiation	BTU/ft ² /day	4,896	4,694	4,267	3,896	3,589	--	--
Water Vapor Pressure	mm Hg	20.6	19.9	16.2	12.3	10.6	--	--
Equilibrium Temperature	degrees F	83.8	80.0	72.6	67.6	63.9	--	--
Saturated Vapor Pressure	mm Hg	29.4	26	20.3	17.1	15.1	--	--
Evaporation at Equilibrium Temperature	Gal per day Inches/month	2,382,150 4.7	1,651,260 3.2	1,215,950 2.4	1,423,560 2.8	1,468,940 2.9	-- 49.6	2,103,950 --
Plant Operational Load Factor	%	27	27	100	51	27	--	43
Reservoir Hot Side Temperature	degrees F	103.9	100.1	97.7	89.3	84.1	--	--
Reservoir Cool Side Temperature	degrees F	83.9	80.1	77.7	69.3	64.1	--	--
Saturated Vapor Pressure	mm Hg	32.4	28.9	29	21.7	17.2	--	--
Evaporation at Heated Temperature	Gal per day Inches/month	3,194,240 6.3	2,436,290 4.8	3,796,150 7.5	2,787,800 5.5	2,154,440 4.2	-- 77.5	3,287,400 --

Note: Maximum delta T across condenser = 20 degrees F
Maximum Circulating Water Pump Rate = 195,000 gallons/minute
Cooling Reservoir Size = 570 acres
Climatological/Meteorological data from the National Oceanic and Atmospheric Administration
Methodology Based on Sonnichsen (1975)

Table 5.1.1-2. Estimation of Evaporation from the Proposed Hardee Power Station Cooling Reservoir at Worst Case Load Conditions (Page 1 of 2)

Item	Units	Jan	Feb	Mar	Apr	May	Jun	Jul
Average Air Temperature	Degrees F	61.8	63.1	67.1	72.1	76.6	80.2	81.3
Average Dew Point Temperature	Degrees F	53	54	57	60	67	72	73
Relative Humidity	%	73	72	70	66	72	76	76
Daily Average Wind Speed	mph	7	8	9	8	7	6	6
Wind Speed Function		104.3	114.8	126.7	114.8	104.3	95.2	95.2
Net Short Wave Radiation	BTU/ft ² /day	1,210	1,447	1,754	1,994	2,205	2,124	1,976
Cloud Cover Fraction	%	53	47	48	47	46	58	63
Net Incoming Radiation	BTU/ft ² /day	3,669	3,911	4,335	4,709	5,039	5,133	5,048
Water Vapor Pressure	mm Hg	10.2	10.6	11.8	13.2	16.8	19.9	20.6
Equilibrium Temperature	degrees F	64.2	65.7	68.5	72.2	77.8	87.1	89.0
Saturated Vapor Pressure	mm Hg	15.2	16.1	17.7	20.1	24.2	32.6	34.7
Evaporation at Equilibrium Temperature	Gal per day Inches/month	1,482,870 2.9	1,795,370 3.5	2,125,580 4.2	2,252,370 4.4	2,194,650 4.3	3,437,870 6.8	3,816,850 7.5
Plant Operational Load Factor	%	100	100	100	100	100	100	100
Reservoir Hot Side Temperature	degrees F	90.7	91.7	92.9	96.7	107.2	110.9	112.6
Reservoir Cool Side Temperature	degrees F	70.7	71.2	72.9	76.7	82.2	90.9	92.6
Saturated Vapor Pressure	mm Hg	22.9	23.4	24.8	28.1	33.5	43.9	46.2
Evaporation at Heated Temperature	Gal per day Inches/month	3,766,490 7.4	4,178,310 8.2	4,683,490 9.2	4,863,820 9.6	4,952,790 9.7	6,496,770 12.8	6,929,890 13.6

Note: Maximum delta T across condenser = 20 degrees F
Maximum Circulating Water Pump Rate = 195,000 gallons/minute
Cooling Reservoir Size = 570 acres
Climatological/Meteorological data from the National Oceanic and Atmospheric Administration
Methodology Based on Sonnichsen (1975)

Table 5.1.1-2. Estimation of Evaporation from the Proposed Hardee Power Station Cooling Reservoir at Worst Case Load Conditions (Page 2 of 2)

Item	Units	Aug	Sep	Oct	Nov	Dec	Total	Average
Average Air Temperature	Degrees F	81.6	80.2	74.7	67.4	62.7	--	--
Average Dew Point Temperature	Degrees F	73	72	66	58	54	--	--
Relative Humidity	%	75	76	74	72	73	--	--
Daily Average Wind Speed	mph	6	6	7	7	8	--	--
Wind Speed Function		95.2	95.2	104.3	104.3	114.8	--	--
Net Short Wave Radiation	BTU/ft2/day	1,828	1,672	1,480	1,317	1,110	--	--
Cloud Cover Fraction	%	61	60	47	46	52	--	--
Net Incoming Radiation	BTU/ft2/day	4,896	4,694	4,267	3,896	3,589	--	--
Water Vapor Pressure	mm Hg	20.6	19.9	16.2	12.3	10.6	--	--
Equilibrium Temperature	degrees F	83.8	80.0	72.6	67.6	63.9	--	--
Saturated Vapor Pressure	mm Hg	29.4	26	20.3	17.1	15.1	--	--
Evaporation at Equilibrium Temperature	Gal per day	2,382,150	1,651,260	1,215,950	1,423,560	1,468,940	--	2,103,950
	Inches/month	4.7	3.2	2.4	2.8	2.9	49.6	--
Plant Operational Load Factor	%	100	100	100	100	100		100
Reservoir Hot Side Temperature	degrees F	108.0	104.7	97.7	93.5	89.7	--	--
Reservoir Cool Side Temperature	degrees F	88.0	84.7	77.7	73.5	69.7	--	--
Saturated Vapor Pressure	mm Hg	40.2	36.3	29	25.2	22.3	--	--
Evaporation at Heated Temperature	Gal per day	5,305,700	4,439,460	3,796,150	3,825,810	3,819,240	--	4,754,830
	Inches/month	10.4	8.7	7.5	7.5	7.5	112.1	--

Note: Maximum delta T across condenser = 20 degrees F

Maximum Circulating Water Pump Rate = 195,000 gallons/minute

Cooling Reservoir = 570 acres

Climatological/Meteorological data from the National Oceanic and Atmospheric Administration

Methodology Based on Sonnichsen (1975)

evaporation; seepage out into the surficial aquifer; leakance down through the confining layers into deeper confined aquifers; and discharges to Payne Creek.

These water flows into and out of the proposed cooling reservoir were estimated using available hydrological data. Rainfall inputs to the reservoir were estimated based on observed monthly rainfall for Wauchula from 1934 through 1984 (51-years). Surface water runoff and surficial aquifer seepage for the reservoir watershed was estimated based on available Payne Creek flows, correlated to long-term (1934 - 1984) streamflow records for the Peace River. The tributary reservoir watershed area was estimated to be 125 ha (310 acres) based on Agrico's proposed reclamation plan and reclamation topography. Long-term reservoir evaporation was estimated on the methodology and data presented in Table 5.1.1-1 for the average annual load conditions. Leakance was estimated based on available regional data, compiled by USGS and phosphate mining operations. Reservoir side seepage losses were estimated based on anticipated reservoir and groundwater levels, the edge and side design and anticipated construction materials.

To facilitate water management during varying climatic conditions, 0.6 m (2 ft) of allowable operational fluctuation in reservoir water level is planned. 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. 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 51-year period, 1934 - 1984, predicted reservoir elevation is presented in Figure 5.1.1-1. This analysis, as presented in Figure 5.1.1-1, shows the cooling reservoir level will be operated below the control/discharge elevation of 37.8 m (124 ft) MSL most of the time.

Based on the long-term modeling analysis, and given a maximum control elevation of 37.8 m (124 ft) MSL and a minimum control elevation of 37.2 m (122 ft) MSL, the cooling reservoir elevation will be typically maintained below 37.5 m (123 ft) MSL. Thus, based on 51 years of long-term analysis, the reservoir will exceed 37.5 m (123 ft) MSL during only 9 periods during the 51-year period of record.

Based on this monthly water balance analysis, the proposed reservoir is estimated to have not discharged during the 51-year period of analysis (see Figure 5.1.1-2). Any discharges which may occur will only occur during extremely wet meteorological conditions.

These extremely limited discharge occurrences are a direct result of: (1) significant reservoir water losses due to evaporation and seepage through the reservoir sides and (2) the positive impact of the 0.6 m (2 ft) of allowable operational fluctuation in reservoir water level; allowing water management and conservation. Average annual evaporative losses are approximately 3.29 million gallons per day (mgd); average side seepage is approximately 0.92 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.

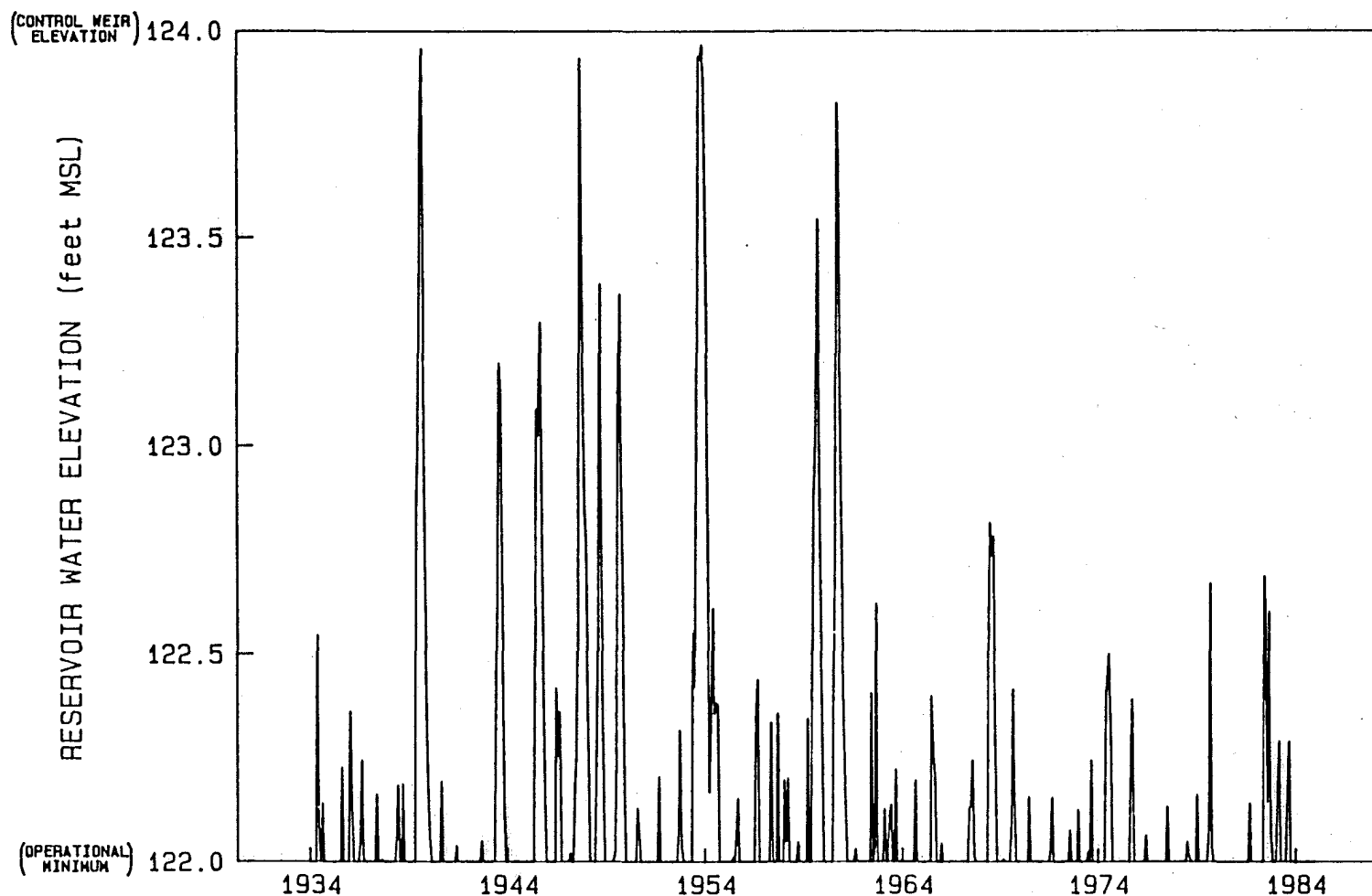


Figure 5.1.1-1 PREDICTED COOLING RESERVOIR ELEVATIONS
(51 YEARS)

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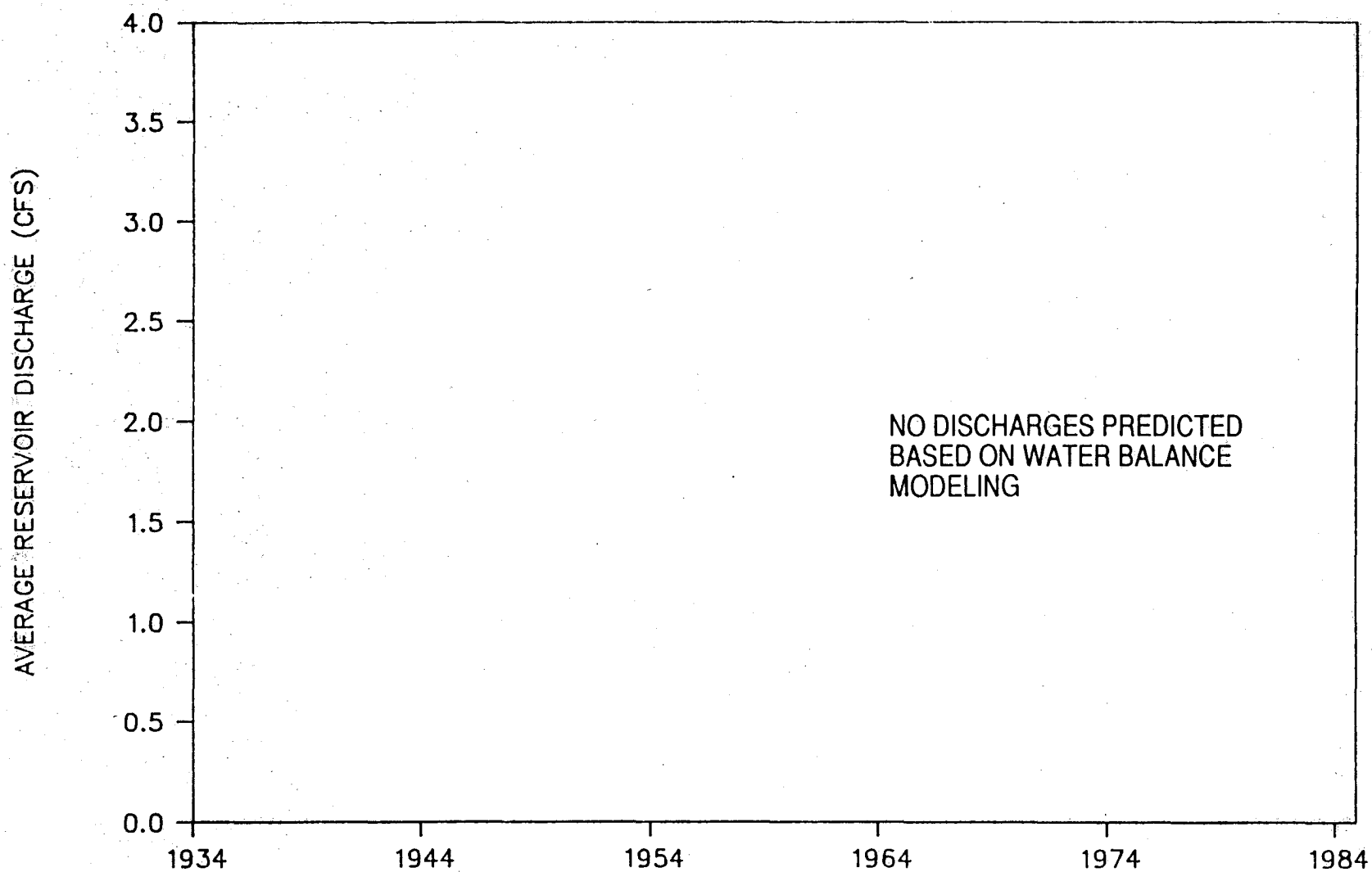


Figure 5.1.1-2 PREDICTED COOLING RESERVOIR DISCHARGES

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To evaluate event specific discharges and the associated dilution, a HEC-1 model analysis was conducted for the Payne Creek and the cooling reservoir.

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 their reclamation plan.

Two different extreme rainfall events were analyzed: the 10-year, 24-hour storm [19 cm (7.5 inches)] and the 25-year, 24-hour storm [23 cm (9.0 inches)]. Model geometry was determined based on available 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 adjust 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 cfs was included, reflecting an average water yield of approximately 0.9 cfs per square mile (based on USGS data for Payne Creek as previously presented in Section 2.3.4).

Based on the prediction and analysis of anticipated reservoir elevations, previously presented in Figure 5.1.1-1, the initial (i.e., pre-event) reservoir elevation was assumed to be 37.5 m (123 ft) MSL. As previously discussed, this condition is predicted to occur only 9 times in 51-years or approximately once every five years. Therefore, the assumed initial reservoir elevation of 37.5 m (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 this HEC-1 analysis, the anticipated Payne Creek runoff hydrograph at the plant site for the 10-year, 24-hour rainfall is presented in

Figure 5.1.1-3. 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 (123 ft) MSL], no discharge from the reservoir is predicted as a result of the 10-year, 24-hour rainfall. The 0.3m (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 (123 ft) MSL to 37.7 m (123.86 ft) MSL or just under the 37.8 m (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 5.1.1-4. 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 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 three days.

Reservoir discharge in response to the 25-year, 24-hour rainfall is presented in Figure 5.1.1-5. During this storm, no reservoir discharge

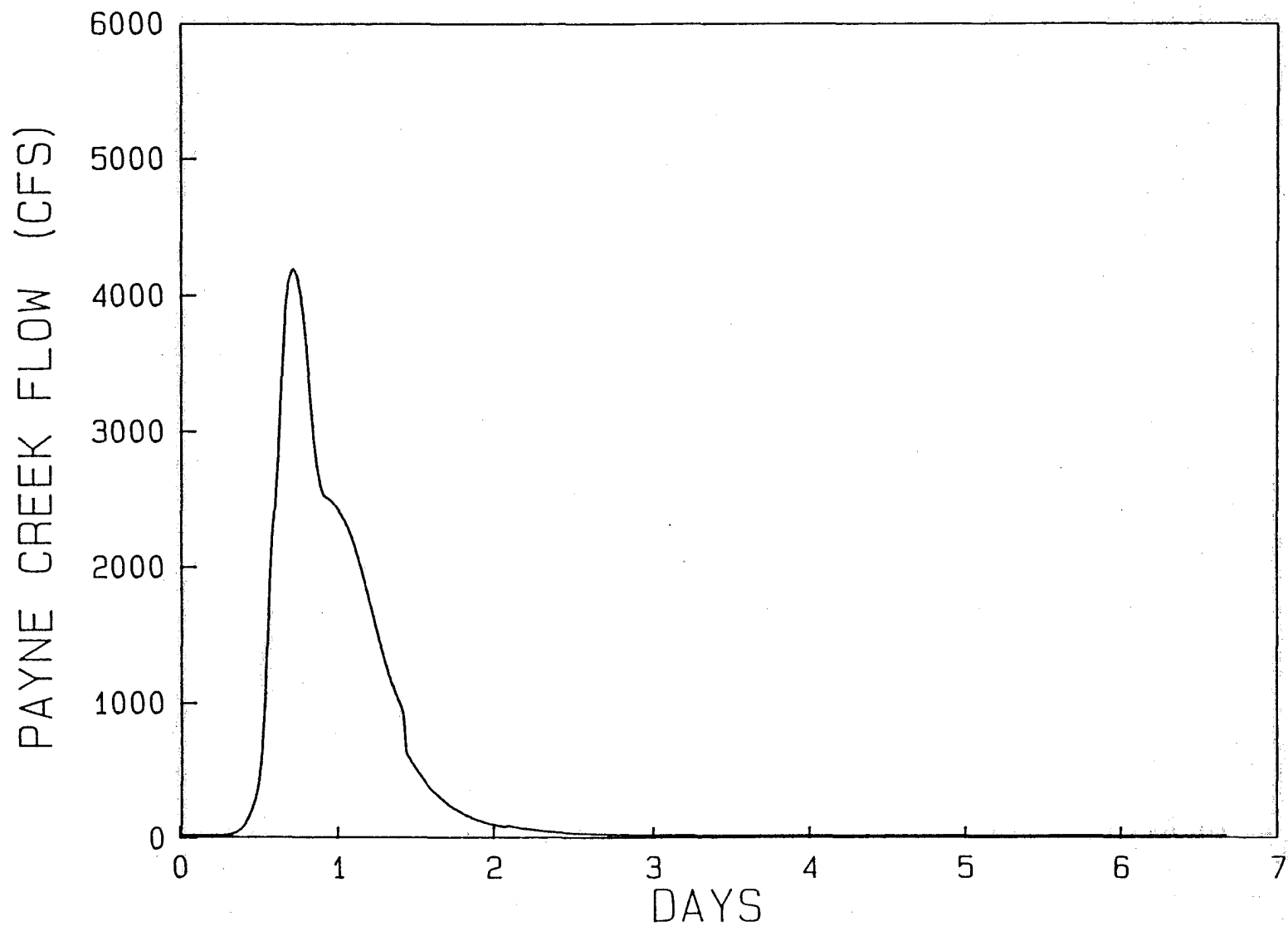


Figure 5.1.1-3 PAYNE CREEK RUNOFF HYDROGRAPH
(10-YEAR, 24-HOUR STORM)

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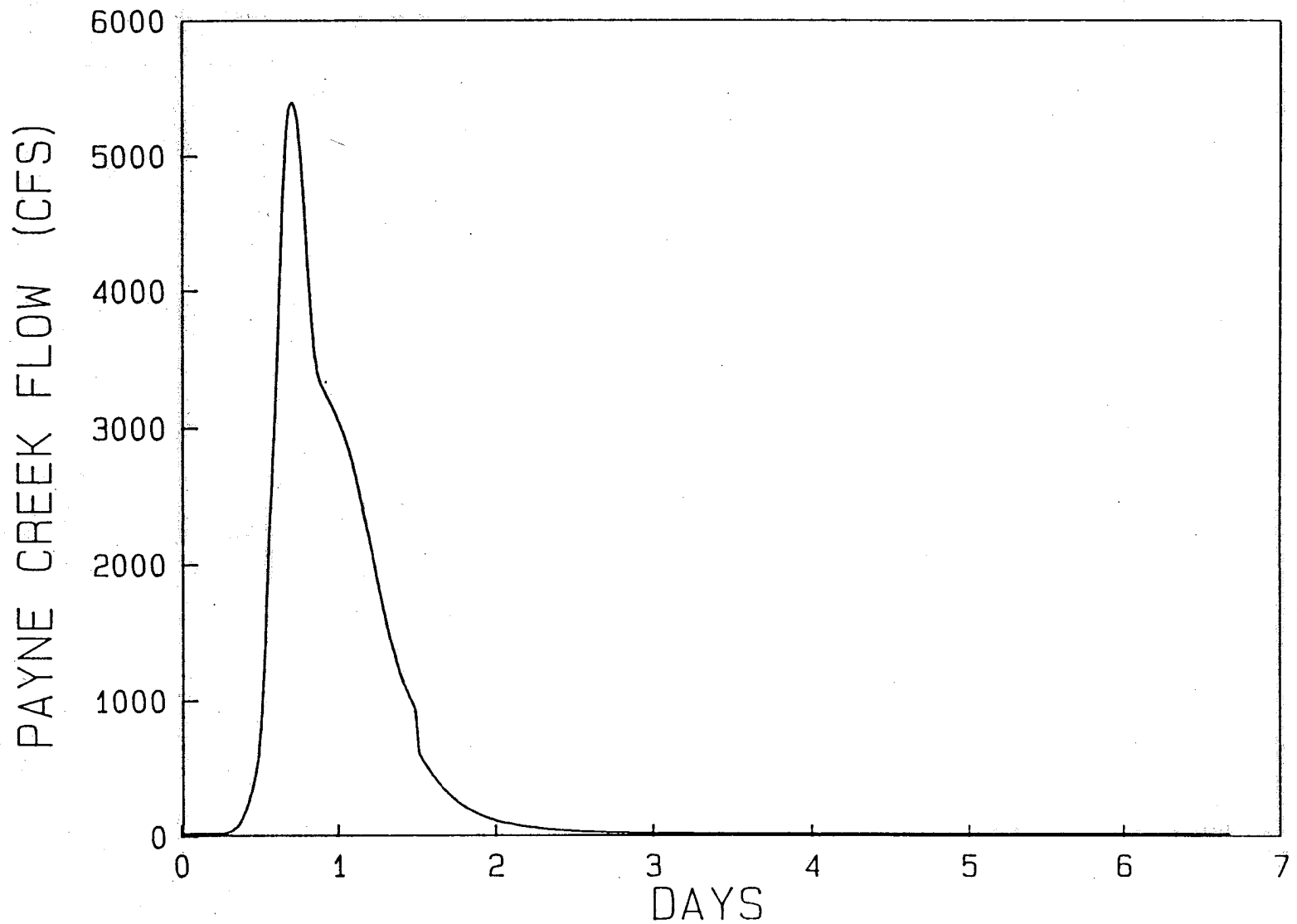


Figure 5.1.1-4 PAYNE CREEK RUNOFF HYDROGRAPH
(25-YEAR, 24-HOUR STORM)

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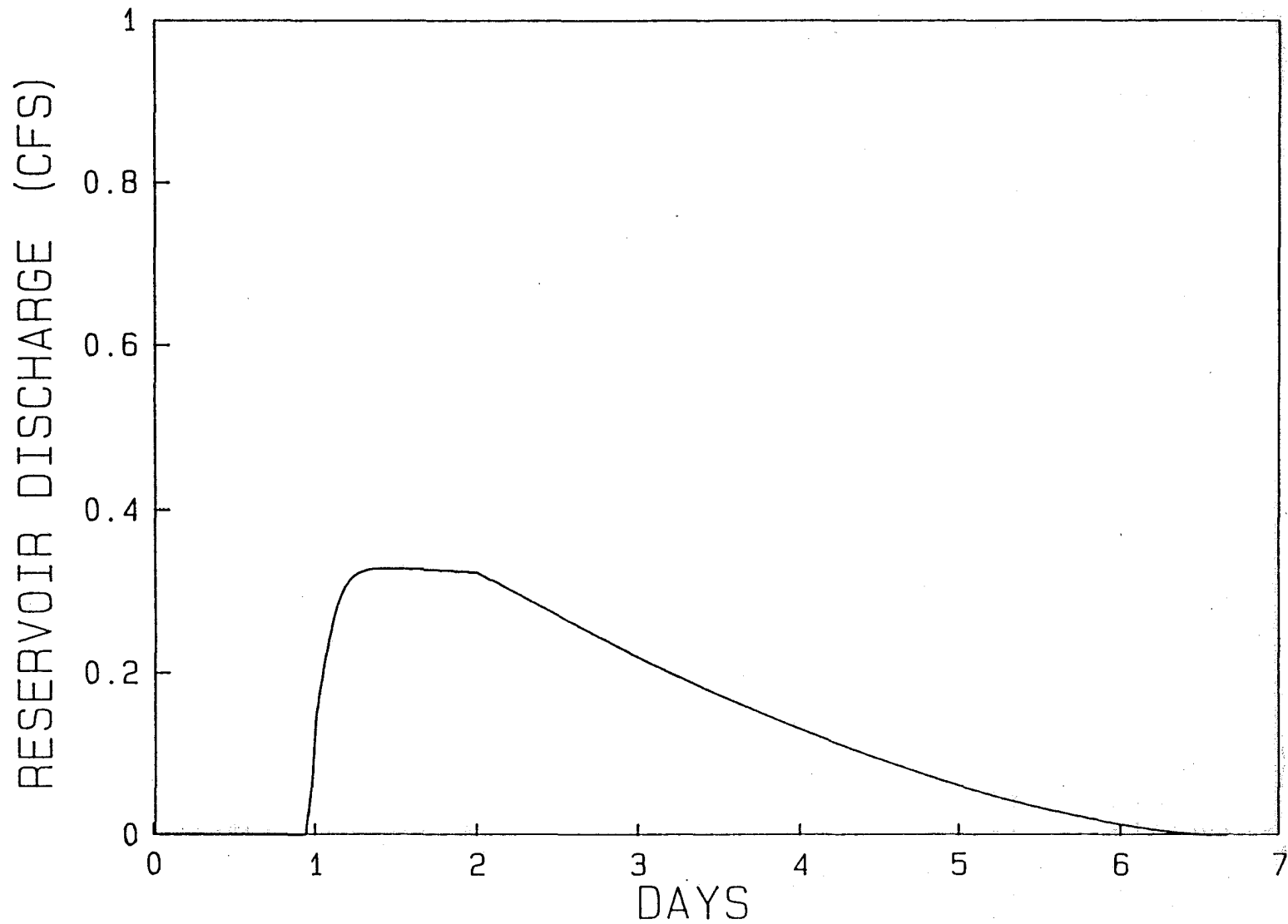


Figure 5.1.1-5 PREDICTED COOLING RESERVOIR DISCHARGE
(25-YEAR, 24-HOUR STORM)

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occurs early during the rainfall; reservoir discharge begins 20 hours after the start of rainfall. Prior to this time, the one foot of storage provided by the reservoir prevents reservoir discharge; discharge only occurs 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 (124.04 ft) MSL or approximately 1.2 m (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 was 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 an average daily deficit of 1,777,000 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 foot sharp crested weir set at 124 feet MSL. Based on these two factors, reservoir discharge will decrease to zero in approximately 6.5 days after the beginning of the 25-year, 24-hour rainfall.

Potential for discharge impacts was evaluated by comparing these Payne Creek and the reservoir discharge hydrographs for the 25-year, 24-hour rainfall. These two hydrographs are superimposed and presented in revised Figure 5.1.1-6. (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, 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 the 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

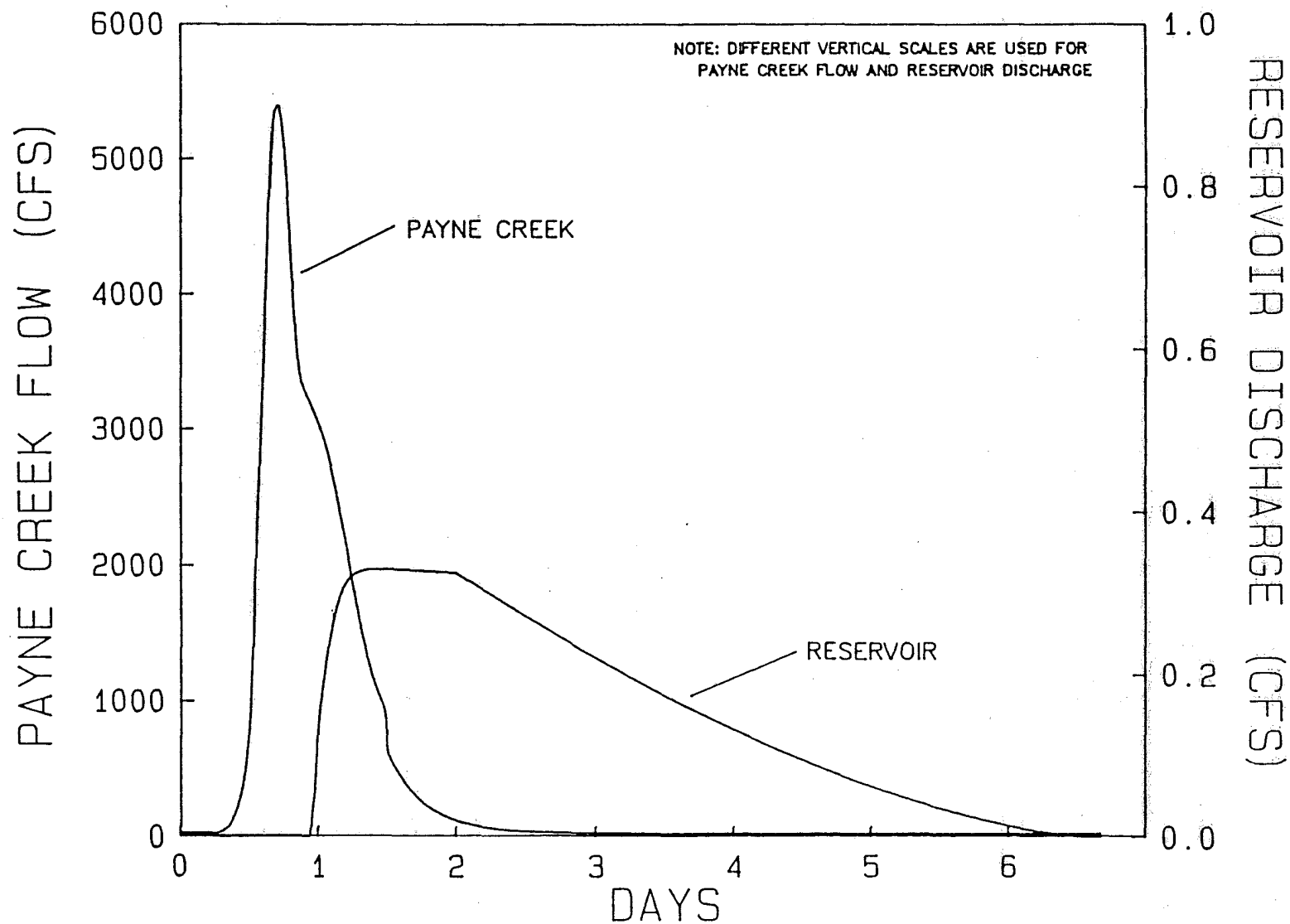


Figure 5.1.1-6 COMPARISON OF PAYNE CREEK FLOW AND RESERVOIR DISCHARGE FOR THE 25-YEAR, 24-HOUR STORM

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corresponds to an 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, 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, worst case (i.e., July) temperature conditions were assumed. For the reservoir discharge conditions, a worst case condition of 35°C (95°F) was assumed, to reflect the worst case load conditions [34°C (93°F)] predicted for July, 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 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 quickly diluted by Payne Creek flows. For example, at a distance of 15 m

Table 5.1.1-3. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Maximum (July) Temperature Conditions

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
86 degrees F											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
95 degrees F											
Mixed Concentration (degrees F) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	95.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0
50	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.1	86.0
100	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
150	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
250	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
300	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
350	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
450	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
500	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
550	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
650	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
700	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
750	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
850	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
900	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
950	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,050	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,100	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,150	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
1,250	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1

(50 ft) below the point of discharge, the maximum plume temperature is 30.1°C (86.2°F), or approximately 0.1°C (0.2°F) above background conditions. At this point, the thermal plume will be virtually indistinguishable from background conditions.

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 27°C (80°F) was assumed, to reflect the predicted October - worst case load conditions (26°C or 78°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 17.8°C (64°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 equilibrium water temperature of 22.6°C (72.6°F) calculated in Table 5.1.1-1; this assumed minimum October stream temperature corresponds with the observed November stream temperature measured in the monitoring program. As such, this combination of maximum reservoir and minimum creek temperatures, and the resulting temperature differential of 8.9°C (16°F), represents 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 15 m (50 ft) below the point of discharge, the maximum plume temperature is 17.9°C (64.3°F), or approximately 0.15°C (0.3°F) above background conditions. At this point, the thermal plume will be virtually indistinguishable from background conditions.

Table 5.1.1-4. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - October Temperature Conditions

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
64 degrees F											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
80 degrees F											
Mixed Concentration (degrees F) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	80.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
50	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.2	64.1
100	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.1
150	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
200	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
250	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
300	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
350	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
400	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
450	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
500	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
550	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
600	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
650	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
700	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
750	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
800	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
850	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
900	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
950	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,000	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,050	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,100	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,150	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,200	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2
1,250	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2

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 to fluctuate the reservoir level to manage available water, discharges from the cooling reservoir will only be required 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 the proposed sheetflow discharge into Payne Creek.

Based on the available data and the impact analysis presented herein, it is anticipated the reservoir discharges of the proposed cooling reservoir will not cause adverse thermal impacts or significantly increase the temperature of Payne Creek, or 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 a minimal mixing zone [e.g., less than 30 m (100 ft)], the proposed infrequent reservoir discharges will meet all requirements of Chapter 17-3.05(1)(d)(i), Florida Administrative Code (F.A.C.).

5.1.2 Effects on Aquatic Life

5.1.2.1 Thermal Impacts

As discussed in Section 5.1.1, minimum or no discharge will occur from the cooling reservoir into Payne Creek. Furthermore, it is anticipated that reservoir discharge will be required only during very intensive, wet periods, such as hurricanes or major frontal storms. 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, on the cold side is conservatively estimated to be 32°C (89°F) during July and the maximum worst case monthly discharge condition is 34°C (93°F) (see Section 5.1.1) during July. 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 [criteria of 33°C (92°F) versus discharge of 34°C (93°F)]. However, applicable temperature criterion will be met outside the requested mixing zone. Based on creek flow and anticipated dilution, the temperature impacts under worst conditions should be localized in the immediate vicinity of the point of discharge. At a distance of 15 m (50 ft), the thermal plume will be virtually indistinguishable from background concentrations. No impacts are anticipated outside the plume (see Section 5.1.1).

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.

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 worst case plant discharge during the summer is 34°C (93°F), a temperature differential of 3.9°C (7°F) may occur.

As discussed in Section 5.1.1 ambient temperature in Payne Creek during the infrequent discharge conditions will be found in 90 percent of the stream's width. Thus the potential for greatest thermal shock will be localized within 15 m (50 ft) downstream from the discharge point (see Table 5.1.1-3). During summer conditions, aquatic organisms will be acclimated to high temperature conditions, thus they may be more tolerant to higher temperatures. Fish can detect and avoid areas of thermal stress. Because of the localized area of impact no thermal blockage will occur. Additional modeling was carried out to evaluate potential worst conditions during the winter months. The assumptions included a reservoir temperature of 27°C (80°F) and a creek temperature of 18°C (64°F). The modeling carried out predicts that the cooling reservoir discharge will be quickly diluted by Payne Creek flows. Within 30 m (100 ft) of the discharge point, the plume temperature is predicted to be 0.1°C (0.2°F) above background (see Table 5.1.1-4). Class III water quality standards will be met at the edge of the mixing zone and applicable water quality criteria will be met within the mixing zone. Based on the worst cases modeled, no impact is anticipated outside the mixing zone.

5.1.3 Biological Effects of Modified Circulation

No water intakes will be placed in the creek and minimal infrequent discharges will take place. 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 of the cooling reservoir and the anticipated retention time in the system, no major changes in water quality are anticipated in Payne Creek, thus no impacts are anticipated on the aquatic communities.

Due to the planned preventive measures, factors such as scouring, erosion and deposition of suspended solids are not expected to cause major effects on Payne Creek. During periods of discharge, the water volume may increase slightly over flood conditions, but it is not anticipated to affect the biological communities.

5.1.4 Effects of Offstream Cooling

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 towards Payne Creek where it is discharged forming a significant component of base flow during periods of low flow.

Operation of the cooling reservoir will do little to modify this general pattern. Some redistribution of flow in the surficial aquifer would be expected during construction but a new pattern will become established after the reservoir is filled. During operation, the reservoir bottom will become less permeable as a result of reactions between the dissolved solids in the reservoir water and the clayey sands. The change in the amount of groundwater/surface water interchange at Payne Creek will be minimal because the downstream face of the berm is a flat slope of 20:1 (horizontal to vertical) and is set back from the Payne Creek Floodplain. These two

features effectively reduce the hydraulic gradients in the vicinity of the reservoir.

5.1.4.2 Fogging

The Tampa area experiences approximately 22 days a year during which fog reduces visibility to 0.4 km (1/4 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.

The cooling reservoir will be constructed on 231 ha (570 acres) of mined lands that will be reclaimed after mining. There are existing ponds owned by CFI that are located adjacent to the project site as well as ponds in the surrounding area. The north and south CFI ponds, the closest to the site, are located on approximately 71 ha (175 acres) immediately to the east of the property site. Because of the number and size of existing phosphate related ponds, the proposed cooling reservoir is not expected to significantly increase the amount of fog that currently exists in the area. Indeed, the proposed cooling reservoir does not utilize forced evaporation, such as cooling towers, and would not produce similar fogging conditions.

5.1.5 Measurement Programs

5.1.5.1 Groundwater Monitoring And Assessment Methodology

MONITORING

Information required by Chapter 17-28.700(6)(d), F.A.C., is provided in this application. As part of operational monitoring, three shallow monitoring wells will be installed: one background well upgradient of the reservoirs; one well at the edge of the zone of discharge; and one well downgradient from the reservoir.

IMPACT ASSESSMENT

Hydrologic models used to describe and predict the movement of groundwaters and dissolved solutes include both analytical and numerical methods. The computer codes used for evaluation of the site are capable of execution on both IBM OS2 or IBM AT microcomputers. Results files are then networked to a DEC VAX minicomputer for contour plotting of results using Intergraph Digital Terrain Modeling software. These programs are summarized as follows:

FDMODEL - a finite difference groundwater model based on the USGS IADI method. This model is used for regional studies and is capable of modeling surface water bodies contained within a phreatic aquifer, confined aquifers, diffuse recharge/leakage, and point sources of recharge and/or leakage. This model is a two-dimensional model and must be used with superposition to evaluate multi-level aquifers.

FEMODEL - a finite element groundwater model based on the Galerkin method. This model is capable of incorporating an irregular spaced grid so that drawdowns near pumping or injection wells can be modeled. Both phreatic and confined aquifers can be modeled with variable pumping schedules and anisotropic transmissibility.

PTRANS - an analytic solute transport model for point discharges made in one-dimensional or two-dimensional saturated porous media. Both momentary

and permanent injections of solute can be evaluated at any time and distance from the source considering dispersion, advection, and reaction.

FETRANS - a finite element solute transport model based on the Galerkin method. This two-dimensional model is capable of incorporating an irregular spaced grid so that irregular shaped areas can be modeled. Nodes can be held at constant or variable concentrations with variable pumping schedules. Transport is allowed by hydrodynamic dispersion and molecular diffusion; retardation can be modeled by reducing the advection velocity.

Parameter evaluation techniques consisted of reviewing pumping test data for the appropriate aquifer and determining geometric mean value for each parameter. Groundwater flow velocities were developed from piezometer slug testing on site (see Section 2.3.2). Transport parameters were derived from the literature.

5.1.5.2 Surface Water Monitoring

The temperature monitoring program is structured to provide the necessary data on operational water temperatures at the site for determination of project compliance and impacts. Temperatures will be recorded during discharge events from the cooling reservoir (RES-1).

The locations of the temperature monitoring station are shown in Figure 5.1.5-1.

5.1.5.3 Biological Monitoring

Because of the lack of anticipated ecological impacts no biological monitoring is proposed at this time.

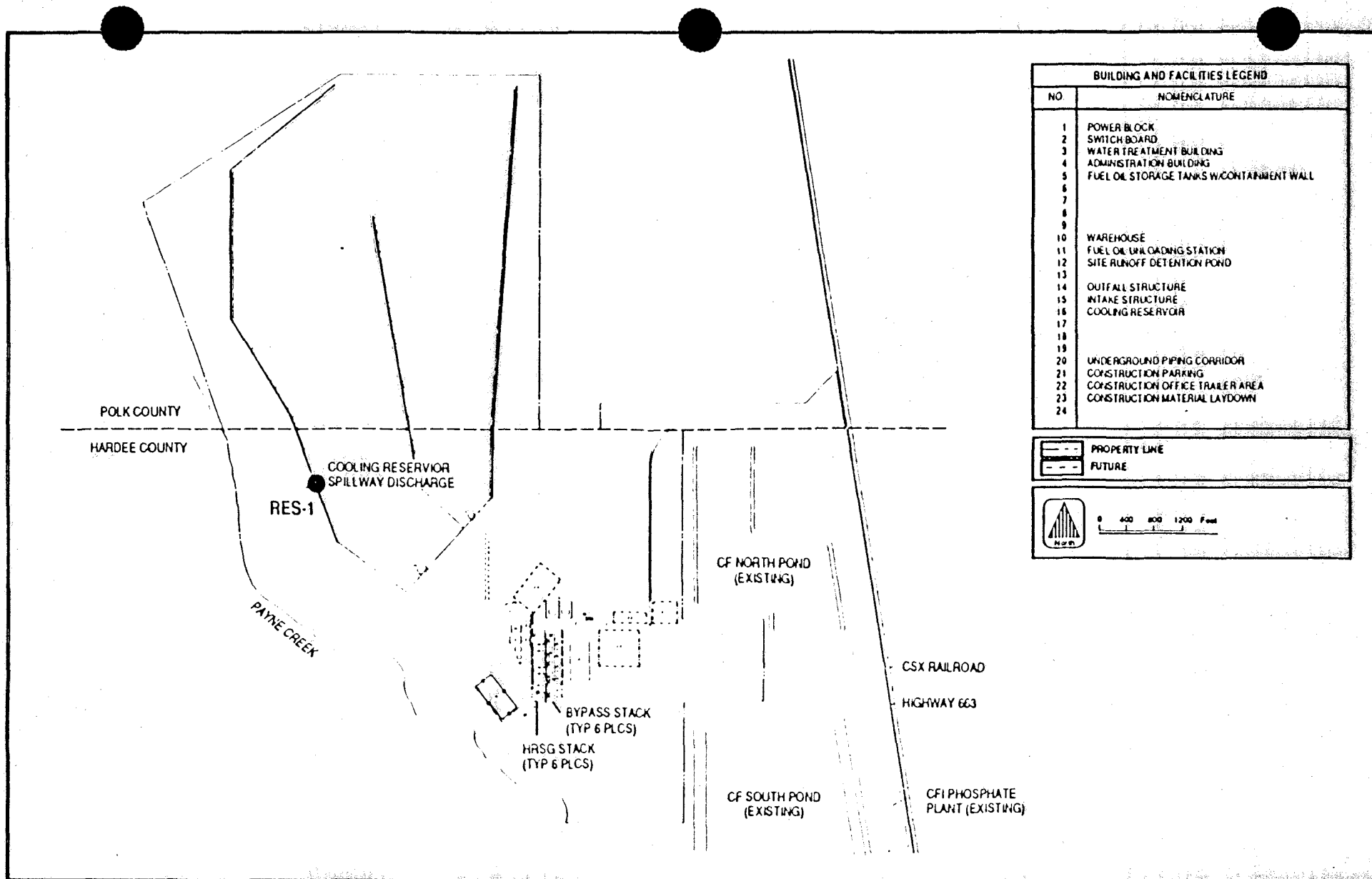


Figure 5.1.5-1 OPERATIONAL MONITORING TEMPERATURE AND
WATER QUALITY STATION LOCATIONS

**Hardee
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5.2 EFFECTS OF CHEMICAL AND BIOCIDES DISCHARGES

5.2.1 Industrial Wastewater Discharges

5.2.1.1 Surface Water Discharges

In addition to the previously described recirculating cooling system discharges, the Hardee Power Station 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.

In general, the proposed plant as designed will treat, retain, and/or recycle wastewater flows to the maximum extent possible and thus minimize offsite surface water discharges, consistent with FDER 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, softener regeneration brines, plant water pretreatment filter backwash and sanitary wastewaters. Anticipated generation rates for these wastewater streams have been previously presented in Figures 3.5-1 through 3.5-3. Given the anticipated fuels (i.e., gas or oil), no fuel or flue gas desulfurization related wastewaters are anticipated.

The proposed plant will incorporate a neutralization basin to treat softener regeneration brines and miscellaneous chemical drain wastes prior to discharge to the cooling reservoir. This proposed neutralization basin will treat these wastes by: pH neutralization; flow equalization; sedimentation; and mixing and dilution. These neutralized and treated wastewaters will be discharged 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 488 cubic meter/day (129,000 gallons/day) for the plant under average annual load conditions. Anticipated low volume wastewater quality has been previously presented in Section 3.5. The cooling reservoir will be neither waters of the State of Florida or waters of the United States and, therefore, no discharge criteria or effluent limitations apply. It is anticipated that plant low volume wastewaters will be treated to levels equivalent to those effluent criteria prior to discharge to the cooling reservoir.

Use of the cooling reservoir to receive these treated plant wastewaters maximizes the retention and recycle of treated wastewater flows and thus minimizes offsite surface water discharges.

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 previously presented in Figure 3.5-3, approximately 16,707 cubic meters/day (4,414,000 gallons per day) of rainfall, upland runoff and surficial groundwater seepage, and Lower Floridan Aquifer makeup water will enter the reservoir. Therefore, plant wastewaters will receive an overall 34:1 dilution within the reservoir prior to release to adjacent surface or subsurface waters as either surface or groundwater discharges.

Based on the anticipated plant and cooling reservoir water balance (previously presented in Figure 3.5-3) 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 reservoir water quality (i.e., after 30 years of facility operation) has been estimated based on a mass balance of all reservoir water

inflows and outflows; typical reservoir water inflow quality and predicted reservoir (discharge) quality are presented in Table 5.2.1-1. FDER 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. First, these reservoir effluent estimates are based on chemical mass balances of water inflow and outflows, and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which may occur in the reservoir. These physio-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.

Table 5.2.1-1. Summary of Estimated Cooling Reservoir and Intake Water Quality Conditions, and Reservoir Quality for the Hardee Power Station (Page 1 of 2)

Parameter	Reservoir Intake/Influent Water Quality					FDER Class III Water Quality Criteria
	Surface Runoff	Surficial Aquifer	Floridan Aquifer Makeup	Treated Neutralization Basin Effluent	Cooling Reservoir Quality ¹	
Calcium, mg/L as CaCO ₃	63	83	113	1130	240	
Magnesium, mg/L as CaCO ₃	39	30	49	490	100	
Sodium, mg/L as CaCO ₃	17	30	37	3050	200	
Potassium, mg/L as CaCO ₃	0	1	8	80	16	
Total Hardness, mg/L as CaCO ₃	102	113	162	1620	340	
Alkalinity, mg/L as CaCO ₃	61	83	160	0	260	>20
Sulfate, mg/L as CaCO ₃	37	30	26	4540	250	
Chloride, mg/L as CaCO ₃	21	34	21	210	50	
Silica, mg/L	5.4	17	27	270	60	
Fluoride, mg/L	1.0	0.57	2.0	20	4.1	10
Cyanide, mg/L	<0.004	<0.004	<0.005	0.05	0.01	0.005
MBAS, mg/L	0.040	0.040	<0.180	1.8	0.36	0.5
Oil and Grease, mg/L	<5	<5	<5	0	<5	5
Turbidity, NTU	1.7	51	14	10	31	29 above Background
pH, units	7	7.5	7.5	6-9	7.5	6.0-8.5
Total Dissolved Solids, mg/L	190	158	342	6860	860	
Specific Conductivity, umhos/cm	173	225	320	12100	1080	1275
Total Kjeldahl Nitrogen, mg/L	0.74	0.14	0.39	3.9	0.9	
Ammonia Nitrogen, mg/L	0.11	0.07	0.20	2.0	0.4	
Unionized Ammonia, mg/L ²	0.001	0.002	0.007	0.022	0.014	0.02
Organic Nitrogen, mg/L	0.65	0.07	0.19	1.9	0.4	
Nitrate+Nitrite-Nitrogen, mg/L	0.50	0.085	0.031	0.3	0.1	
Total Nitrogen, mg/L	1.24	0.24	0.421	4.2	1.0	
Orthophosphorus, mg/L	0.41	0.47	0.20	2.0	0.5	
Total Phosphorus, mg/L	0.44	2.08	0.20	2.0	0.8	
Arsenic, ug/L	<5	<9	<10	0.1	20	50
Barium, ug/L	<10	<10	75	750	150	
Beryllium, ug/L	<3	10	<0.9	9	4.0	1100
Cadmium, ug/L	<0.4	6	<0.7	7	2.6	1.2
Chromium, ug/L	<10	<10	13	130	28	50
Copper, ug/L	7	65	7	70	27	30
Iron, ug/L	293	1700	420	0	980	1000

Table 5.2.1-1. Summary of Estimated Cooling Reservoir and Intake Water Quality Conditions, and Reservoir Quality for the Hardee Power Station (Page 2 of 2)

Parameter	Reservoir Intake/Influent Water Quality					FDER Class III Water Quality Criteria
	Surface Runoff	Surficial Aquifer	Floridan Aquifer Makeup	Treated Neutralization Basin Effluent	Cooling Reservoir Quality ¹	
Lead, ug/L	6.1	<6.7	14	140	29	30
Manganese, ug/L	7.9	28	28	0	47	
Mercury, ug/L	0.24	0.24	<0.2	2	0.5	0.2
Nickel, ug/L	16	16	23	230	49	100
Selenium, ug/L	<5	<5	16	160	32	25
Silver, ug/L	<0.08	<0.08	<0.4	4	0.8	0.07
Strontium, ug/L	100	100	300	3000	610	
Zinc, ug/L	7.4	<50	143	1400	280	1000 30
Alpha, Gross (pC/L)	1.7	30	8.4	84	22.2	15
Radium 226 (pC/L)	0.7	2.0	3.0	30	6.2	5

Note: 1. Reservoir quality estimates are based on mass balances and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which may occur in the reservoir and act to remove material from the water column and thus reduce reservoir concentrations.

2. Unionized ammonia concentrations are based on a worst case reservoir water temperature of 95°F (35°C).

Second, in the determination of neutralization basin 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. 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 physio-chemical and/or biological removal and the assumption of the analytical detection limit as the actual concentration), these estimates are conservative estimates of reservoir discharge quality.

Based on these long-term (30-year) water quality estimates, the cooling reservoir discharges may exceed the applicable FDER Class III water quality criteria for cyanide, turbidity, cadmium, mercury, selenium, silver, gross alpha, and radium.

To assess mixing and dilution of these discharges and to estimate the mixing zone necessary to meet the applicable FDER 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; detailed modeling results are summarized in Appendix 11.5.5. Given the low discharge rates and relatively high streamflow rates, mixing zones lengths are typically very short and mixing zone widths correspondingly narrow. The mixing depth will extend the entire depth of the water column. For cyanide, turbidity, cadmium, mercury, selenium, silver, gross alpha, and radium, the mixing zone length required to meet the applicable FDER Class III water quality criteria is 15 m (50 ft) or less.

Regarding reservoir effluent concentrations of mercury and silver, both have been estimated based on the presumption of these contaminants present in makeup waters at levels equal to the analytical detection limits (as discussed above). Therefore, these mixing zone lengths reflect this conservative effluent estimating methodology. The creek areas within these mixing zone lengths meet all requirements for mixing zones as specified in Chapter 17-4.244, F.A.C.

Given the anticipated reservoir water quality, the treatment provided to plant wastewaters, the infrequent occurrences of discharge (previously 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. 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 FDER 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

Table 5.2.1-2. Summary of Estimated Cooling Reservoir Discharge Water Quality Mixing Zones Necessary to Meet Class III Water Quality Criteria for the Hardee Power Station

Parameter	Payne Creek (Station PC-2) Streamflow Quality	660 MW Plant			FDER Class III Water Quality Criteria
		Cooling Reservoir Effluent Quality	Required Mixing Zone Length (feet)	Required Mixing Zone Width (feet)	
Cyanide, mg/L	<0.004	0.010	<50	<3	0.005
Turbidity, NTU	1.5	31	<50	<3	29 NTU above ambient
Cadmium, ug/L	<0.4	2.6	50	<3	1.2
Mercury ¹ , ug/L	0.1	0.5	50	<3	0.2
Selenium, ug/L	<5	32	<50	<3	25
Silver ² , ug/L	<0.04	0.8	<50	<3	0.07
Alpha, Gross (pC/L)	1.7	22.2	<50	<3	15
Radium 226 (pC/L)	0.5	6.2	<50	<3	5

- Note: 1. No mercury was detected (at a detection limit of 0.2 ug/L) in Payne Creek during high flow conditions; therefore, a stream concentration of half of the detection limit was assumed as a basis for estimating the mixing zone length.
2. No silver was detected (at a detection limit of 0.08 ug/L) in Payne Creek during the field monitoring program; therefore, a stream concentration of half of the detection limit was assumed as a basis for estimating the mixing zone length.

reservoir and the runoff detention pond and as accidental spills from chemical handling and storage areas.

The cooling reservoir will be constructed of in-situ earth materials creating a permeable filter bed. Given the depth of the reservoir, seepage will be primarily to the surficial aquifer. As described in the previous section and in Section 3, the reservoir receives wellwater from the Florida Aquifer as makeup and various treated plant wastewater flows. This results in a minimum of 40:1 dilution for wastewaters prior to any seepage to groundwater. It also results in an increase in concentration of various water quality parameter over time. Design water analysis is shown in Table 3.5.1-1 and anticipated cooling reservoir water quality is given in Table 3.5.1-2.

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 drinking water standards. These parameters (total dissolved solids, chlorides, and sulfates) were chosen because they are widely reported and common problems in drinking water. The relative differences found can also be applied to other parameters. Table 5.2.1-1 provides a summary of background and projected reservoir concentrations after 30 years, and drinking water 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 towards the south-southwest. Both longitudinal and transverse dispersivity

Table 5.2.1-2. Summary of Estimated Cooling Reservoir Discharge Water Quality Mixing Zones Necessary to Meet Class III Water Quality Criteria for the Hardee Power Station

Parameter	Payne Creek (Station PC-2) Streamflow Quality	660 MW Plant			FDER Class III Water Quality Criteria
		Cooling Reservoir Effluent Quality	Required Mixing Zone Length (feet)	Required Mixing Zone Width (feet)	
Cyanide, mg/L	<0.004	0.010	<50	<3	0.005
Turbidity, NTU	1.5	31	<50	<3	29 NTU above ambient
Cadmium, ug/L	<0.4	2.6	50	<3	1.2
Mercury ¹ , ug/L	0.1	0.5	50	<3	0.2
Selenium, ug/L	<5	32	<50	<3	25
Silver ² , ug/L	<0.04	0.8	<50	<3	0.07
Alpha, Gross (pC/L)	1.7	22.2	<50	<3	15
Radium 226 (pC/L)	0.5	6.2	<50	<3	5

- Note: 1. No mercury was detected (at a detection limit of 0.2 ug/L) in Payne Creek during high flow conditions; therefore, a stream concentration of half of the detection limit was assumed as a basis for estimating the mixing zone length.
2. No silver was detected (at a detection limit of 0.08 ug/L) in Payne Creek during the field monitoring program; therefore, a stream concentration of half of the detection limit was assumed as a basis for estimating the mixing zone length.

reservoir and the runoff detention pond and as accidental spills from chemical handling and storage areas.

The cooling reservoir will be constructed of in-situ earth materials creating a permeable filter bed. Given the depth of the reservoir, seepage will be primarily to the surficial aquifer. As described in the previous section and in Section 3, the reservoir receives wellwater from the Florida Aquifer as makeup and various treated plant wastewater flows. This results in a minimum of 34:1 dilution for wastewaters prior to any seepage to groundwater. It also results in an increase in concentration of various water quality parameter over time. Design water analysis is shown in Table 3.5.1-1 and anticipated cooling reservoir water quality is given in Table 3.5.1-2.

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 drinking water standards. These parameters (total dissolved solids, chlorides, and sulfates) were chosen because they are widely reported and common problems in drinking water. The relative differences found can also be applied to other parameters. Table 5.2.1-1 provides a summary of background and projected reservoir concentrations after 30 years, and drinking water 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 towards the south-southwest. Both longitudinal and transverse dispersivity

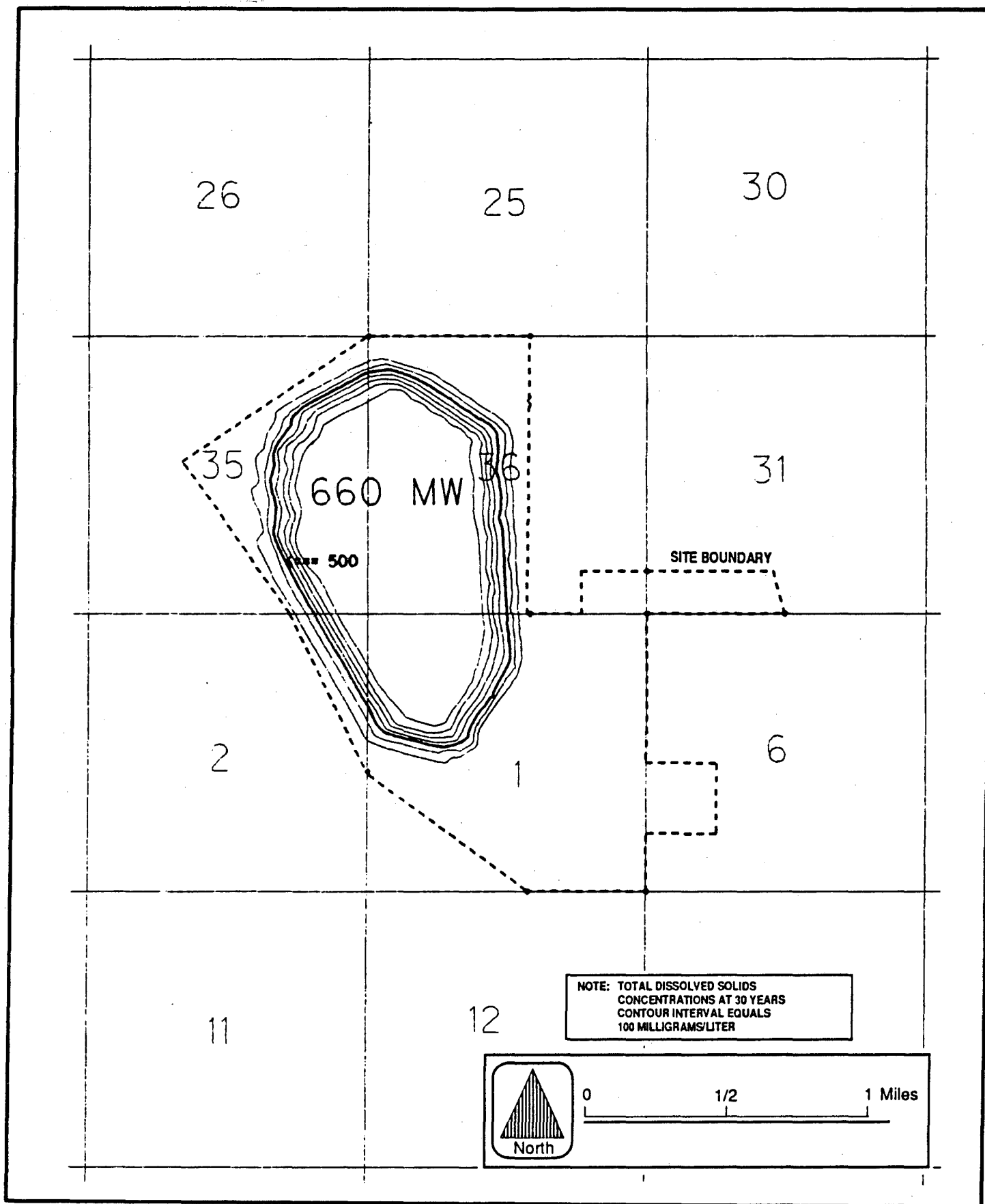


Figure 5.2.1-1 PREDICTED GROUNDWATER DISCHARGE
FOR 660 MW FACILITY

**Hardee
Power Station**

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 250 mg/liter SO_4 isopleth and the 500 mg/liter TDS isopleth will have moved 320 ft from the inside of the cooling reservoir berm (see Figure 5.2.1-2).

At the edge of this zone of discharge, groundwater concentrations will meet the applicable groundwater quality standards. The edge of this zone of discharge is within the Applicant's property and will not threaten or impair any present or future water supplies. This zone of discharge is in compliance with FDER regulations Chapter 17-28.700(3) and (4) F.A.C.

In order to more closely define the movement of the 500 mg/liter TDS contour with time, additional analyses were conducted using a one-dimensional technique and incorporating a retardation factor of 1.0 (no retardation).

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.

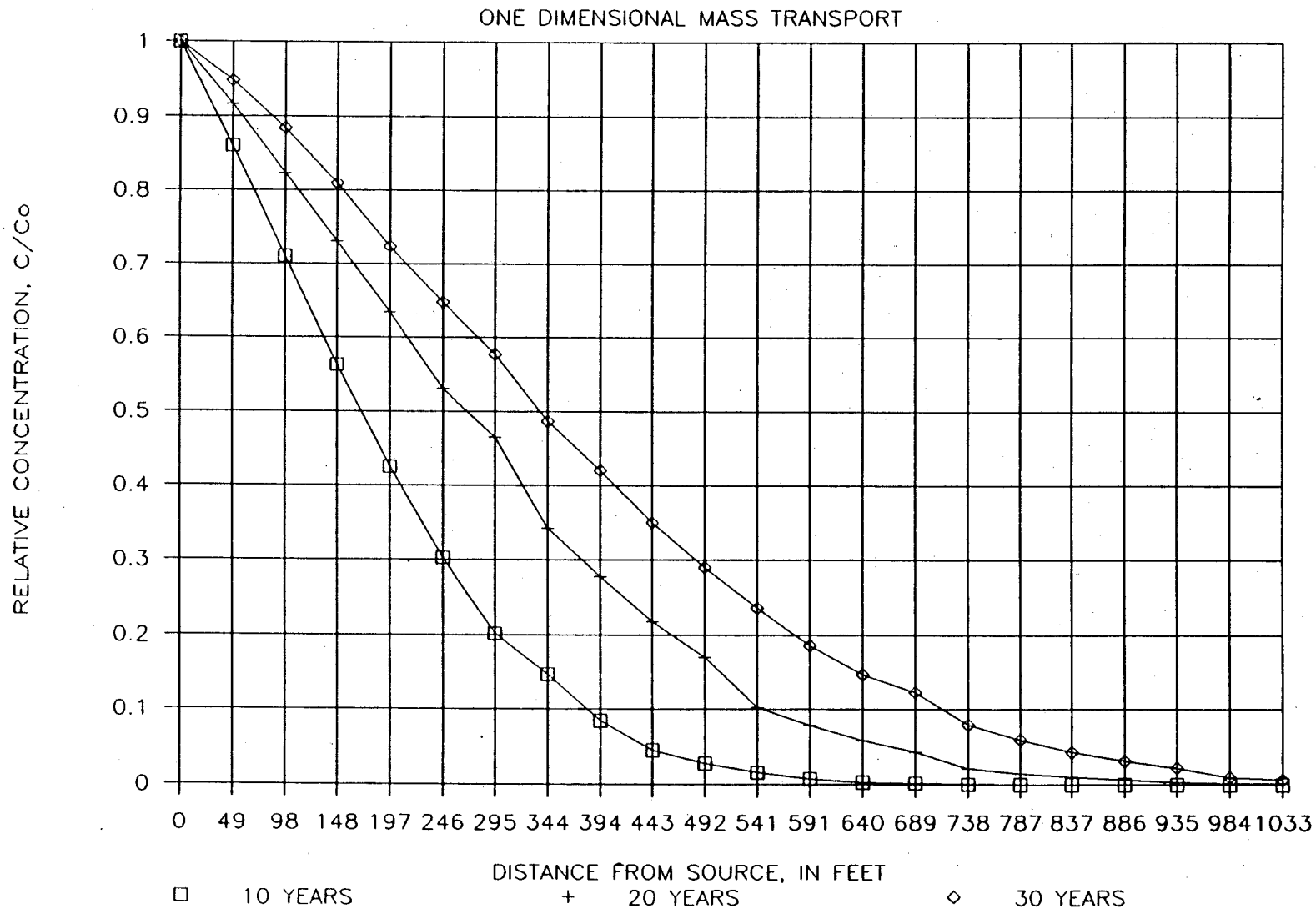


Figure 5.2.1-2 PREDICTED SOLUTE TRANSPORT FROM COOLING RESERVOIR

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5.2.1.3 Biological Impacts

The long-term reservoir water quality was presented on Table 5.2.1-1. For those parameters estimated to exceed the FDER 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 toxic. Transport of reservoir water through ground water will further dilute the water quality concentrations. No biological impacts are anticipated on Payne Creek from this potential impact.

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 outfall should 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 make up water demineralization system will also use chemicals for their processes. Based on the treatment provided prior to discharge to the cooling reservoir, these influents to the cooling reservoir are not expected to be a major toxicity issue. Chemicals used for cleaning of the heat recovery steam generator and feedwater piping will not be stored onsite and will be administered by means of a temporary system. The chemical cleaning contractor will either dispose of the chemical cleaning wastes offsite or treat the wastes in a portable treatment system prior to routing the wastewater to the cooling reservoir.

5.2.1.4 Biological Monitoring

Because of the lack of anticipated ecological impacts no biological monitoring is proposed at this time.

5.2.2 Cooling Tower Blowdown

Cooling towers were not selected as the primary cooling alternative, but are considered a feasible secondary alternative. This cooling alternative is discussed in Chapter 8.

5.2.3 Measurement Programs

5.2.3.1 Assessment Methodology - Surface Water

Methodologies used to determine the impacts for the following monitoring program has been discussed in detail in Sections 5.1.1 and 5.1.2. The following monitoring program has been developed to monitor predicted impacts and, as appropriate, provide a quantitative basis for implementing any necessary project modifications.

5.2.3.2 Physical Chemical Monitoring

The cooling reservoir discharge station, RES-1, will be sampled during any discharge events.

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 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 proposed cooling reservoir is a surface reservoir designed to manage all surface and subsurface water inflows and outflows. The cooling reservoir water balance has been presented in Figures 3.5-1 through 3.5-3. Based on the proposed cooling reservoir design, approximately 1,080,000 gallons/day (or approximately 1.67 cfs) will seep through the reservoir edge bordering Payne Creek and into the groundwater systems adjacent to Payne Creek.

Given the estimated reservoir drainage basin area of 190 ha (470 acres) and the design reservoir area of 231 ha (570 acres), water drainage from approximately 421 ha (1,040 acres) or 14.1 square km (1.6 squares miles) are influenced by the cooling reservoir. Thus, this edge seepage loss is equivalent to a long-term water yield of approximately 1.03 cfs per mile for the influenced drainage basin. This is very similar to the expected long-term water yield from the Payne Creek areas (estimated in Table 2.3.3-2 to be approximately 0.9 cfs mile). Thus, groundwater systems adjacent to Payne Creek and the associated wetlands will receive water quantity subsidies similar to what they currently receive. This water will be uniformly distributed during the year. Whereas this will have little impact to Payne Creek and the adjacent wetlands during wet periods, this will subsidize the Payne Creek floodplain during dry periods. Therefore, the proposed cooling reservoir should not have a significant adverse water quantity impact to the wetlands adjacent to Payne Creek.

5.3.2 Groundwater

5.3.2.1 Consumptive Use Impacts

The main consumptive use impact from the operation of the Hardee Power Station would be the withdrawal of potable water from the Floridan Aquifer. Three 2,000 gpm wells will be required for full build out. A maximum withdrawal rate of 7.7 mgd is proposed for the 660 megawatt plant at the site. Small quantities of water will also be used for drinking water, plant maintenance (cleaning) water, and miscellaneous water use at the plant.

During dry months, groundwater from the Florida Aquifer will be needed to augment the cooling water reservoir. Preliminary design of the wellfield for such a withdrawal is based upon 3 deep wells screened in the Avon Park Dolomite each with a capacity of 2,000 gpm. These 3 wells would be spaced a minimum of 30 m (100 ft) apart to provide adequate redundancy in cases of accidental loss of a well or unscheduled well maintenance. Multiple wells also provide better efficiency for wells and pumps and operate within their performance envelope.

The parameters listed in Table 5.3.2-1 were used to evaluate drawdown at the well and site boundary. These parameters were used with the modified Thesis equation and the law of superposition to determine the drawdown at various distances from the pumping wells.

Worst case water consumption scenarios suggest that a peak short-term water withdrawal of 15.4 mgd may be required for the 660 MW plant. For a dry period lasting 120 days (November through February), drawdowns around the two pumping wells were calculated using a two-dimensional finite element model. Results are shown in Figure 5.3.2-1. As can be seen from these results, even peak short term withdrawals will not produce excessive drawdown at the site boundaries so long as the wellfield located more than 122 m (400 ft) away from the site boundaries. Given the proposed location, 427 m (1,400 ft) from the nearest site boundary a maximum drawdown of <0.9 m (<3 ft) at the boundary is predicted.

5.3.2.2 Recharge of Water Table Aquifer

The presence of the cooling water reservoir results in increased percolation of surface water into the ground water system due to the hydraulic head in the reservoir. Preliminary water budgets which considered monthly precipitation and evaporation rates suggest that as much as 10 cm (4 inches) of recharge to the surficial aquifer would occur per month through the bottom of the 231 ha (570 acre) cooling water reservoir. Both finite difference and finite element computer models indicate that the groundwater table would mound up during each dry season, thereby recharging the intermediate aquifer system on a long-term basis.

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

Table 5.3.2-1. Average Preliminary Deep Well Aquifer Parameters
for Hardee Power Station (Avon Park Dolomite)

Aquifer	Floridan
Transmissivity	1,000,000 GPD/FT
Storativity	0.005
Depth to Static Water	85 FT
Proposed Plant Grade	117 FT

Source: Hydrology of the South Rockland Area and Vicinity-Polk and Hardee Counties. Report prepared by Dames & Moore for Agrico Chemical Company, 1979.

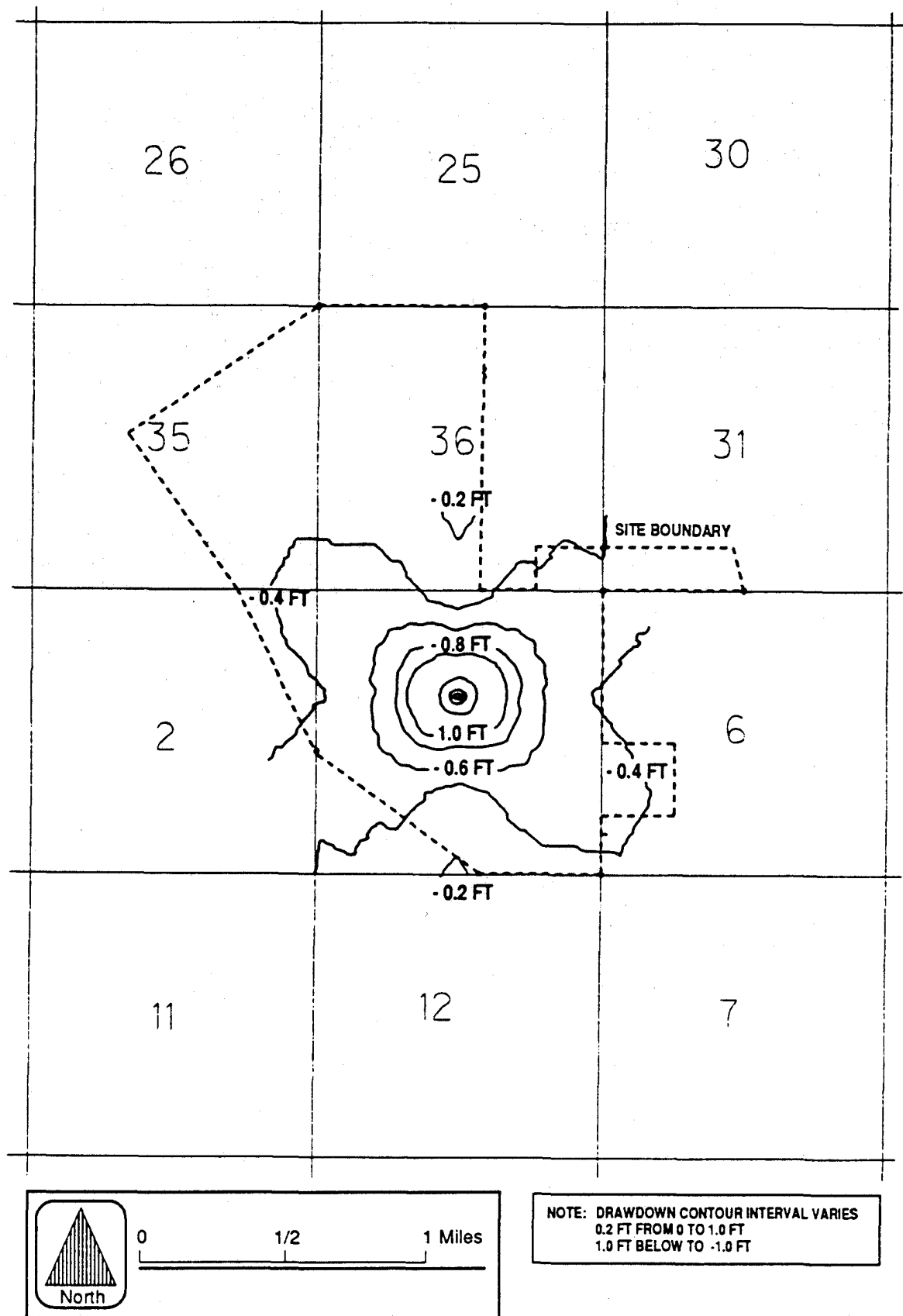


Figure 5.3.2-1 PREDICTED GROUNDWATER DRAWDOWN

**Hardee
Power Station**

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 and Florida Department of Environmental Regulation stormwater quantity and quality control requirements. Given the site topography, plant runoff will be discharged, after treatment, to Payne Creek. Details regarding this stormwater system design are presented in Appendix 11.5.6.

Given the anticipated fuels (i.e., gas or oil), no fuel related stormwaters (e.g., coal pile runoff) are anticipated. 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

5.3.5.1 Assessment Methodology - Surface Water

Methodologies used to determine the impacts are discussed in detail in Section 5.3.1.

5.3.5.2 Physical Chemical Monitoring

See Section 5.2.3.2.

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 Solid Waste

Because of the type of fuels (e.g., natural gas and fuel oil) for the Hardee Power Station, only small quantities of solid wastes will be generated at the plant (see Section 3.7.1). Solid wastes will be limited to general trash, sanitary waste treatment sludge, and infrequent replacement of demineralized resins. The sanitary waste sludge will be disposed of off site by a contractor. Other wastes will be disposed of by a trash disposal contractor to an available sanitary landfill. There will be no on site

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 Power Station are waste streams produced during regeneration of the demineralizers (see Section 3.7.2). These waste streams will be neutralized in a neutralization basin and become non-hazardous.

Acid cleaning wastes (see Section 3.6.5) will either be disposed of off site at a licensed facility or neutralized in a portable treatment system prior to routing the wastewater to the cooling reservoir.

No on 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, thus accomplishing 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

5.6.1.1 Analysis Approach and Assumptions

GENERAL MODELING APPROACH

The general modeling approach followed USEPA and FDER 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 can be compared to the applicable standard when 5 years of meteorological data are 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 to reduce the computation time required to perform the modeling analysis. The basic difference between the two phases is the receptor grid used when predicting concentrations, the number of emission points, and the number of meteorological periods evaluated. In general, concentrations for the screening phase were predicted using a coarse receptor grid, limited number of major sources, and a 5-year meteorological record.

After a final list of highest, second-highest short-term concentrations was 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, second-highest concentration from the screening phase was

produced. The air dispersion model was executed for the meteorological periods during which both the highest and second-highest concentrations were predicted to occur at that receptor, based on the screening phase results. 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.

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 USEPA 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 50 km of the proposed facility's site, the terrain has maximum elevations of 15 m (50 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 (ISCST) dispersion model (USEPA, 1988a) was used to evaluate the pollutant emissions from proposed facility and existing major facilities. This model is contained in USEPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (USEPA, 1988b). The ISCST model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights. Major features of the ISCST model are presented in Table 5.6.1-1.

The ISCST 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

Table 5.6.1-1. Major Features of the ISCST Model

ISCST Model Features

- o Polar or Cartesian coordinate systems for receptor locations
- o Rural or one of three urban options which affect wind speed profile exponent, dispersion rates, and mixing height calculations
- o Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1972, and 1975)
- o Procedures suggested by Huber and Snyder (1976); Huber (1977); and Schulmann and Hanna (1986) and Schulmann and Scire (1980) for evaluating building wake effects
- o Procedures suggested by Briggs (1974) for evaluating stack-tip downwash
- o Separation of multiple point sources
- o Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
- o Capability of simulating point, line, volume and area sources
- o Capability to calculate dry deposition
- o Variation with height of wind speed (wind speed-profile exponent law)
- o Concentration estimates for 1-hour to annual average
- o Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm
- o Receptors located above local terrain, i.e., "flagpole" receptors
- o Consideration of time-dependent exponential decay of pollutants
- o The method of Pasquill (1976) to account for buoyancy-induced dispersion
- o A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)
- o Procedure for calm-wind processing

Source: USEPA, 1988a

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% 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 FDER, the rural mode was selected because of the lack of residential, industrial and commercial development within 3 km the proposed facility site.

In this analysis, the USEPA regulatory options were used to address maximum impacts. These options included:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients, and
6. Calm wind processing.

METEOROLOGICAL DATA

Meteorological data used in the ISCST 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, FDER 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 method used to process the data discussed in the PSD Permit Application.

EMISSION INVENTORY

Preliminary modeling indicated that the proposed facility's impacts could be above the significant impact levels for SO₂, NO₂ and PM at distances of approximately 50, 50, and 10 km, respectively, from the facility.

Therefore, the emission inventories for those pollutants were developed from available databases, such as FDER's Air Pollution Inventory System (APIS) and previous studies performed by KBN. A detailed discussion about the development of the emission inventory is presented in the PSD Permit Application.

In order to reduce the model computation time but effectively model sources that are most likely to interact with the proposed facility, modeling was performed in screening and refined phases. In the screening phase, only those sources with emissions above a certain threshold, based on the source's distance from the proposed facility, were modeled.

Summaries of the amount of modeled emissions in the screening phase compared to the refined phase by distance categories from the proposed facility are given in Tables 5.6.1-2 through 5.6.1-4. For the SO₂ modeling analysis, approximately 98% of the SO₂ emissions in the refined phase were modeled in the screening phase. As indicated, most of the emissions occur beyond 30 km from the proposed facility.

For the NO₂ modeling analysis, approximately 98% of the NO₂ emissions in the refined analysis were modeled in the screening phase. Similar to the SO₂ emission sources, most of the NO₂ emissions occur beyond 30 km from the proposed facility.

For the PM modeling analysis, approximately 75% of the PM emissions were modeled in the screening phase. There were no emission sources within 10 km

Table 5.6.1-2. Summary of Modeled SO₂ Emissions Used for Screening and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		Emissions (TPY)	Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	6,005	5,730	95.4
15 - 20	> 1000	5,216	4,647	89.1
20 - 25	> 1500	15,876	13,943	87.8
25 - 30	> 2000	21,025	16,629	79.1
30 - 50	> 3000	501,286	499,711	99.7
0 - 50		549,408	540,660	98.4

Table 5.6.1-3. Summary of Modeled NO₂ Emissions Used for Screening and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		Emissions (TPY)	Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	0	0	--
15 - 20	> 1000	610	0	0.0
20 - 25	> 1500	0	0	--
25 - 30	> 2000	0	0	--
30 - 50	> 3000	111,768	110,386	98.8
0 - 50		112,378	110,386	98.2

Table 5.6.1-4. Summary of Modeled PM Emissions Used for Screening and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		Emissions (TPY)	Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	1,705	1,705	100.0
15 - 20	> 1000	1,550	0	0.0
20 - 25	> 1500	3,136	0	0.0
25 - 30	> 2000	3,875	0	0.0
30 - 50	> 3000	32,295	29,982	92.8
0 - 50		42,561	31,687	74.5

of the proposed facility (the significant impact distance) with most emissions occurring beyond 30 km from the proposed facility.

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 areas in which maximum concentrations would be expected due to the proposed unit. A total of 344 receptors were located in a radial grid centered on the proposed facility. The grid extended from the plant property out to 6.0 km from the plant site. The specific location of each receptor is 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 9 radials, at 2 degree increments, centered on the radial which the maximum concentration was produced.

To ensure that a valid highest, second-highest concentration was calculated, concentrations were predicted for the refined grid for the periods that produced both the highest and second-highest concentration from the screening receptor grid.

Refined modeling analysis was performed for the annual average period but used a different approach than that used for short-term average periods. Because the spatial distributions of annual average concentrations are not expected to vary significantly from those produced from the screening analysis, concentrations were calculated at the receptor which produced the highest annual concentration in the screening analysis. For this analysis,

concentrations were calculated for the entire year using the refined emission inventory.

BACKGROUND CONCENTRATIONS

To estimate total air quality concentrations, a background concentration must be added to the modeling results. The background concentration is considered to be the air quality concentration contributed by sources not included in the modeling evaluation.

The background concentrations for the modeling analysis were presented in Section 2.3.7.2. Based on this analysis, the background 3-, 24-hour, and annual average SO₂ concentrations are assumed to be 267, 51, and 11 ug/m³, respectively. For NO₂ concentrations, the annual average background concentration is assumed to be 45 ug/m³. For PM concentrations, the background 24-hour and annual average concentrations are assumed to be 91 and 45 ug/m³, respectively. These background levels were added to model-predicted concentrations to estimate total air quality levels for comparison to AAQS.

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 must be 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 are input to the model which are used to modify the dispersion parameters.

The building dimensions considered for the proposed facility are presented in Table 5.6.1-5. In these analyses, building downwash conditions were assumed to occur for all directions around each stack although these conditions may not occur for certain directions. Based on sensitivity

Table 5.6.1-5. Structure Dimensions* and GEP Stack Height Calculations* for the Hardee Power Station

Structure	Building Dimensions (ft)				GEP Stack Height
	Height	Length	Width	Maximum Projected Width	
HRSG*	45	50	25	56	113
Combustion Turbine Enclosure**	40	1175	75	1178	100

Note: These structure dimensions produced the worst case impacts for an HRSG stack height of 75 feet.

* Used in modeling analyses.

** Based on a single structure that encloses all the combustion turbines associated with a 660 MW plant.

analyses performed for the proposed facility, higher concentrations were produced with the building dimension using a height of 45 ft which also produced the highest GEP height. Therefore, the building dimensions associated with this height were used in performing subsequent model calculations.

5.6.1.2 Model Results

PROPOSED FACILITY ONLY

For the screening modeling analysis, a summary of the maximum SO₂, NO₂, PM, CO, Be, and Hg concentrations due to the proposed facility is presented in Table 5.6.1-6. These results are presented for a range of operating conditions that could produce high impacts by modeling each unit with the maximum emission rate or minimum flow rate. The conditions were as follows:

1. Case 1: Maximum emissions at 0°C (32°F);
2. Case 2: Maximum emissions at 35°C (95°F);
3. Case 3: Minimum flow rate at 0°C (32°F);
4. Case 4: Minimum flow rate at 35°C (95°F).

As indicated in Table 5.6.1-6, the concentrations are predicted for the operating conditions with minimum flow rates (Cases 3 and 4). It should be noted that the modeled SO₂ emissions were specific for each case because the maximum predicted impacts were relatively high when compared to the PSD Class II increments. For the other pollutants, the emissions from Case 1, which had the highest emissions among the cases, were modeled for all four cases. Therefore, for pollutants other than SO₂ the maximum impacts predicted for Cases 2 through 4 are conservative because lower impacts would be predicted if the true emissions associated with each case were modeled.

The maximum predicted 3-, 24-hour and annual SO₂ concentrations are 424, 62.5 and 6.7 ug/m³, 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

Table 5.6.1-6. Maximum Concentrations Predicted for the Combined Cycle Plant (660 MW)
for 4 Operating Designs in the Screening Modeling Analysis

Pollutant	Averaging Period	Maximum Concentrations (ug/m ³)				Air Quality Requirements (ug/m ³)	
		Maximum Emissions		Minimum Flow Rate		De Minimis Levels	PSD Class II Increment
		32°F Case 1	95°F Case 2	32°F Case 3	95°F Case 4		
SO ₂	3-hour	196	281	359	424	NA	512
	24-hour	54.7	53.8	62.5	60.0	13	91
	Annual	5.8	5.7	6.7	6.5	NA	20
PM(TSP)	24-hour	5.1	5.9	6.4	7.5	10	37
	Annual	0.54	0.63	0.68	0.82	NA	19
PM(PM10)	24-hour	5.1	5.9	6.4	7.5	10	NA
	Annual	0.54	0.63	0.68	0.82	NA	NA
NO ₂	Annual	2.9	3.3	3.6	4.3	14	25
CO	1-hour	99.0	112.0	130.3	178.5	NA	NA
	8-hour	21.4	24.2	26.1	38.0	575	NA
Be	24-hour	0.0002	0.0003	0.0003	0.0004	0.001	NA
Hg	24-hour	0.0011	0.0012	0.0013	0.0016	0.25	NA

NA = Not applicable

* Modeled as 3 stacks, each separated by 100 m.

data collected by the FDER are being used in this application to satisfy preconstruction monitoring requirements and to establish background concentrations.

The maximum predicted 24-hour and annual average PM concentrations are 7.5 and 0.82 $\mu\text{g}/\text{m}^3$, respectively. Because the maximum 24-hour concentration is below the de minimis monitoring level, preconstruction monitoring is not required for the permit application.

The maximum predicted annual NO_2 concentration is 4.6 $\mu\text{g}/\text{m}^3$, which is below the de minimis monitoring level. Similar to the PM concentrations, preconstruction monitoring requirements is not required for the permit application.

The maximum predicted 1- and 8-hour average CO concentrations are 179 and 38.0 $\mu\text{g}/\text{m}^3$, respectively, which 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 Be and Hg concentrations are 0.0004 and 0.0016 $\mu\text{g}/\text{m}^3$, respectively, which are less than the de minimis monitoring levels. Therefore, preconstruction monitoring is not required for these pollutants.

PSD CLASS II INCREMENT CONSUMPTION

For the refined modeling analysis, summaries of the maximum SO_2 , PM, and NO_2 concentrations predicted for comparison to the PSD Class II increments are presented in Table 5.6.1-7. These results show that maximum concentrations due to all PSD sources are less than the maximum allowable PSD Class II increments for all averaging periods and pollutants.

Table 5.6.1-7. Maximum Predicted SO₂, PM, and NO₂ Concentrations
for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (ug/m ³)	PSD Class II Increment (ug/m ³)
<u>SO₂ Concentrations</u>		
3-Hour*	424	512 ⁺
24-Hour*	66.0	91 ⁺
Annual	81.0	20
<u>PM (TSP) Concentrations</u>		
24-Hour*	8.0	37 ⁺
Annual	0.9	19
<u>NO₂ Concentrations</u>		
Annual	4.6	25

* Highest, second-highest concentrations predicted for this averaging period.

⁺ Not to be exceeded more than once per year.

The maximum 3-hour average SO₂ PSD increment consumption from the refined analysis is predicted to be 424 ug/m³, which is 83% of the maximum allowable PSD Class II increment of 512 ug/m³, not to be exceeded more than once per year.

The maximum 24-hour average SO₂ PSD increment consumption from the refined analysis is predicted to be 66.0 ug/m³, which is 73% of the maximum allowable PSD Class II increment of 91 ug/m³, not to be exceeded more than once per year.

The maximum annual average SO₂ PSD increment consumption from the refined analysis is predicted to be 8.1 ug/m³, which is 41% of the maximum allowable PSD Class II increment of 20 ug/m³.

The maximum 24-hour average TSP PSD increment consumption from the refined analysis is predicted to be 8.0 ug/m³, which is 22% of the maximum allowable PSD Class II increment of 37 ug/m³, not to be exceeded more than once per year.

The maximum annual average TSP PSD increment consumption from the refined analysis is predicted to be 0.9 ug/m³, which is 6% of the maximum allowable PSD Class II increment of 19 ug/m³.

The maximum annual average NO₂ PSD increment consumption from the refined analysis is predicted to be 4.6 ug/m³, which is 17% of the maximum allowable PSD Class II increment of 25 ug/m³.

TOTAL AIR QUALITY IMPACT

For the refined modeling analysis, summaries of the maximum total SO₂, PM, and NO₂ concentrations predicted for comparison to the AAQS are presented in Table 5.6.1-8.

Table 5.6.1-8. Maximum Predicted SO₂, PM and NO₂ Concentrations from the Hardee Power Station for Comparison to AAQS

Averaging	Maximum Concentration (ug/m ³)	AAQS (ug/m ³)
<u>SO₂ Concentrations</u>		
3-Hour*	691	1300 ⁺
24-Hour*	169	260 ⁺
Annual	30.3	60
<u>*PM (TSP) Concentrations</u>		
24-Hour*	112	150 ⁺
Annual	48.6	50
<u>*NO₂ Concentrations</u>		
Annual	50.6	100

* Highest, second-highest concentration for this average period.

+ Not to be exceeded more than once per year.

The total concentrations are determined from the impacts of the modeled sources added to the background concentration determined from monitoring data. These results show that the maximum SO₂, PM, and NO₂ concentrations due to all sources are below the AAQS for all averaging periods.

The maximum 3-hour average SO₂ concentration due to all sources from the refined analysis is predicted to be 691 ug/m³, which is 53% of the AAQS of 1300 ug/m³, not to be exceeded more than once per year. The proposed facility contributed 61% to this maximum 3-hour average concentration.

The maximum 24-hour average SO₂ concentration due to all sources is predicted to be 169 ug/m³, which is 65% of the AAQS of 260 ug/m³, not to be exceeded more than once per year. The proposed facility contributed 29% to this maximum 24-hour concentration.

The maximum annual average SO₂ concentration due to all sources is predicted to be 30.3 ug/m³, which is 51% of the AAQS of 60 ug/m³. The proposed facility contributed 20% to the maximum concentration.

The maximum 24-hour PM concentration due to all sources is predicted to be 112 ug/m³, which is 75% of the AAQS of 150 ug/m³. The proposed facility did not contribute to this maximum concentration.

The maximum annual average concentration due to all sources is predicted to be 48.6 ug/m³, which is 97% of the AAQS of 50 ug/m³. The proposed facility contributed less than 2% to the maximum concentration.

The maximum annual average NO₂ concentrations of 50.9 ug/m³ due to all sources is below the AAQS of 100 ug/m³. The proposed facility contributed approximately 8.4% to the maximum concentration.

5.6.1.3. Additional Impact Analysis

SOILS

Soils in the site region have been disrupted 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 formed in unconsolidated loamy textured sediment influenced by calcareous material (Robbins, et al., 1984). They are coarse-loamy siliceous, hyperthermic Typic Ochraqualfs.

SO₂ and NO₂ 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 affect 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 SO₂ and NO₂ from stack emissions are not expected to have a significant adverse affect on soils in the vicinity because (1) the predicted concentrations of both gases are low, (2) Payne Creek floodplain and other wetland soils contain organic matter and/or calcium carbonate nodules that buffer changes in acidity, and (3) ground limestone will be applied to lands being reclaimed for pasture and citrus. Therefore, the facility is not expected to have a significant adverse impact on regional vegetation or soils.

VEGETATION AND WILDLIFE

The response of vegetation and wildlife to atmospheric pollutants is influenced by the concentration of the pollutant, duration of the exposure and the 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 the duration of the exposure. The impact of the Hardee Power Station 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--The maximum total 3-hour average SO₂ concentration predicted in the Hardee Power Station region is 691 ug/m³. This concentration is predicted to occur about 0.5 km (0.24 miles) north of the stacks and represents the concentration that would occur during the worst-case meteorological conditions of the past five years (see Chapter 7.0). The maximum 3-hour average ground-level concentration predicted for the other four years ranged from 579 to 634 ug/m³. These concentrations would occur between one and six km (0.6 to 3.7 miles) from the stacks with directions ranging from north to east-southeast. Concentrations decrease with distance beyond the location of the maximum concentration.

The maximum total predicted 24-hour average SO₂ concentration is 169 ug/m³ and is located approximately 2 km (1.24 miles) east-southeast of the stacks. The maximum total predicted annual SO₂ concentration is 30.3 ug/m³. This concentration is predicted to occur 1.75 km (1.1 miles) to the east of the stacks.

These concentrations and averaging times can be compared with SO₂ doses known to adversely affect plant and animal species (Tables 5.6.1-9 and 5.6.1-10). The expected doses from operation of the Hardee Power Station combined with background sources are much lower than doses known to cause a detrimental effect on vegetation and wildlife.

Nitrogen Oxides--The maximum predicted 3-hour, 24-hour and annual average NO₂ concentrations due to the Hardee Power Station are predicted to be 297, 42 and 4.6 ug/m³, respectively. The maximum total predicted annual average concentrations due to all sources is 50.9 ug/m³ which includes a background concentration of 45 ug/m³ derived from monitoring data in Bartow. The NO₂

Table 5.6.1-9. SO₂ and NO₂ Doses Reported to Affect Plant Species Similar to Vegetation in the Region of the Hardee Power Plant

Pollutant	Species	Dose and Effect	Reference
SO ₂	Strawberry	1,040 ug/m ³ for 6 hours per day for 3 days had no affect on growth	Rajput, <u>et al.</u> , 1977
SO ₂	Citrus	2,080 ug/m ³ for 23 days with 10 day interruption reduced leaf area	Matsushima and Brewer, 1972
SO ₂	Ryegrass	42 ug/m ³ for 26 weeks or 367 ug/m ³ for 131 days reduced dry weight	Bell, <u>et al.</u> , 1979 Ayazaloo and Bell, 1981
SO ₂	Tomato	1,258 ug/m ³ for 5 hours per day, for 57 days, reduced growth	Kohut, <u>et al.</u> , 1983
SO ₂	Duckweed	390 ug/m ³ for 6 weeks reduced growth	Fankhauser, <u>et al.</u> , 1976
SO ₂	Lichens (<u>Parmotrema</u> and <u>Ramalina</u> spp.)	400 ug/m ³ 6 hours per week for 10 weeks reduced CO ₂ uptake and biomass gain of <u>Ramalina</u> , not <u>Parmotrema</u>	Hart, <u>et al.</u> , 1988
SO ₂	Bald Cypress	1,300 and 2,600 ug/m ³ for 48 hours. Only 2600 ug/m ³ reduced leaf area.	Shanklin and Kozlowski, 1985
SO ₂	Green Ash	210 ug/m ³ for 4 hours per day, 5 days per week for 6 weeks reduced growth	Chappelka, <u>et al.</u> , 1988
NO ₂	Ryegrass	39.5 ug/m ³ for 6 minutes had no affect on shoot weight	Lane and Bell, 1984
NO ₂	Citrus	470 ug/m ³ for 290 days injured trees	Thompson, <u>et al.</u> , 1970
NO ₂	Sphagnum	11.7 ug/m ³ averaged over 18 months compared with control of 4.8 ug/m ³ (exceeded 15 ug/m ³ 4 times) reduced growth	Press, <u>et al.</u> , 1986

Table 5.6.1-10. Examples of Lowest Observed Effect Levels of Air Pollutants
Adapted from Newman (1981) and Newman and Schreiber (1988)

Pollutant	Reported Effect	Concentration ($\mu\text{g}/\text{m}^3$)	Exposure
Sulfur Dioxide	respiratory stress in guinea pigs	427 to 854	1 hour
	respiratory stress in rats	267	7 hours/day;* 5 day/week for 10 weeks
	decreased abundance in deer mice	13-157	continually** for 5 months
Nitrogen Dioxide	respiratory stress in mice	1,917	3 hours
	respiratory stress in guinea pigs	95 to 950 $\mu\text{g}/\text{m}^3$	8 hr/day for* 122 days

* Used to compare as a range between 3-hour and 24-hour averaging times.

** Used to compare with annual averaging times.

doses known to adversely affect some plant and animal species that have been tested are shown in Tables 5.6.1-9 and 5.6.1-10. The predicted doses of NO₂ due to the proposed facility are far lower than the doses reported to injure vegetation and animals; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse affect on vegetation and wildlife.

Total Suspended Particulates--The maximum total 24-hour and annual average concentrations are predicted to be 112 and 48.6 ug/m³, respectively. These concentrations are predicted to occur between 1.75 to 6 km from the stacks. High deposition of particulates on plant leaves can reduce photosynthesis through shading and impede diffusion of gases. However, at least 5 g/m² 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 Hardee Power Station. Predicted particulate levels are lower than reported effects levels in animals (Newman, 1975).

Carbon Monoxide--The maximum predicted 1-hour and 8-hour average CO concentrations due to the facility are 179 and 38 ug/m³, respectively. 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. 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 0.0004 ug/m³. Levels of Be greater than 2 ug/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 ug/m³ 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 0.0016 ug/m^3 . Siegle, et al., (1984) reported that 7 days of exposure to 50 ug/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. Predicted mercury levels are significantly lower than reported effects levels in animals (Newman, 1975).

5.7 NOISE IMPACTS

5.7.1 Impacts to Adjacent Properties

The noise monitoring data collected during the on-site 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.)

The USEPA, 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 weighing added to the nighttime SPL. The equation for L_{dn} is:

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

where: L_d = daytime L_{eq} for the period from 0700 to 2200 hours

L_n = nighttime L_{eq} for the period from 2200 to 0700 hours.

The USEPA 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

Table 5.7.1-1. USEPA Recommended Noise Criteria

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

Code:

- 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 communications is a critical activity.
- Based on lowest level.
- Based only on hearing loss.
- 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.

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

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

Source: EPA, 1974

earlier (see Section 2.3.8), neither Polk County nor Hardee County has a noise ordinance for receiving lands.

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. The program calculated SPLs due to the proposed facility, utilizing the on-site background and minimum L_{eq} s 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 67.9 dBA at Site 4 for background L_{eq} and 67.5 dBA at Site 4 for minimum background. The minimum predicted SPL impacts occurred at Site 6 (residences) with a value of 43.9 dBA for minimum background and at Site 3 with 49.2 dBA for L_{eq} background.

The overall predicted noise impacts of the proposed facility at the property boundary are calculated to be less than 3 dBA above ambient background levels as indicated at Sites 1 and 2. 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 may be well below 3 dBA above background. The data confirms that the proposed facility's noise impact would be unmeasurable at the property boundary due to the fact that the SPL of the proposed facility (including background) is within 4 dBA of the ambient background noise levels.

5.7.2 Impact to Biota

The projected noise from plant operation will not have any affect on surrounding biota. No sensitive wildlife communities, i.e., rookeries, occur within 1.6 km (1 mile) of the plant. Wildlife species in the area have been exposed to similar noise conditions from mining and other industrial activities in this region for years.

Table 5.7.1-2. Sound Power Levels of Dominant Sources for Each Combined Cycle Unit

Source Type*	Sound Pressure Levels (dB)	Octave Band Center Frequency, Hz								
		31.5	63	125	250	500	1K	2K	4K	8K
Combustion Turbine (2 ea)	136	135	128	118	111	108	102	99	93	90
Steam Turbine	120	111	117	115	110	106	102	99	91	85
Boiler Feed Pumps	105	93	95	97	97	97	97	97	94	87
Air Compressor	109	98	94	99	98	96	99	104	101	94
Total for Combined Cycle (1 ea)	136	135	128	120	114	110	107	107	103	96

* Based upon preliminary engineering design information

Table 5.7.1-3. Impact Results Using Average Leq Background Values [All values dBA]

Site	Description	Background*	Proposed Facility w/o Background	Proposed Facility W/ Background
1	Northeast Boundary of Proposed Facility	49.4	49.4	52.4
2	Southeast Boundary of Proposed Facility	43.3	53.5	53.9
3	Southsoutheast of Proposed Facility	41.9	48.4	49.2
4	Southwest of Proposed Facility (Adjacent to)	58.0	67.4	67.9
5	Southeast of Proposed Facility (Adjacent to)	41.8	67.4	67.4
6	South of Proposed Facility (@ Residences)	49.0	42.8	49.9

* Average values of collected data.

Table 5.7.1-4. Impact Results Using Average Minimum Background Values [All values dBA]

Site	Description	Background*	Proposed Facility w/o Background	Proposed Facility w/ Background
1	Northeast Boundary of Proposed Facility	49.4	49.4	49.5
2	Southeast Boundary of Proposed Facility	43.3	53.5	53.5
3	Southsoutheast of Proposed Facility	41.9	48.4	48.5
4	Southwest of Proposed Facility (Adjacent to)	58.0	67.4	67.5
5	Southeast of Proposed Facility (Adjacent to)	41.8	67.4	67.4
6	South of Proposed Facility (@ Residences)	49.0	42.8	43.9

* Average values of collected data.

5.8 CHANGES TO NON-AQUATIC SPECIES POPULATION

5.8.1 Flora

Potential impacts to onsite and regional vegetation due to plant operation arise primarily from the cooling system and stack emissions.

COOLING SYSTEM

The 231 ha (570 acre) cooling reservoir will be located in an area that has been mined and already partially excavated at the time of construction. Water sources for the reservoir will be surficial groundwater, surface runoff, rainfall, and a deep well. Most water loss will be through evaporation and subsurface seepage. Surface water runoff to Payne Creek from the cooling reservoir will be during extremely wet conditions and very infrequent (see Section 5.1.1). The overflow will be directed to a protected channel which will sheet flow over a 6 to 9 m (20 to 30 ft) length of rip-rap before it reaches the creek. No adverse impact to the creek is expected because the flow to the creek is very infrequent and the water will sheet flow over a 9 m (30 ft) or greater length of the floodplain and a 5 to 9 m (15 to 30 ft) width of floodplain before it reaches the creek. This wide area of flow through floodplain vegetation will dissipate flow energy and filter undissolved solids.

The volume of water that enters Payne Creek by subsurface seepage from the cooling reservoir will be equivalent to the volume of water that the creek received from tributaries and stormwater runoff before the site was mined. However, instead of receiving water in pulses during rainfall events, there will be a steady stabilized flow to the floodplain. This will not affect the small swamp that is preserved onsite because most of the vegetation consists of bayhead species. These species, e.g., loblolly bay and sweetbay magnolia, are naturally adapted to areas kept wet by steady seepage from higher terrain (Wharton, et al., 1976).

The flatwoods vegetation of the floodplain is at present being overgrown by a maturing hardwood canopy due to lack of fire. Steady seepage with no long intervening drought periods will enhance the invasion of hardwood forest

into what is now a flatwoods community. Peat will probably accumulate over the life of the plant in these areas because the soil will be more continuously saturated. The rates of decomposition and mineralization of organic matter will be retarded. If peat does accumulate the floodplain may become more efficient in removing nitrogen and other pollutants from water that overflows the creek bank.

Deciduous hardwood trees are more prevalent in wetlands that receive pulses of flooding alternating with lower flow. They receive more oxygen in the root zones during low flow. Flooding periods carry dissolved nutrients from upstream and upland areas as well as organic nutrients, which mineralize during dry periods. Steady seepage flows favor evergreen hardwoods because these species tolerate less fertile conditions. There may be an increase in evergreen hardwoods in the upper floodplain area onsite that will be more influenced by cooling reservoir seepage. Flooding will still occur in the onsite floodplain due to surface flow from areas upstream of the cooling reservoir during periods of high rainfall. The floodplain is expected to consist of a mixture of species types. It will contain a greater abundance of evergreen and deciduous hardwoods and fewer flatwoods species than it does at present.

OFFSITE WETLANDS

Effects of water supplied by relatively consistent subsurface flow rather than pulses of stormwater runoff will be less pronounced with distance downstream of the site. The steady water supply will maintain water in the channel during drought periods to a greater degree than if the facility were not built. The large offsite wetland adjacent to the northwest corner of the site will be slightly wetter than it is at present due to seepage from the cooling reservoir. However, this wetland probably historically received more water before the surrounding uplands were mined than it does now. No adverse impact is expected to this wetland due to seepage from the cooling reservoir.

The temperature of the cooling reservoir water will vary with the season but it is not expected to exceed 35°C (95°F) during the summer. This is 2-3°C (4-5°F) warmer than a natural pond of similar depth and size would be. Subsurface seepage water may warm the overlying ground 1-2°C (2-3°F). Water temperature in Payne Creek near the point of discharge during worst-case conditions is expected to be approximately 32°C (89.6°F).

Levitt (1972) reported that many species can endure temperatures of 35-45°C (96°-113°F), but are killed by a temperature of 45-46°C (113-115°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 of Payne Creek is not expected to exceed 32°C (89.6°F) even under worst case conditions, no damage to floodplain vegetation is expected from the discharge from the cooling reservoir.

Submerged and floating vegetation will probably establish in the cooling reservoir. If aquatic vegetation in the cooling reservoir becomes so abundant that flow into and out of the condensers is impeded, then vegetation will be controlled by mechanical or chemical methods.

5.8.2 Fauna

The cooling reservoir will probably be used for foraging and resting habitat by wading birds and other avian species as well as mammals, e.g., raccoons, and reptiles and amphibians. No adverse impacts will occur to fauna utilizing the cooling reservoir.

5.9 TRANSPORTATION IMPACTS AND OTHER PLANT OPERATION EFFECTS

Operation of the Hardee Power Station will require approximately 80 employees working over three shifts daily. As with the construction effort, it is anticipated that a majority of the operating jobs will be filled by people already residing within commuting distance of the plant. Consequently, traffic associated with the operation of the facility will be dispersed over area roads and should not affect any one particular access route. In addition, since the workforce will be divided into three shifts, the number of operation employee vehicles can easily be absorbed into the area traffic network without creating any delays or changes to area traffic flow.

5.10 ARCHAEOLOGICAL SITES

Because of the lack of archaeological sites on the Hardee Power Station property no active, on-site 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 state and local resources due to operation of the Hardee Power Station are the use of land, and the consumption of water, natural gas and fuel oil.

The land areas used by the Hardee Power Station would have otherwise been mined and reclaimed to pastureland. The Hardee Power Station project will use the lands for energy production.

Some ground and surface water will be consumed (i.e., evaporated) in the operation of the cooling reservoir. The amounts used are negligible compared to the available local supply. Section 5.3 discusses the amounts available and to be consumed. No short- or long-term impacts to local surface and groundwater resources or water users are anticipated from the proposed water use by the Hardee Power Station.

Natural gas and fuel oil will be consumed as fuel. The amounts are described in Chapter 3. This is an irreversible and irretrievable commitment of national energy resources for the production of energy for the state of Florida.

5.12 VARIANCES

Mixing zones and zones of discharges will be required for specific surface water and ground water parameters, as discussed in Sections 5.1.1 and 5.2.1. To the extent that any of these will exceed the allowable length or other applicable limitations, variances will be required.

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HARDEE
POWER
STATION

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 6

**TRANSMISSION LINES
AND OTHER
LINEAR FACILITIES**

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TAMPA ① Pebble Dale 16 miles
FPC ② Vandolah 8 mi.
③ Lee 78 mi.

6.0 TRANSMISSION LINES AND OTHER LINEAR FACILITIES

6.1 TRANSMISSION LINES

6.1.1 Project Introduction

Three transmission lines are needed to connect the proposed Hardee Power Station to the Florida transmission grid to supply projected power needs starting in 1992. The determination of need for the Hardee Power Station and associated facilities is discussed in Section 1.2 of this document.

The individual transmission lines will originate from the proposed Hardee Power Station 230 kV switchyard. One transmission line will terminate approximately 26 km (16 miles) north at Tampa Electric's existing Pebbledale Substation. A second transmission line will terminate approximately 13 km (8 miles) south of the Hardee Power Station at FPC's Vandolah Substation. The third transmission line will parallel the Vandolah line from the Hardee Power Station to the Vandolah Substation and then continue south terminating at the Lee Substation in North Ft. Myers. The transmission line between the Hardee Power Station and the Lee Substation will have a total length of approximately 126 km (78 miles). No intermediate substations are planned. All termination substations are currently existing.

The transmission line connecting the Hardee Power Station with the Pebbledale Substation will be constructed by Tampa Electric on or adjacent to existing road right-of-way (ROW), existing transmission ROW, and new transmission ROW. The width of the corridor is generally 0.8 km (0.5 mile) with variable widths ranging from 0.4 km (0.25 mile) near Bradley Junction to 1.6 km (1 mile) in the phosphate mining areas. A single 230 kV transmission line is requested between the Hardee Power Station and the Pebbledale Substation. The total number of transmission lines within the corridor will vary along the length of the route. The preferred corridor includes areas where there are existing 69 kV and 230 kV transmission lines. Along Old Highway 37 there will be areas where an existing 69 kV transmission line will coexist within the corridor with the proposed line.

Where the corridor intersects the existing ROW, the proposed line will share the corridor with the existing 230 kV transmission line. In the 3 km (2 miles) of corridor directly south of Pebbledale Substation, the proposed line may share the corridor with as many as three other transmission lines (one 230 kV and two 69 kV lines). In addition, in the phosphate area northeast of Bradley Junction, future relocation of existing power lines for mining operations may result in additional lines being placed within the corridor. The typical ROW width within the corridor between the Hardee Power Station and the Pebbledale Substation will be 30 m (100 ft) for single pole construction and 46 m (150 ft) for H-frame construction.

② The transmission line corridor between the Hardee Power Station and the Vandolah Substation will contain two 230 kV transmission lines, one terminating at the Vandolah Substation and the other continuing south to the Lee Substation. The corridor will follow existing road ROW, existing transmission line ROW, and new transmission ROW. The total number of transmission lines within the corridor will vary along the length of the route. Between the Hardee Power Station and the Vandolah Substation, the width of the corridor will be 0.8 km (0.5 mile) with the exception of a slight increase near Ft. Green Springs. The typical ROW width within the corridor between the Hardee Power Station and the Vandolah Substation will be 53 to 61 m (175 to 200 ft) for H-frame construction and 30 m (100 ft) for single pole construction.

The transmission line corridor from the Vandolah Substation south to the Lee Substation will be for a single 230 kV line. The corridor will follow existing transmission line ROW, existing road ROW, and new transmission line ROW. The total number of transmission lines within the corridor will vary along the length of the route. Between the Vandolah Substation and the Lee Substation the width of the corridor will generally be 0.8 km (0.5 mile) but will vary locally. The typical ROW to be constructed within the corridor from the Vandolah Substation and the Lee Substation will be 46 m (150 ft) for H-frame construction and 30 m (100 ft) for single pole construction.

6.1.2 Corridor Location and Layout

The routes for the preferred transmission line corridors and alternative segments from the Hardee Power Station to all three substations are presented in Figure 6.1.2-1 (see Appendix 11.10) at a scale of 1:126,720. FDOT highway maps were used as the base map for Figure 6.1.2-1. Existing transmission lines of 115 kV and above within 8 km (5 miles) of the proposed corridor are also shown. Major geographic features are depicted relative to the proposed corridor. The exact corridor locations are shown on aerial photographs in Figure 6.1.2-2 (see Appendix 11.10).

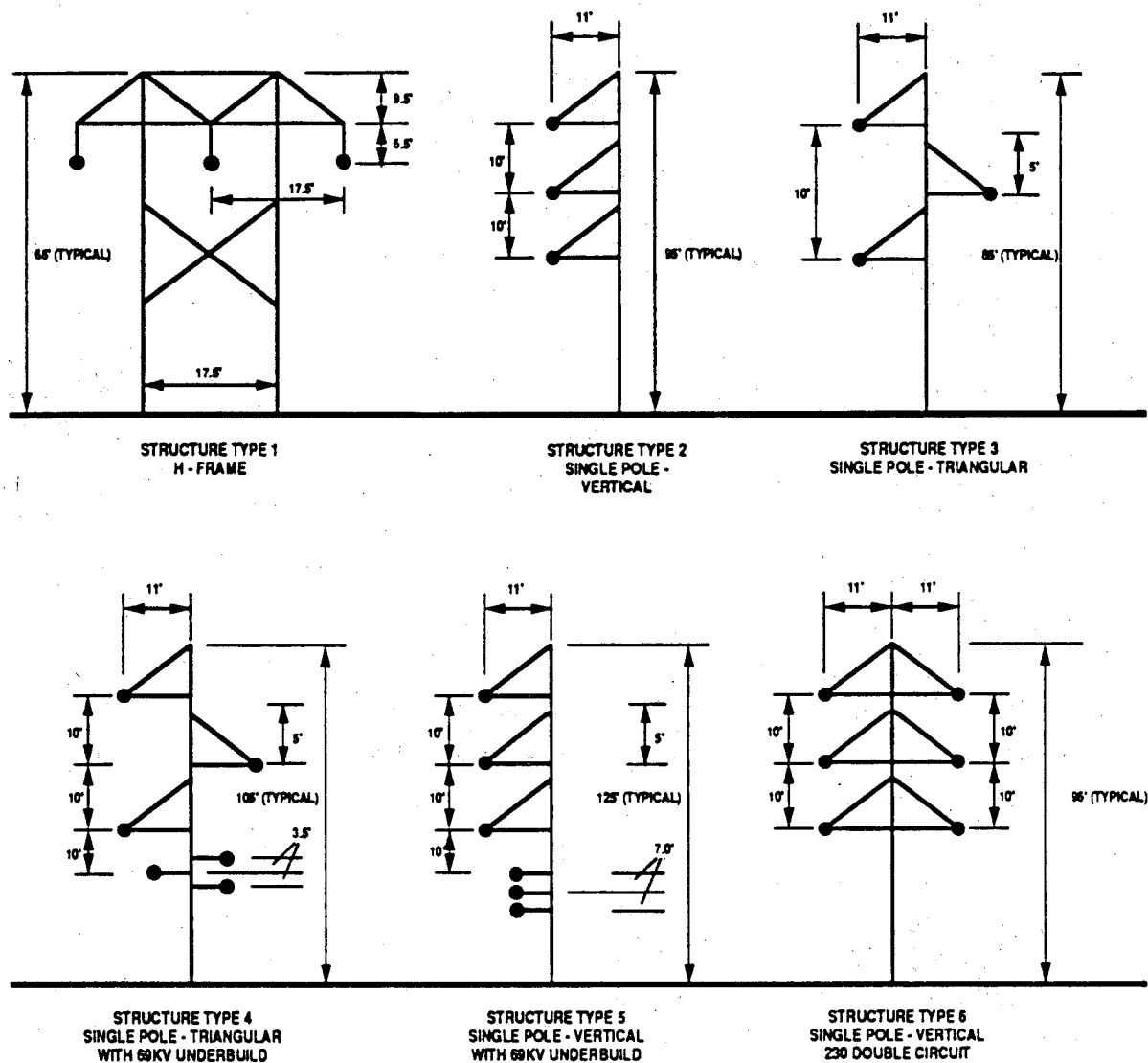
6.1.3 Transmission Line and Road Design Characteristics

The transmission line will be constructed using wood H-frame structures where the ROW width and surrounding land use features allow. Single steel or concrete poles will be utilized in urban areas with more restricted ROWs. It is anticipated that the majority of the transmission line will be constructed of wood H-frame structures based on the rural land use characteristics of much of the corridor and surrounding areas. Typical configurations to be used on H-frame and single pole structures are shown on Figure 6.1.3-1. Where the lines turn shallow angles, similar unguyed structures will be used. Where the lines turn steep angles the structures will utilize guys and anchors.

The design voltage of the proposed lines will be nominally 230 kV with a maximum current rating (MCR) of 2,040 amperes and a maximum continuous capacity of 640 to 812 megavolt-amperes (MVA). The MCR is the nominal capacity which would be expected to result in the conductor to reach its design temperature limit of 140°C (284°F).

why the
172 MVA
Range?
TEMP?

Final conductor selection has not been completed. The optimum conductor will be determined based on an analysis of economics and performance considerations. A typical conductor for this type of construction is a 1590 aluminum conductor steel reinforced (ACSR) unit with a nominal operating voltage of 230,000 volts. The overhead ground wire may contain fiber optic communications circuits or may be a stranded steel cable.



NOT TO SCALE

Figure 6.1.3-1 HARDEE POWER STATION
TRANSMISSION STRUCTURES

**Hardee
Power Station**

Conductor profiles for H-frame and single pole configurations are presented in Figures 6.1.3-2 and 6.1.3-3, respectively.

Span lengths between structures will average between 183-213 m (600 to 700 ft). Individual span lengths will be determined by the topography of the route and the width of the ROW. The entire line will meet National Electrical Safety Code Standards for clearance to ground and obstructions.

~~Additionally, the minimum clearance from any energized conductor to ground will be 8 m (27 ft).~~

UNDERBUILD?

Existing roadways will be used for access to the transmission line wherever possible. If adequate access roads do not exist, new roads will be constructed which will typically be unpaved and have a maximum width of 6 m (20 ft). It is estimated that approximately 40 miles of new access road will need to be constructed. No new bridges will be required as part of the corridor construction.

Structure pads will typically be constructed adjacent to the access roads. The pads will be approximately 7 m (24 ft) in width, with the length varying as a function of the distance between the structure and the access road.

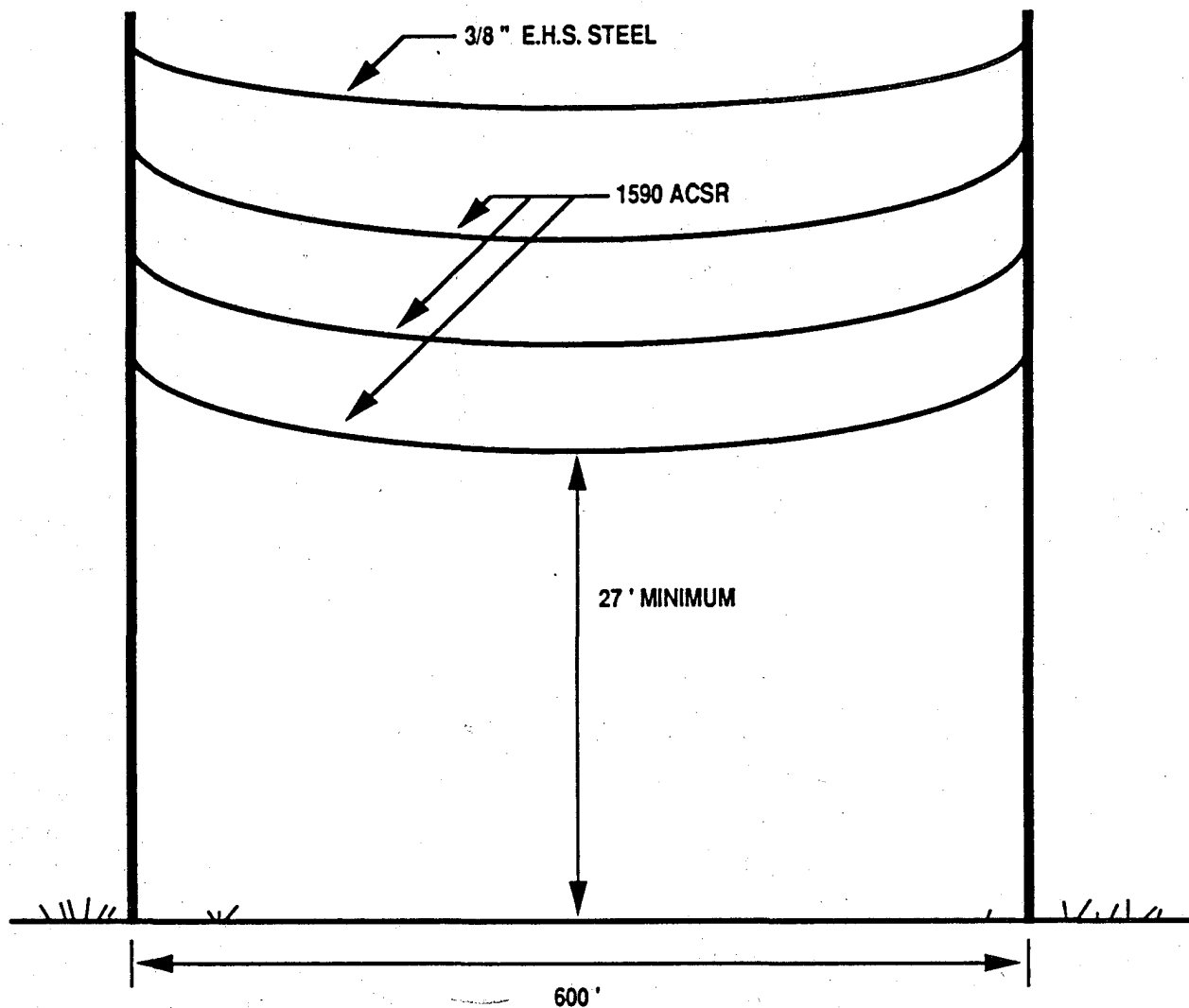
with what materials?

6.1.4 Cost Projections

Approximate costs for the transmission lines are presented in Table 6.1.4-1. The actual cost of the transmission lines may vary depending on the final ROW and structure location, cost of ROW acquisition and other site specific conditions.

6.1.5 Corridor Selection

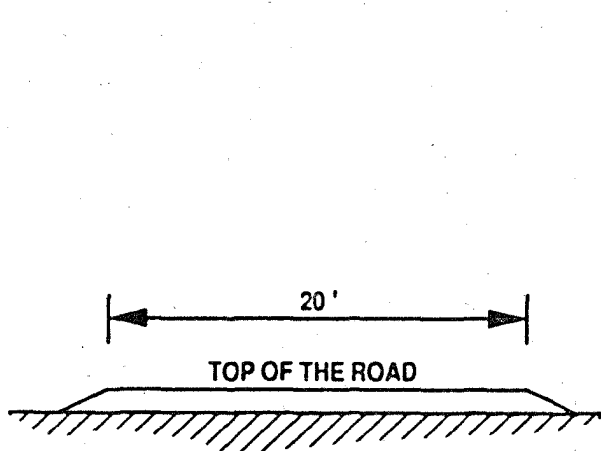
The objective of the transmission line corridor siting study was to select the most favorable corridor in the study area based on a combination of socioeconomic, environmental, engineering and economic considerations. The study area for the corridor selection study (Figure 6.1.5-1) was defined by the geographic distribution of the Hardee Power Station and the three end point substations, i.e., Pebbledale, Vandolah and Lee Substations.



1590 ACSR (LAPWING)
600' RULING SPAN

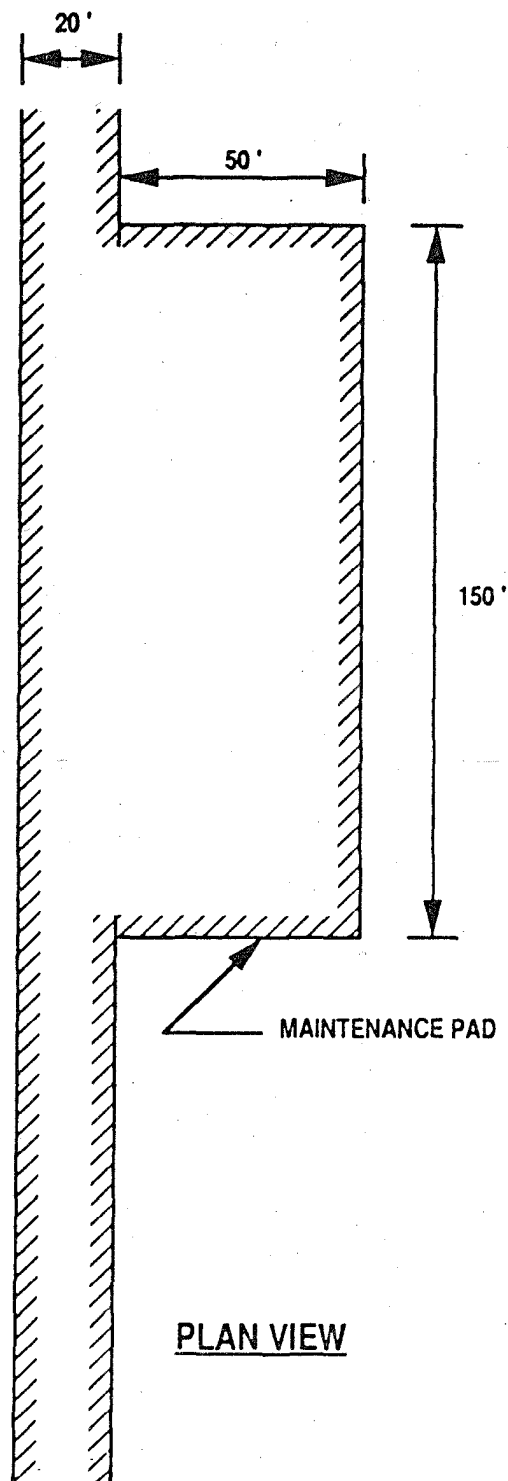
Figure 6.1.3-2 CONDUCTOR PROFILE FOR H-FRAME
CONSTRUCTION

**Hardee
Power Station**



NOTE: FILL TO BE ADDED AS REQUIRED

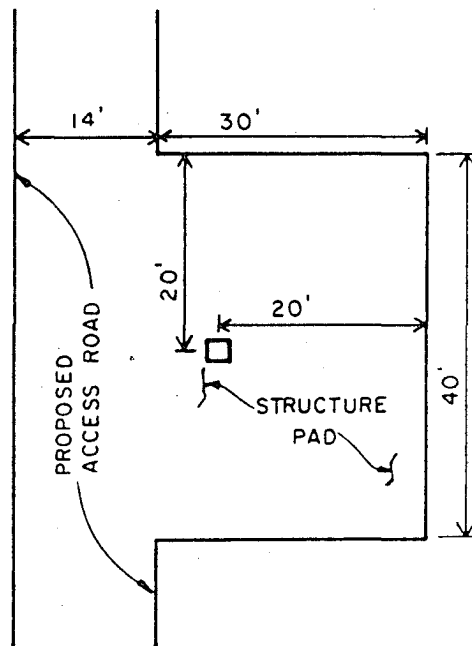
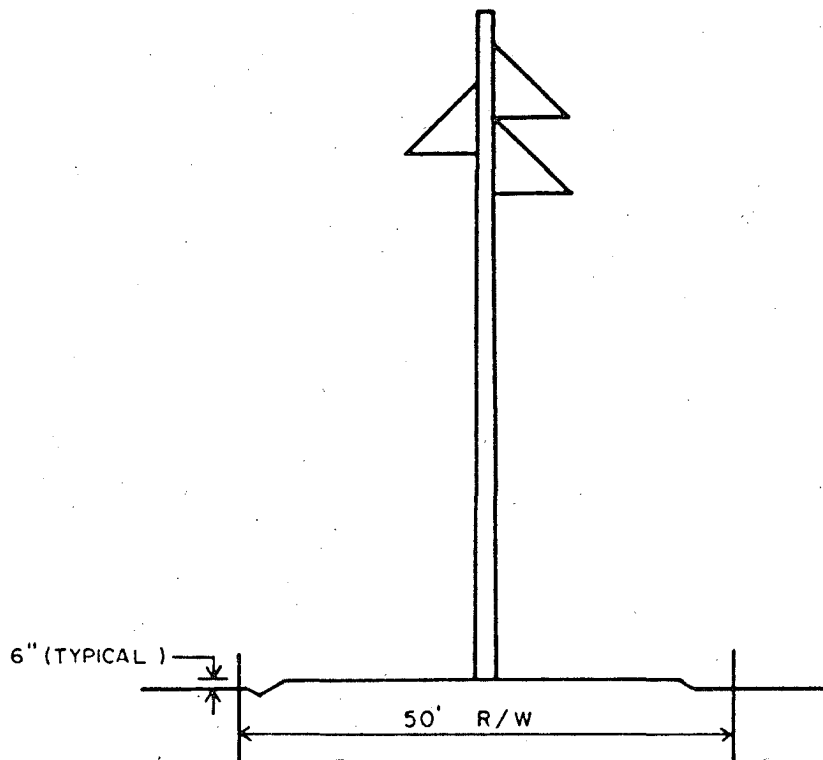
CROSS-SECTION



PLAN VIEW

Figure 6.1.6-4 HARDEE POWER STATION TO PEBBLEDAL
SUBSTATION TYPICAL ACCESS ROAD PLAN
AND CROSS-SECTION

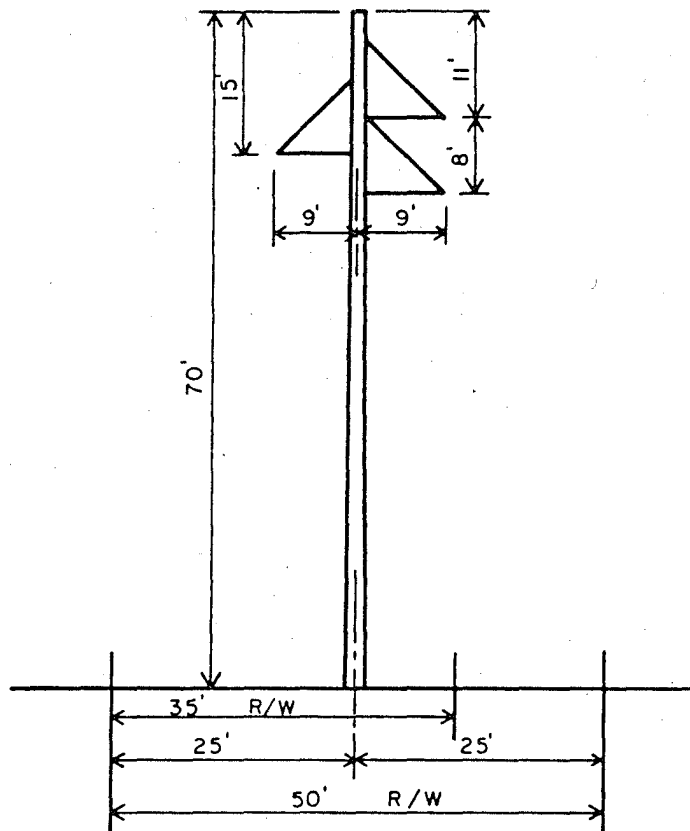
Hardee
Power Station



NOT TO SCALE

Figure 1.3-3
TYPICAL ACCESS ROAD AND STRUCTURE PAD DESIGN —
NO EXISTING ACCESS AVAILABLE

SOURCE: FPL, 1988.

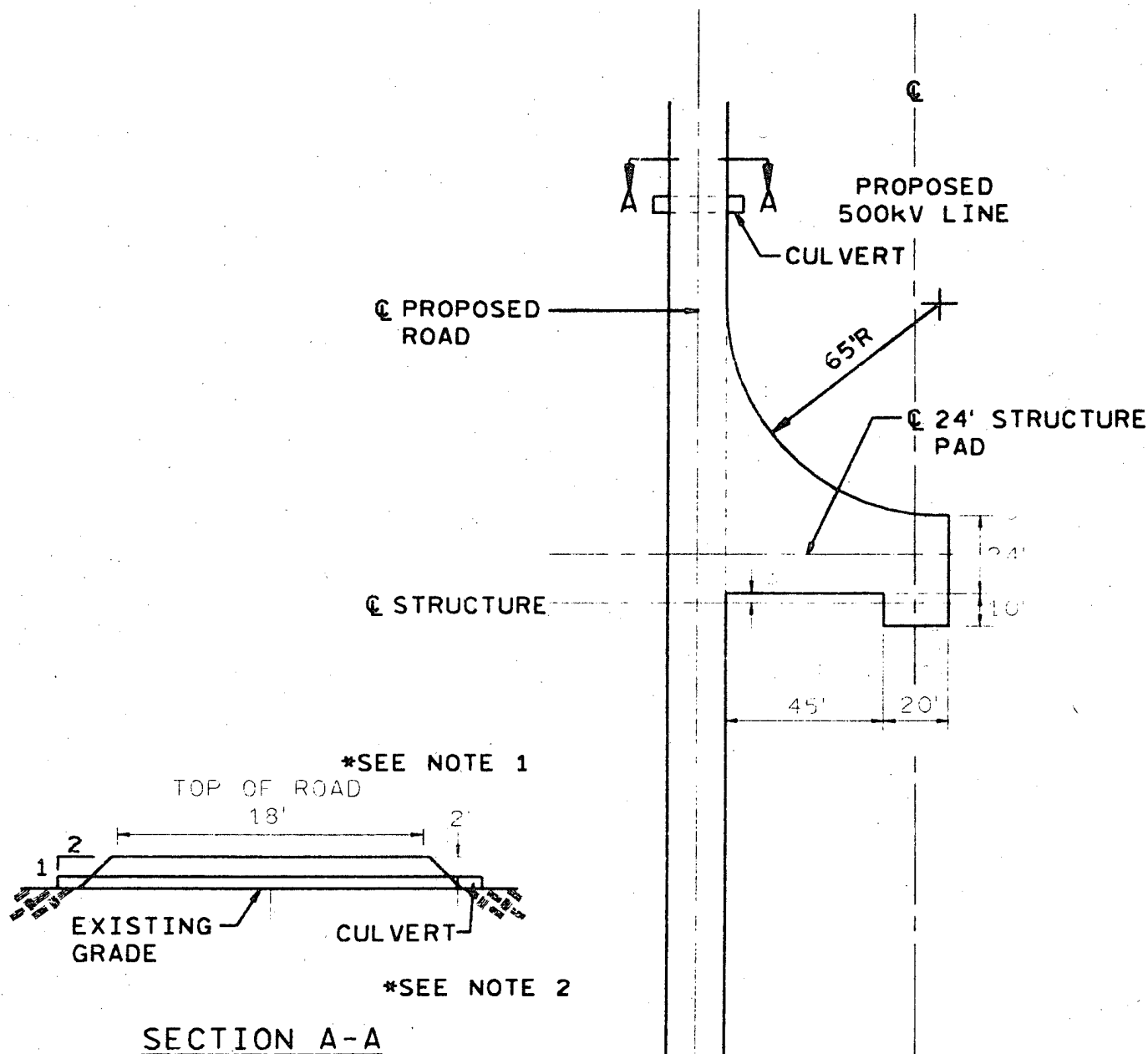


NOTE: RIGHT-OF-WAY REQUIREMENTS FOR THIS STRUCTURE TYPE
WILL BE 35' WHEN ADJACENT TO OTHER RIGHTS-OF-WAY,
50' OTHERWISE.

NOT TO SCALE

Figure 1.3-2
TYPICAL CONCRETE POLE STRUCTURE —
TRIANGULAR CONFIGURATION

SOURCE: FPL, 1988.



NOTES

1. HEIGHT OF ROAD VARIES, MINIMUM 6" ABOVE MEAN HIGH WATER.
2. SPACING, DIAMETER AND LENGTH AS REQUIRED TO MAINTAIN FLOW. A MINIMUM OF TWO FEET OF COVER OVER THE CULVERT IS REQUIRED.

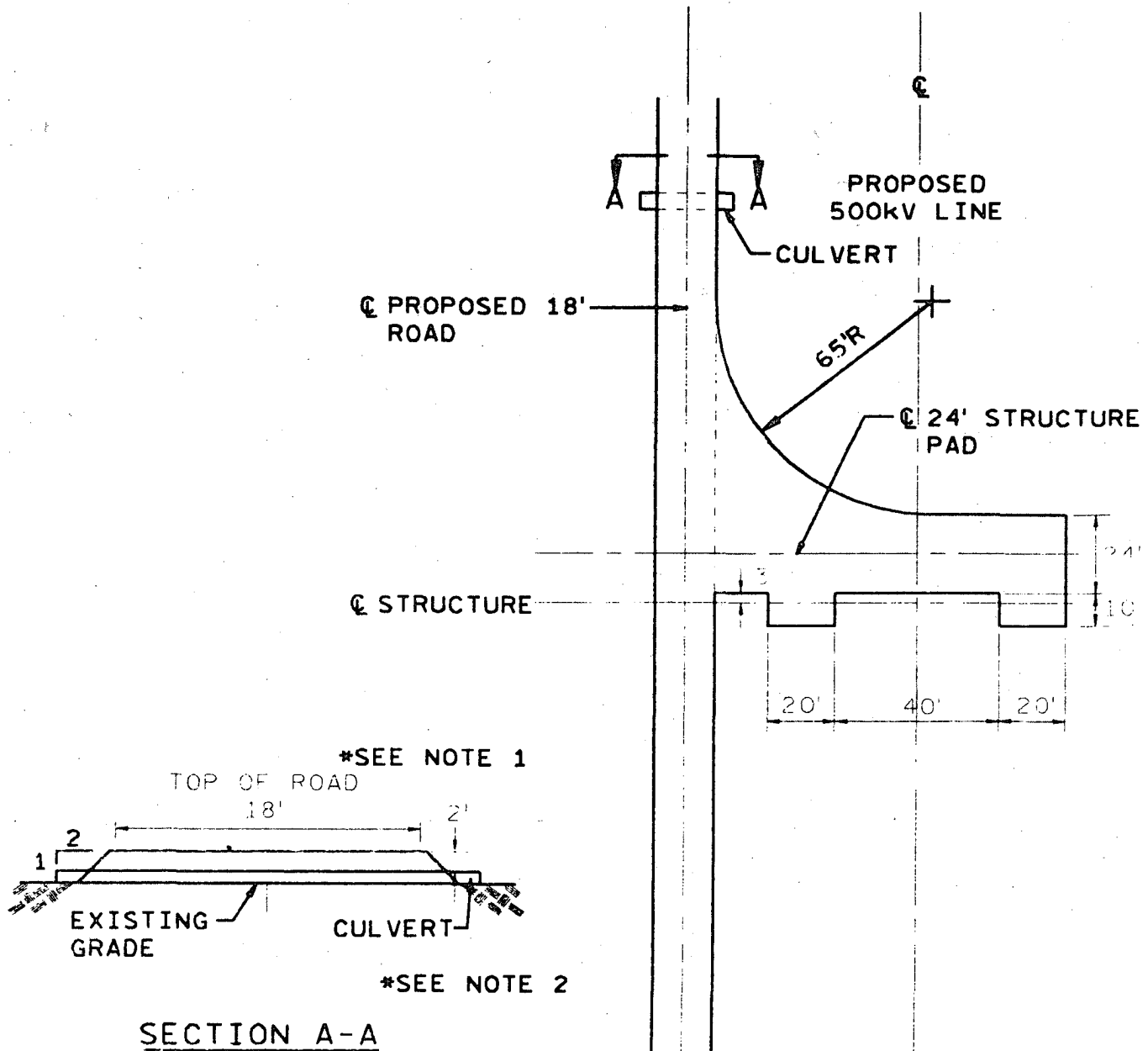
Figure 1.3-7
TYPICAL ACCESS ROAD AND STRUCTURE PAD LAYOUT
FOR SINGLE-POLE STRUCTURE

SOURCE: FPL, 1988.



Levee-Midway
500kV
Transmission Line

FPL



NOTES

1. HEIGHT OF ROAD VARIES, MINIMUM 6" ABOVE MEAN HIGH WATER.
2. SPACING, DIAMETER AND LENGTH AS REQUIRED TO MAINTAIN FLOW. A MINIMUM OF TWO FEET OF COVER OVER THE CULVERT IS REQUIRED.

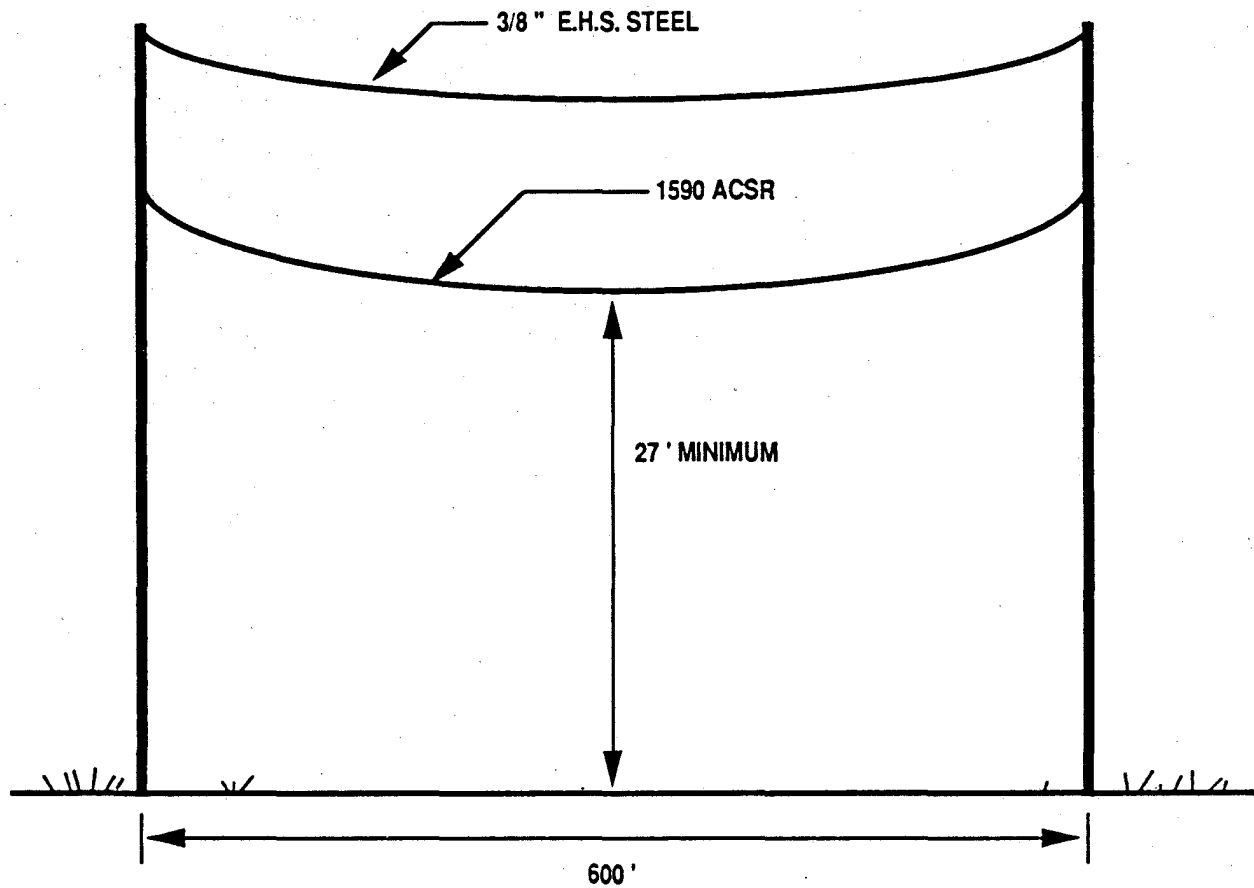
Figure 1.3-6
TYPICAL ACCESS ROAD AND STRUCTURE PAD LAYOUT
FOR H-FRAME STRUCTURE

SOURCE: FPL, 1988.



Levee-Midway
500kV
Transmission Line

FPL



1590 ACSR (LAPWING)
600' RULING SPAN

Figure 6.1.3-3 CONDUCTOR PROFILE FOR SINGLE POLE
CONSTRUCTION

**Hardee
Power Station**

Table 6.1.4-1. Cost Projections for the Preferred and Alternative Corridors for the Hardee Power Station Project in 1988 Dollars

Corridor	Section	Approximate Length (Miles)	Estimated ROW Cost (\$)	Total ROW Preparation Cost (\$)	Line Construction Cost (\$)	Estimated Cost per mile (\$)	Total Cost (\$)
Preferred	C1	16	606,000	836,000	2,560,000 to 4,000,000	250,000 to 340,000	4,002,000 to 5,442,000
	C2	8*	580,800	200,000	3,219,200	250,000	4,000,000
	C3	70	2,540,000	875,000	14,084,000	250,000	17,500,000
Alternative	C1	18	1,091,000	528,000	2,880,000 to 4,500,000	250,000 to 340,000	4,499,000 to 6,119,000

* Two parallel lines of 13 km (8 miles) each.

C1 = Hardee Power Station to Pebbledale Substation

C2 = Hardee Power Station to Vandolah Substation

C3 = Vandolah Substation to Lee Substation

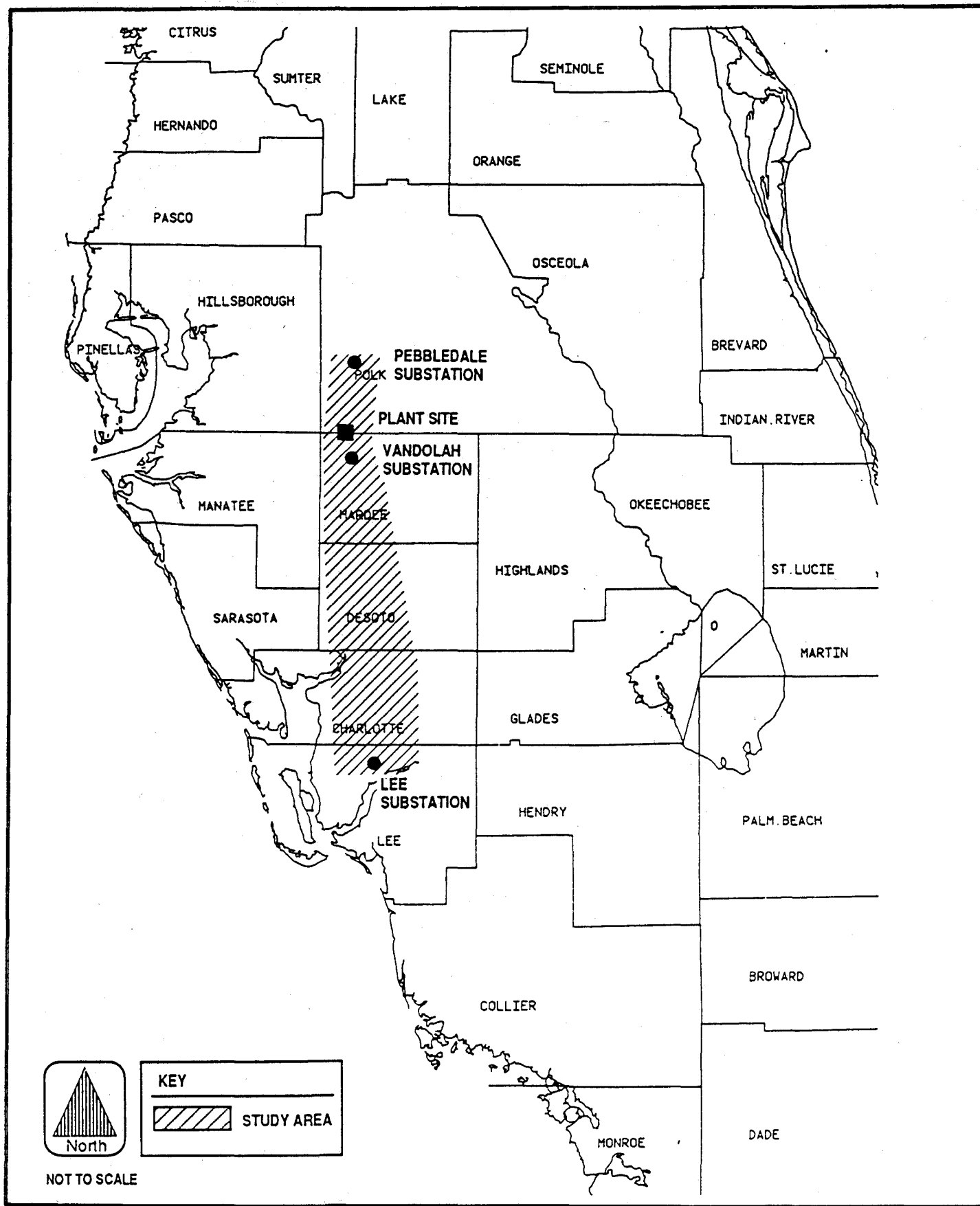


Figure 6.1.5-1 TRANSMISSION CORRIDOR SELECTION
STUDY AREA

**Hardee
Power Station**

The corridor selection study consisted of a sequential, iterative screening and evaluation process which was conducted in three phases:

1. Regional resources mapping and screening;
2. Selection of candidate corridors; and
3. Selection of preferred and alternative corridors.

Each of the phases in the corridor selection process was based on specific criteria and involved increasing levels of detail.

The end points for the transmission line and line voltage were selected by the Applicant based on studies of the need for power in their service area. The limits of the study area were selected to incorporate the three identified end points and to provide a broad area in which to locate the transmission line ROW.

Phase 1: Regional Resources Mapping and Screening -- The objectives of this phase were to: 1) establish criteria for classifying unfavorable areas (e.g., urban areas and critical habitats); 2) develop a regional screening map of the study area to identify potentially favorable areas; and 3) screen out areas which were unfavorable for the location of a transmission line.

The first task of Phase 1 was the compilation, accurate mapping, and rating of resources in the study area which could affect the suitability of certain areas for transmission corridor siting. Through this process, areas which were determined to be unsuitable due to specific siting constraints such as economics, environmental impacts and land use conflicts were identified and subsequently eliminated from further siting consideration. Through this process, land areas within the study area which possessed unalterable obstacles or restrictions to siting of the corridor were identified. A three-level rating scale was developed to classify various areas within the study area based on socioeconomic/land use, ecological and physical criteria. Specific criteria evaluated are presented in Table 6.1.5-1.

Sensitive areas were mapped throughout the study area using the PC ARC/INFO[®] geographic information system (GIS). PC ARC/INFO[®] is a computer-based

Table 6.1.5-1. Phase 1 Screening Criteria for Transmission Line Corridors for the Hardee Power Station

Land Use Criteria	Ecological Criteria	Physical Engineering Criteria
Residential Areas	Important Species	Major Water Bodies
Unique Use/Restricted Areas	Wetlands/Sensitive Vegetation	Flood-Prone Areas
Recreation, Parks, and Natural Resource Areas		Phosphate Reserves
Agricultural Areas		
Historic Sites		
Archaeological Sites		
Minable Phosphate Reserves		

Source: SECI, 1982.

mapping and analytical system that allows multiple thematic coverages to be digitized and plotted. The coverages mapped for Phase I of the transmission line siting study included:

- o all water bodies with a width greater than 0.4 km (0.25 mile);
- o land use features including residential, commercial and recreational areas, airports, and towns;
- o known nesting areas and habitats of threatened and endangered species;
- o major floodplain areas;
- o transportation routes including roads and railroads; and
- o phosphate mining areas.

Based on the results of the regional mapping and screening, favorable, potentially favorable, and unfavorable areas within the study area were identified. Areas identified as unfavorable were removed from further consideration and those identified as favorable or potentially favorable were assessed further in Phase 2 of the siting study.

Phase 2: Identification of Candidate Corridors -- The objective of this phase was to identify candidate corridors based on information obtained during the regional mapping and screening.

Candidate corridors were selected by using the regional screening maps developed in Phase 1 in addition to information from helicopter flyovers. Corridor segments were identified in areas rated as favorable and potentially favorable for transmission line development. Candidate corridors were then developed by using the corridor segments identified in areas rated as favorable and potentially favorable, based on the following criteria:

- o using the most direct routes between the new power plant and the transmission line end points;
- o paralleling existing ROWs;
- o minimizing crossing of other transmission lines, rivers and highways;
- o minimizing impact on residential and commercial development; and
- o minimizing impact to wetlands and other forested areas.

By applying the above criteria, candidate corridors were identified and are presented in Figure 6.1.5-2 (see Appendix 11.10). The candidate corridors were then further screened at a greater level of detail during Phase 3 of the siting study.

Phase 3: Selection of Preferred and Alternative Corridors -- The objective of Phase 3 was to select the preferred and alternative corridors based on quantitative ranking criteria (socioeconomic, land use, environmental, and physical/engineering).

During this phase of the corridor siting study, the candidate corridors identified previously were evaluated at a greater level of detail and ranked, based on criteria presented in Table 6.1.5-2. The criteria emphasized the identification of constraints within each of the candidate corridors that could affect routing of the actual ROW. A quantitative ranking was developed for each of the candidate corridors based on a scale from one to three. Appropriate maps, aerial photography, local and regional planning documents, and other data sources were used to provide the detailed information used in the ranking process. Each criterion was weighted to reflect its overall importance relative to the other criteria. ~~A weighted composite score was developed for each of the combinations of corridor segments which was used to identify the preferred and alternative corridors.~~

6.1.6 Hardee Power Station to Pebbledale Substation Transmission Line

6.1.6.1 Description of Preferred and Alternative Corridors

The preferred and alternative corridors between the Hardee Power Station and Pebbledale Substation are described below. The corridor description starts at the Hardee Power Station and proceeds north to Tampa Electric's Pebbledale Substation. This section of the transmission line will be constructed and maintained by Tampa Electric.

HARDEE POWER STATION TO PEBBLEDAL E SUBSTATION

Selection of the preferred and alternative corridors in the area between the Hardee Power Station and the Pebbledale Substation was made primarily on the

Table 6.1.5-2. Candidate Corridor Ranking Criteria

Corridor Ranking Criteria

Residential Density

Land Use Planned Development

Regional Facilities

Airports

Ecology

Natural Communities

Natural Areas

Wildlife Habitats

Rare and Endangered Species

Length of Corridor

basis of economics but also in consideration of other factors. The preferred route (see Figure 6.1.6-1 in Appendix 11.10) is the most direct route between the termination point and the Hardee Power Station using existing road and transmission line ROWs. In addition, this route avoids the populated areas of Bradley Junction, Oak Terrace, and Pinedale, while making use of phosphate mining land where practical.

Due to mining setback restrictions, the siting study concentrated on routing the corridor adjacent to existing highway and railroad ROWs. In addition, wherever practical, existing transmission line ROWs were used for the routing of the transmission corridor.

Due to the uncertainty of mining plans, alternative routing was identified in this area, as shown on the corridor site map. This alternative route makes extensive use of highway and railroad ROW and is less dependent on mining activities in the area. This alternative is a viable route if the preferred route is not available.

The preferred corridor starts at the Hardee Power Station and heads north paralleling to CR 61 for approximately 16 km (10 miles), making use of existing highway ROW. The corridor in this area has a width of 0.8 km (0.5 mile). Due to mining setback restrictions in the area of public road ROWs, lands adjacent to the road ROW may also be available for siting of the transmission line ROW. By routing the corridor parallel to the existing road ROW the need for access road construction and filling is minimized. Directly south of the community of Bradley Junction, the corridor turns to the east for a distance of approximately 0.8 km (0.5 mile). In this area, the corridor maintains a width of approximately 0.4 km (0.25 mile) to avoid residential development. The corridor then increases in width to 0.8 km (0.5 mile) and heads north for approximately 1.6 km (1 mile) to Agricola Road and joins the existing ROW, while staying east of Bradley Junction. The corridor then heads toward the east along the existing ROW for a distance of approximately 2.8 km (1.7 miles). The corridor in this area has a width of 1.6 km (1 mile). Finally, the corridor turns north and follows

the existing ROW to the Pebbledale Substation. The width of the corridor for this section is 1.6 km (1 mile).

~~An alternative route is identified which continues north into Bradley Junction rather than running east as does the preferred route.~~ The alternative corridor runs north through Bradley Junction and is 610-m (2,000 ft) wide with its western edge 76 m (250 ft) west of SR 37. ~~This alignment will allow either SR 37 or the railroad ROW to be utilized in the Bradley Junction area.~~ The section of corridor through Bradley Junction is expected to have a minimum impact on the community of Bradley Junction while maintaining an alignment parallel to existing state road and railroad ROW.

The alternative corridor shifts to the west at the intersection of SR 37 and the railroad directly north of Bradley Junction. The corridor continues north with a width of 0.5 mile and is centered on SR 37. The corridor continues north but narrows to a width of 457 m (1,500 ft) to avoid the community of Oak Terrace. At the intersection of SR 37 and SR 640, the corridor turns east and follows SR 640 to a point directly north of Pebbledale Substation. Beginning at the intersection of SR 37 and SR 640, the corridor has a width of 457 m (1,500 ft). The northern edge of this section is approximately 61 m (200 ft) north of SR 640 thus avoiding the community of Pinedale. Once past the community of Pinedale, the corridor widens to approximately 0.8 km (0.5 mile) as it follows SR 640 east approximately 3.6 km (2.25 miles). The corridor then turns south and follows the existing transmission line ROW to Pebbledale Substation. The width of this section is 0.8 km (0.5 mile).

6.1.6.2 Socio-Political Environment of the Pebbledale Substation Corridor Area

6.1.6.2.1 Governmental Jurisdictions

The preferred and alternative corridors are shown in Figure 6.1.6-1 (see Appendix 11.10) at a scale of 1:126,720 relative to governmental jurisdictions within 0.8 km (0.5 mile) of the edge of the corridor. The corridor runs in a south to north orientation through the extreme northern section of Hardee County and through Polk County. No incorporated

municipalities are known to occur within 0.8 km (0.5 mile) of the Pebbledale corridor.

6.1.6.2.2 Zoning and Land Use

POLK COUNTY

The relevant provisions of the Polk County Comprehensive Plan are discussed in Section 2.2.2 of this document. Additionally, the Polk County Electric Utility Element establishes as a policy to, "Encourage the design of transmission lines and substations compatible with existing land use." For the reasons set forth elsewhere in this chapter (see discussions regarding corridor siting, land uses, ecology, etc.), the Polk County 230 kV transmission line corridor routing is compatible with existing land uses. Moreover, the 230 kV transmission line is a Class I essential service which is authorized throughout Polk County under the Zoning Ordinance. The January 24, 1989 letter from the Zoning Administrator of Polk County and January 20, 1989, memorandum written by the Chief of Current Planning for Polk County (both documents are included in Appendix 11.2) confirm that the transmission line corridor is consistent with the Polk County Comprehensive Plan and in compliance with the Polk County Zoning Ordinance. Further, land use maps showing the Hardee Power Station to Pebbledale Substation corridor are presented in Figure 6.1.6-2 (see Appendix 11.10).

HARDEE COUNTY

The relevant provisions of the Hardee County Comprehensive Plan are discussed in Section 2.2.2 of this document. No specific constraints on transmission line siting are set forth in the plan. The discussion in this section pertaining to planning approach, adjacent land uses, ecology, etc., demonstrates that the 230 kV transmission line corridors in Hardee County are consistent with the Hardee County Comprehensive Plan. Moreover, transmission lines are specifically authorized in all zoning districts in Hardee County as use exceptions pursuant to Section 2.3C of the Hardee County Zoning Ordinance.

6.1.6.2.3 Easements, Title, Agency Works

Easements will be required for the transmission line corridor to cross lands under the jurisdiction of the Board of Trustees of the Internal Improvement Trust Fund. A list of roads, and railroads within the preferred and alternative corridors between the Hardee Power Station and the Pebbledale Substation for which crossing approvals will be required is presented in Table 6.1.6-1.

6.1.6.2.4 Vicinity Scenic, Cultural, and Natural Landmarks

As identified in Section 6.1.6.2.1, no state resource areas will be crossed by the proposed transmission line corridor from the Hardee Power Station to the Pebbledale Substation.

6.1.6.2.5 Archaeological and Historical Sites

DHR was contacted to determine whether any archaeological or historic sites listed or eligible for listing in the National Register of Historic Places, or otherwise of national, state, or local significance might be affected by the proposed 230 kV transmission line corridor between the Hardee Power Station and the Pebbledale Substation. A set of USGS topographic quadrangle maps (1:24,000) and a set of 1984 Mark Hurd aerial photographs (1:24,000) showing the locations of the corridor were reviewed by the DHR personnel. Known sites and potential historical and archaeological site locations within the corridor were identified by the DHR staff.

One known site exists in the corridor between the Hardee Power Station and the Pebbledale Substation. This site is located in an area previously surveyed by archaeologists. However, this site (8-Po-90) is not considered significant. No other known archaeological or historical sites were identified within the Pebbledale corridor.

6.1.6.3 Bio-Physical Environment of the Corridor Area

6.1.6.3.1 Land Use/Vegetation

Existing land use and vegetation cover within 0.8 km (0.5 mile) and vegetation cover within 0.4 km (0.25 mile) from the edge of the corridor between the Hardee Power Station and the Pebbledale Substation

Table 6.1.6-1. Easements, Title, Crossing Approvals Normally Required for Transmission Line Construction in the Preferred and Alternative Corridors Between the Hardee Power Station and Pebbledale Substation

Facility	Corridor	Affected Agency	Previous Approval	Changes
<u>Roads</u>				
CR 663	C1	Polk County	Utility Permit	None
CR 630	C1	Polk County	Utility Permit	None
CR 640	C1	Polk County	Utility Permit	None
SR 37	Cla	FDOT	Utility Permit	None
CR 640	Cla	Polk County	Utility Permit	None
CR 663	Cla	Polk County	Utility Permit	None
<u>Railroads</u>				
Seaboard Coastline	C1	FDOT	Utility Permit	None
Seaboard Coastline	Cla	FDOT	Utility Permit	None

Note: C1 - Hardee Power Station to Pebbledale Substation
 Cla - Hardee Power Station to Pebbledale Substation Alternative Corridor

(Figure 6.1.6-3 in Appendix 11.10) were determined using USGS 1:24,000 topographic quadrangle maps alongside recent aerial photographs at the same scale. Generalized 1985 Land Use Maps prepared by the COE for SWFWMD were also examined. Helicopter flights and ground inspections were used to clarify interpretations.

The land use maps have been prepared according to the FLUCCS (FDOT, 1985).

LAND USE

Aerial photographs at a scale of 1:24,000 depicting the preferred and alternative corridors between the Hardee Power Station and the Pebbledale Substation are included in Figure 6.1.2-2 (see Appendix 11.10). Much of the preferred corridor between the Hardee Power Station and the Pebbledale Substation runs through land which has been strip mined for phosphate ore. This corridor also passes along the southern and eastern sides of the unincorporated community of Bradley Junction.

The alternative corridor segment starts at the southern boundary of Bradley Junction and proceeds north including both SR 37 and the Seaboard Coastline Railroad. Land use within the alternative corridor includes areas of residential development and mined phosphate lands.

VEGETATION

The preferred and alternative corridors pass through heavily mined phosphate lands, which were formerly scrub and sandhill rangeland with marshes, ponds, and cypress domes in depressions and floodplain swamps and forests along the creeks. Farming, phosphate mining, and other land clearing activities have eliminated most of the original vegetation. Practically all remaining forested communities have been cut over to some extent.

The major natural communities are pine flatwoods and prairies, with a full range of hydric, mesic, and xeric types represented. Smaller tracts of hammock also range from hydric to xeric in character. The primary wetland type is marsh with floodplain forest communities along streams.

Hammocks are relatively fire-intolerant hardwood forests. In the study area they are usually dominated by live oak (Quercus virginiana), sand live oak (Q. geminata), laurel oak (Q. hemisphaerica), and cabbage palm (Sabal palmetto). Water oak (Q. nigra), sweetgum (Liquidambar styraciflua), and sugarberry (Celtis laevigata) are also common.

Scrub communities are shrubby thickets and/or sand pine (Pinus clausa) forests adapted to catastrophic fires at less frequent intervals. The typical shrubs include sand live oak (Q. geminata), scrub oak (Q. inopina), Chapman's oak (Q. chapmanii), myrtle oak (Q. myrtifolia), rosemary (Ceratiola ericoides), fetterbush (Lyonia ferruginea), and other leathery-leaved species. The forest floor is usually white sand with patches of deer moss (Cladonia spp.), prickly pear (Opuntia humifusa), and occasional grasses and forbs. There are no clearly defined areas of scrub in the corridor, but some areas of xeric flatwoods or oak hammock may have admixtures of scrub species.

Flatwoods usually occur on low-lying, level lands with a high water table and, consequently, a hardpan layer within a few feet of the soil surface. Slash pine (Pinus elliottii) is usually the dominant species in these stands of scattered pines, but longleaf may occur on some sites in the corridor. Natural flatwoods have a very diverse grassy understory dominated by wiregrass, but places subjected to repeated winter burning may have a dense thicket of saw palmetto (Serenoa repens) beneath the pines.

Red maple (Acer rubrum), sweetbay Magnolia virginiana), loblolly bay (Gordonia lasianthus), swamp bay (Persea palustris), dahoon holly (Ilex cassine), and sweetgum (Liquidambar styraciflua) are the most common. Wax myrtle (Myrica cerifera), carolina willow (Salix caroliniana), and buttonbush (Ceophalanthus occidentalis) are abundant in disturbed wetlands along the Pebbledale corridor.

Where fires occur too often for trees to become established, marshes are the wetland vegetation. These are typically composed of herbaceous emergents like maidencane (Panicum hemitomon), bulltongue sagittaria (Sagittaria

lancifolia), and pickerel weed (Pontederia cordata). These communities may grow on either organic or mineral soils, though the latter are usually termed wet prairies.

6.1.6.3.2 Affected Water and Wetlands

The area between the Hardee Power Station and the Pebbledale Substation contains various scattered water bodies and wetland areas. Any corridor located in this area of Florida is likely to traverse through some water bodies and wetlands.

Water bodies crossed by this corridor are listed in Table 6.1.6-2. All water bodies encountered within the corridor can be spanned without the need for placing supporting structures within the water bodies. No major bridge construction will be required for the associated access road. The potential impact of the transmission line on water bodies will be minimal, since the width of the final ROW selected within the corridor will be considerably less than the 0.8 km (0.5 mile) to 1.6 km (1 mile) corridor width. Most of the wetlands located in the corridor are small and isolated and efforts will be made to avoid wetland areas during selection of the ROW.

The section of corridor between the Hardee Power Station and the Pebbledale Substation includes numerous phosphate mining areas. Some of these areas have been reclaimed. Many of the mining areas in this section of the corridor contain isolated water bodies. The mining areas and associated water bodies will be avoided during final siting of the transmission line ROW. The preferred corridor crosses the South Prong Alafia River at a point 3.2 km (2 miles) north of Brewster. The South Prong Alafia River is classified as a Class III Surface Water (for recreation an propagation of aquatic life) in Chapter 17-3 F.A.C. The alternative corridor crosses the North Prong Alafia River at a point approximately 0.4 km (0.25 mile) east of the Pinedale Subdivision. This river is a Class III Surface Water (Chapter 17-3 F.A.C.).

Table 6.1.6-2. Water Bodies Within Preferred and Alternative Corridors
Between the Hardee Power Station and the Pebbledale
Substation

Water Body	Receiving Water	Corridor	Comments
Phosphate Mine	Isolated	C1, Cla	Numerous Phosphate Mines Between Hardee Power Station and Pebbledale Substation
South Prong Alafia River	Alafia River	Cla	Two Miles North of Brewster
North Prong Alafia River	Alafia River	Cla	West of Pinedale Subdivision

Note: C1 - Hardee Power Station to Pebbledale Substation
Cla - Hardee Power Station to Pebbledale Substation Alternative Corridor

6.1.6.3.3 Ecology

This section discusses species which are designated as endangered, threatened, or species of special concern by the USFWS or the FGFWFC and which, based on a literature survey and consultations with state, regional, and local agencies, are known or expected to occur in or near the proposed transmission corridor between the Hardee Power Station and the Pebbledale Substation. The species addressed may occur as residents, migrants, or transients. Lists of plant and animal species (Tables 6.1.6-3 and 6.1.6-4) discussed in the following sections were prepared in consultation with FGFWFC and the FNAI.

The probability of occurrence for threatened, endangered, and species of special concern within the corridor was based on known locations (e.g., eagle nests, wading bird colonies), recent and historical reports, and information in the scientific literature, and discussions with biologists familiar with the region. Locations of known occurrences of these species and habitat features critical to their survival within 457 m (1,500 ft) of the corridor are depicted in Figure 6.1.6-3 (see Appendix 11.10).

PLANT SPECIES

No genuinely rare plant species have been reported within the proposed transmission corridor and very few have been documented nearby. There have not been many botanical surveys of the region, however. The list of potentially present protected plants presented in Table 6.1.6-3 was derived from FNAI element occurrence records for a 58 km (36 miles) swath centered on the corridor study area. This list was edited to remove species restricted to Lake Wales Ridge and coastal habitats and supplemented with species documented during Agrico and CFI DRI studies.

There are several rare species that might possibly be found in open xeric habitats in the general area of the corridor. These include scrub holly, scrub buckwheat, Curtiss' milkweed, Ashe's savory, scrub milkwort, nodding pinweed, Florida beargrass, wild coco, and sand butterfly pea. Scientific names and federal and state statuses of these species are given in

Table 6.1.6-3. Protected Rare Plant Species Potentially Present within Five Miles of Proposed Transmission Line Corridor Between the Hardee Power Station and the Pebbledale Substation

Common Name	Scientific Name	Status	
		USFWS*	FDA**
Curtiss' milkweed	<u>Asclepias curtissii</u>		T
Ashe's savory	<u>Calamintha ashei</u>	UR1	T
Spoon-leaved sundew	<u>Drosera intermedia</u>		T
Florida beardgrass	<u>Gymnopogon floridanus</u>	UR2	
Water spider orchid	<u>Habernaria repens</u>		T
Hartwrightia	<u>Hartwrightia floridana</u>	UR2	T
Edison's ascyrum	<u>Hypericum edsonianum</u>	UR1	T
Scrub holly	<u>Ilex opaca</u> var. <u>arenicola</u>	UR5	
Thick-leaved water-willow	<u>Justicia crassifolia</u>	UR2	
Nodding pinweed	<u>Lechea cernua</u>	UR2	
Serpent fern	<u>Phlebodium aureum</u>		T
Scrub milkwort	<u>Polygala lewtonii</u>	UR1	E
Wild coco	<u>Pteroglossapis ecristata</u>	UR2	T
Banded wild-pine	<u>Tillandsia flexuosa</u>		T
Red needleleaf airplant	<u>Tillandsia setacea</u>		T
Shoestring fern	<u>Vittaria lineata</u>		T
Rain lily	<u>Zephyranthes simpsonii</u>	UR5	E
Scrub buckwheat	<u>Eriogonum floridanum</u>		T
Sand butterfly pea	<u>Centrosema arenicola</u>	UR5	

Note: E - Endangered

T - Threatened

UR1 - Under review for listing, with substantial evidence indicating some degree of biological vulnerability and/or threat

UR2 - Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking

UR5 - Still formally under review, but no longer considered a likely candidate for listing because recent information indicates species is more widespread or abundant than previously believed

* USFWS = U.S. Fish and Wildlife Service

** FDA = Florida Department of Agriculture

Table 6.1.6-4. Protected Animal Species Potentially Present within Five Miles of Proposed Transmission Line Corridor Between the Hardee Power Station and the Pebbledale Substation

Common Name	Scientific Name	Status	
		FGFWFC*	USFWS**
<u>MAMMALS</u>			
Sherman's fox squirrel	<u>Sciurus niger shermani</u>	SSC	UR2
Round-tailed muskrat	<u>Neofiber alleni</u>		UR2
<u>BIRDS</u>			
Bald eagle	<u>Haliaeetus leucocephalus</u>	T	E
Red-cockaded woodpecker	<u>Picoides borealis</u>	T	E
Little blue heron	<u>Egretta caerulea</u>	SSC	
Crested caracara	<u>Polyborus plancus audubonii</u>	T	
Southeastern American kestrel	<u>Falco sparverius paulus</u>	T	UR2
Swallow-tailed kite	<u>Elanoides forficatus</u>		UR2
Sandhill crane	<u>Grus canadensis pratensis</u>	T	
Florida scrub jay	<u>Aphelocoma coerulescens</u> <u>coerulescens</u>	T	T
Snowy egret	<u>Egretta thula</u>	SSC	
Tricolored heron	<u>Egretta tricolor</u>	SSC	
Wood stork	<u>Mycteria americana</u>	E	E
Florida burrowing owl	<u>Athene cunicularia floridana</u>	SSC	
<u>REPTILES</u>			
Gopher tortoise	<u>Gopherus polyphemus</u>	SSC	UR2
Eastern indigo snake	<u>Drymarchon corais couperi</u>	T	T
Blue-tailed mole skink	<u>Eumeces egregius lividus</u>	T	T
Florida pine snake	<u>Pituophis melanoleucus mugitus</u>	SSC	UR2
American alligator	<u>Alligator mississippiensis</u>	SSC	T(S/A)

Note: E - Endangered

T - Threatened

T(S/A) - Threatened due to similarity of appearance

SSC - Species of special concern

UR2 - Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

* Florida Game and Fresh Water Fish Commission

** U.S. Fish and Wildlife Service

Table 6.1.6-3. Scrub milkwort is the only one of these plants that is more than moderately rare. Serpent fern, red needleleaf airplant, and shoestring fern might be encountered growing as epiphytes on trees in swamp or hammock habitats.

Edison's ascyrum, hartwrightia, rain lily, water spider orchid, thick-leaved water willow, and/or spoon-leaved sundew may be found in wet depressions or seepage areas.

WILDLIFE SPECIES

The presence or potential for occurrence of the wildlife species listed in Table 6.1.6-4 within a given area is primarily related to the presence of suitable habitat for cover, feeding, and reproduction. In general, the type and quality of wildlife habitat depends upon vegetation, surrounding land use, and hydrology. Wildlife habitat types, therefore, frequently correspond to vegetation types.

The natural communities which serve as the principal wildlife habitats in the corridor include flatwoods, hammocks, and marshes. Most of these are present only as degraded remnants with limited habitat value.

A number of vertebrate species, including reptiles and amphibians, birds, and mammals were identified as important species occurring or possibly occurring within 8 km (5 miles) of the proposed corridor between the Hardee Power Station and the Pebbledale Substation (Table 6.1.6-4). The status and potential for occurrence of each of these species is discussed below.

REPTILES

Most of the rare xeric habitat reptiles of conservation concern to the north and east of the study area have not been documented west of the Lake Wales Ridge. The few known to occur in the Pebbledale corridor vicinity are as follows:

Gopher Tortoise (Gopherus polyphemus)

The gopher tortoise is listed as a species of special concern by FGFWFC and UR2 by USFWS. Gopher tortoise populations have declined due to collection as food and to habitat losses associated with urban growth and conversion of land to commercial pine plantations. Gopher tortoises occur in xeric habitats such as sandhills, xeric hammocks, pine flatwoods, scrubs, and old fields. The burrow excavated by the gopher tortoise is also used by a variety of other organisms, including gopher frogs and indigo snakes. The gopher frog, however, does not occur in the corridor area. Areas of suitable habitat along the corridor could be expected to support gopher tortoises.

Eastern Indigo Snake (Drymarchon corais couperi)

The eastern indigo snake is listed as threatened by both USFWS and FGFWFC. Reasons for its decline include habitat destruction, capture by snake collectors, and mortality from rattlesnake roundups. Eastern indigo snakes are found in dry, sandy areas such as pine flatwoods as well as in hardwood hammocks. Indigo snakes may be expected to occur in appropriate habitats in the corridor area.

Florida Pine Snake (Pituophis melanoleucus mugitus)

The pine snake is listed as a species of special concern by FGFWFC and UR2 by USFWS. It uses sandhills and other open, xeric habitats where pocket gophers, mice, and similar prey are abundant. Although pine snakes have been recorded as far south as Charlotte County, the bulk of the species' range is north of the corridor. It is thus not likely to be found within the affected area.

American Alligator (Alligator mississippiensis)

The alligator is listed as a species of special concern by FGFWFC and threatened due to similarity of appearance with the endangered American crocodile by USFWS. The alligator is found in wetland communities including lakes, ponds, rivers, and marshes. Alligators adapt fairly well to the presence of humans and can be found in urban areas if not molested. Populations have recovered to the point where USFWS has retained their

status as threatened only in order to protect the similar endangered American Crocodile. Alligators probably occur in almost all suitable habitats in the study area.

Blue-tailed Mole Skink (Eumeces egregius lividus)

This lizard is listed as threatened by FGFWFC and USFWS. It is known from only a small area of south-central Florida and is confined to scrub and sometimes shrubby sandhill habitats. The blue-tailed mole skink has been observed approximately 6.4 km (4 miles) east of the Pebbledale corridor, 13 km (8 miles) south of Vandolah. It might be found in scrub communities within the corridor.

MAMMALS

Few mammals of concern occur in the corridor area. Although several uncommon bat species have extensive ranges that encompass the corridor area, no breeding localities or other evidence that they are likely to be found here has been documented.

Sherman's Fox Squirrel (Sciurus niger shermani)

Sherman's fox squirrel is listed as a species of special concern by FGFWFC and UR2 by USFWS. Fox squirrels may occur in sandhill xeric flatwoods and open remnants in the Pebbledale corridor area. They require open, frequently burned sandhills with scattered pines and oaks as habitat.

Round-tailed Muskrat (Neofiber alleni)

The round-tailed muskrat is listed UR2 by USFWS. It utilizes marshes with dense stands of maidencane, pickerel weed, and sagittaria. This species has an irregular spotty distribution encompassing most of the Florida peninsula, including the study area. It may occur in appropriate habitats within the corridor.

BIRDS

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle is listed as threatened by FGFWFC and endangered by USFWS. Eagles in peninsular Florida include permanent residents and seasonal

migrants. Migrants occasionally occur along rivers or lakes. Eagle nests are generally located in tall pines or cypress. Two active nests have been recorded in the vicinity of the Pebbledale corridor. One is approximately 8.0 km (5 miles) south of Bradley Junction and 0.8 km (0.5 mile) west of the corridor centerline. The other is near the center of Section 25 about 3.2 km (2 miles) west of Pebbledale and 0.8 km (0.5 mile) east of the centerline of the nearest corridor segment.

Southeastern Kestrel (Falco sparverius paulus)

The southeastern kestrel is listed as threatened by FGFWFC and UR2 by USFWS. The practically indistinguishable unlisted eastern kestrel also winters in Florida. These small hawks utilize sandhills and similar open upland habitats where they hunt from perches and nest in cavities such as old woodpecker holes in pine trees. They may occur in appropriate habitats in the corridor area.

Burrowing Owl (Athene cunicularia)

Due to habitat loss, the burrowing owl is listed as a species of special concern by FGFWFC. This owl requires well drained sandy soil in areas of sparse growth such as prairies, sandhills, and pastures. Burrowing owls might be found in open upland habitats.

Crested Caracara (Polyborus plancus audubonni)

The caracara is considered threatened by both FGFWFC and USFWS. This is a large hawk whose Florida range is restricted to the open prairie region of the south-central portion of the peninsula. It forages in pastures and sparse pinelands, feeding on both carrion and live prey, and nests in cabbage palm trees. The species range is generally southeast of the study area, but the birds do occasionally travel through the region and could potentially be seen in the corridor.

Swallow-tailed Kite (Elanoides forficatus)

The swallow-tailed kite is listed as UR2 by USFWS. These birds range throughout Florida, but prefer habitat that is a mosaic of forested and open wetlands. They feed on insects and reptiles in wet prairies or marshes and

nest in large cypress or pine trees. Swallow-tailed kites may occasionally be seen in the corridor.

WADING BIRDS

Three species of protected wading birds are known or expected to occur in the vicinity of the corridor. These species are the snowy egret (Egretta thula), little blue heron (Egretta caerulea), and tricolored heron (Hydranassa tricolor). All three species are designated as species of special concern by FGFWFC. These birds utilize similar habitats, requiring wetlands for feeding and shrub swamp or cypress swamp for roosting and nesting. They can be expected to forage in suitable wetlands along the corridor. Although there are several historical records of wading birds nesting within a few miles of the corridor, no active rookeries have been observed within 8.0 km (5 miles) during recent surveys.

Wood Stork (Mycteria americana)

Wood storks are listed as endangered by FGFWFC and USFWS. Reasons for their decline include loss of feeding and nesting areas. Wood storks nest primarily in cypress or mangrove swamps, and forage where fish populations concentrate in freshwater marshes, ditches, and flooded pastures. Wood storks are expected to occasionally forage throughout the corridor in areas of suitable habitat. Storks have nested near the corridor in the past, but no active rookeries have been documented nearby recently.

Florida Sandhill Crane (Grus canadensis pratensis)

The resident Florida subspecies of the sandhill crane is listed as threatened by FGFWFC. Unlisted migratory birds join these flocks in the winter. The sandhill crane uses large open pastures and dry prairies as foraging habitat and breeds in associated wet prairies and marshes. Cranes may occasionally be seen in the corridor area.

Red-cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker is listed as threatened by FGFWFC and endangered by USFWS. The bird nests in "overmature" pines affected by a fungus disease that softens the heartwood. Timber management practices have

greatly reduced the numbers of these trees. No red-cockaded woodpecker colonies have been documented along the corridor and the limited area of pine forest remaining is probably insufficient to maintain populations.

Florida Scrub Jay (Aphelocoma coerulescens coerulescens)

The scrub jay is listed as threatened by both FGFWFC and USFWS. This species is very restricted in its habitat requirements, utilizing brushy early successional scrub habitats virtually exclusively. It has been observed near the corridor and may occur in suitable habitats along the route.

6.1.6.3.4 Other Environmental Features

All relevant environmental features associated with the transmission line corridor between the Hardee Power Station and the Pebbledale Substation have been presented in the preceding subsections. No additional information is deemed necessary to describe environmental characteristics of the transmission line corridor.

6.1.6.4 Effects of Right-of-Way Preparation and Transmission Line Construction

6.1.6.4.1 Construction Techniques

RIGHT-OF-WAY CLEARING

All trees, brush, and scrub growth in the ROW will be cleared. Trees beyond the boundary of the ROW may be trimmed or cut with the owners consent if it is determined that the trees present a danger to the transmission line. Equipment used to cut these may include bulldozers, shearing machines, or chainsaws.

ROAD AND PAD CONSTRUCTION

Access roads will be required in areas where the final transmission line ROW between the Hardee Power Station and the Pebbledale Substation does not follow existing roads. The overall objective of the access roads will be to provide efficient and safe ingress and egress to the transmission line structures while minimizing environmental impact and cost. Access roads

will be required for construction and maintenance of the transmission line facilities.

The use of fill will be minimized in the construction of access roads, and wherever possible, roads will be constructed by blading natural soil from both sides of the intended road. Where fill is required, it will be trucked in and spread, compacted, and shaped to the desired elevation. Access roads will be constructed to have a maximum surface width of 6.1 m (20 ft). Dump trucks may be used for hauling, and bulldozers and graders may be used for spreading and compacting. A typical cross section for the access road is presented in Figure 6.1.6-4.

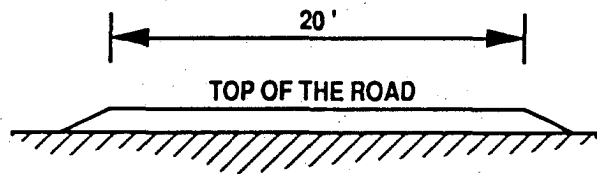
LINE CONSTRUCTION

Multiple structure configurations and construction materials will be used throughout the length of the transmission line from the Hardee Power Station to the Pebbledale Substation. The type of structure used in any particular area will be a function of the characteristics of the ROW and surrounding areas.

For the majority of the ROW which crosses open land, the preferred structure will be wooden H-frame construction (see Figure 6.1.3-1). H-frame construction involves directly imbedding the poles into native soil and attaching cross bracing after imbedment. Suspension insulators are then attached to the cross bracing to allow the phase conductors to be pulled. H-frame construction is used for tangent (straight line) construction.

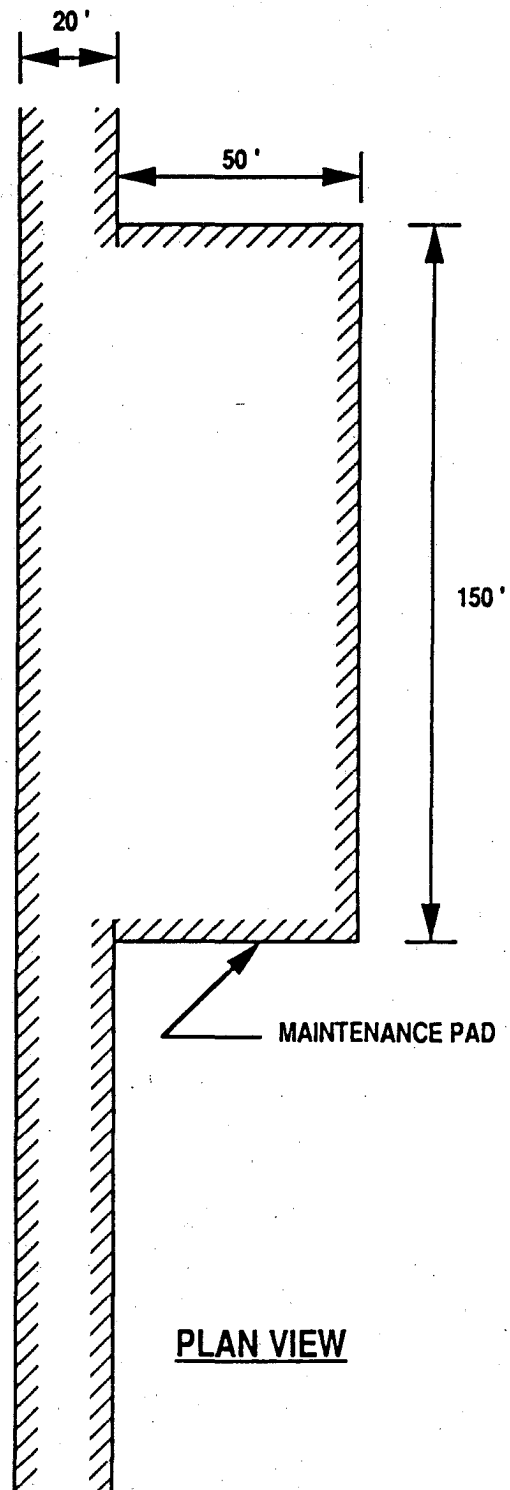
Where the ROW allows, three pole structures will be used for line angle construction. This type of construction involves directly imbedding the structures and guying to meet strength requirements. Once the poles and guy wires are installed, suspension insulators are attached to the structures to allow the conductor to be pulled.

Single pole construction will be used where ROW or other constraints limit the use of H-frame construction. Single pole structures are anticipated to be used in areas where the width of the ROW prohibits the use of H-frame



NOTE: FILL TO BE ADDED AS REQUIRED

CROSS-SECTION



PLAN VIEW

Figure 6.1.6-4 HARDEE POWER STATION TO PEBBLEDAL
SUBSTATION TYPICAL ACCESS ROAD PLAN
AND CROSS-SECTION

**Hardee
Power Station**

structures, and in areas where visual impacts are significant. Single pole structures may be directly imbedded with native soil, crushed rock or concrete backfill. Single pole structures can be used for line angles and can be designed to be self supporting.

Structures will be framed and erected using cranes and other support vehicles. Overhead ground wires and conductors will be installed by various wire-pulling equipment. Vehicles used to support line construction may include bulldozers, tractors, and other light vehicles.

Foundations for structures may be either native soil, crushed rock or concrete backfill. In addition, poured concrete foundations may be used where an extra strong foundation is required. With native soil or crushed rock backfill, a hole is augered and the pole is inserted into the hole. The backfill material is then compacted around the pole up to the surrounding ground level. In the case of poured concrete foundations, the required concrete foundation is poured and anchor bolts are installed. Once the foundation has set, the base of the pole is bolted onto the anchor bolts of the foundation.

EROSION

Disturbance to natural vegetation will be kept to a minimum to reduce the potential for erosion. Where necessary, erosion control measures will be utilized to eliminate erosion during construction. Routine maintenance of the ROW will be designed to minimize ground cover disturbance, and therefore reduce the potential for erosion during operation of the transmission line.

6.1.6.4.2 Impacts on Water bodies and Uses

Exact routing of the ROW within the corridor between the Hardee Power Station and the Pebbledale Substation has not been determined at present. All efforts will be made to avoid waters of the State, including jurisdictional wetlands, during the final routing of the Pebbledale transmission line ROW.

Construction of the Pebbledale transmission line and associated access road is expected to have minimal impact on waters of the State. During the siting process, corridor segments were identified which contained relatively few water bodies or wetlands greater than 0.4 km (0.25 mile) in length. This selection criteria was identified to screen out areas with water bodies or wetlands that could not be spanned by the transmission line. Several small drainage areas and the South Prong Alafia River will be crossed by the corridor but the line construction is not expected to have an impact on these water bodies. Based on the selected type of construction for the support structures, the transmission line will be able to span a maximum distance of approximately 0.4 km (0.25 mile) and still retain adequate ground clearance. Therefore, few, if any, support structures will be constructed within waters of the State. It is also anticipated that the Pebbledale transmission line will be able to span or be diverted around most wetlands. However, some filling in wetland areas may be required for the access road. Most of the wetlands crossed by this corridor are relatively small. Therefore, keyhole filling will be utilized where possible in lieu of continuous filling. The total area that will require filling is not known at the present time, but is expected to represent only a small fraction of the overall corridor length. Where road construction or structure placement must occur in wetlands, the following procedures will be followed. To control runoff of project site sediments, appropriate sediment control methods will be used. Methods to be used include staked silt fences with haybales in upland areas and transitional to shallow wetlands, and floating turbidity barriers in water bodies. Silt screens will be placed downstream of construction abutting all open water. In addition, in areas requiring minor excavation for culvert placement, appropriate stabilization of the banks will be provided.

No bridges are expected to be constructed in association with the transmission line or access road. Therefore, no restrictions to navigation will occur on any water body crossed by the corridor. Adequate clearance

between the surface of the water and the transmission line will be maintained, and no impedance to boat traffic or other water related activity will result.

6.1.6.4.3 Solid Wastes

Solid waste generated from ROW preparation and line construction generally consists of cleared vegetation and construction related debris. All cleared vegetation and combustible debris will be burned on-site. Applicable state and local regulations regarding on-site burning will be followed. Non-combustible material will be collected and disposal will occur at existing landfills.

Approximately three yards of native soil is expected to be removed for each pole installation. The majority of this soil will be used for backfill in cases where native soil backfill is acceptable for foundation. In cases where crushed rock backfill or concrete foundations are used, the soil will be spread over the ROW in a manner to minimize the impact on the surrounding area.

6.1.6.4.4 Changes to Vegetation, Wildlife, and Aquatic Life

ROW preparation and line construction for the Pebbledale transmission line will have minimal adverse impact on terrestrial or aquatic systems because the corridor has been chosen to avoid major areas of ecological importance and the ROW will be routed to avoid smaller areas of significant habitat within the corridor. Critical habitats, substantial areas of forest or wetland, concentrations of rare species, breeding locations of sensitive species, and important examples of rare or threatened natural communities were all screened out during the corridor selection process.

Tampa Electric plans to avoid construction of raised roads wherever possible, so disruption of hydrological patterns should be minimal. Culverts and similar engineering solutions will be applied to correct any disturbance to drainage caused by essential road improvements.

Trees must be cut out of the area beneath and immediately adjacent to the lines.

Construction activities will inevitably have some direct impact on wildlife. Some animals will be displaced from the ROW by disturbance. Plants will be impacted by essential cutting and clearing activities. The cumulative effect of these impacts will be minimal, however, since care has been and will continue to be taken to avoid important habitats.

6.1.6.4.5 Impact on Human Populations

Specialized crews will work to clear easements, clear access roads, prepare foundations, assemble and erect support structures, string conductors, and clean up, with overlap of activities as required. Construction of the Pebbledale line is anticipated to take approximately 18 months. It is expected that construction of the Pebbledale line will not restrict traffic flow on roads adjacent to or crossed by the line. Short-term impacts to area residents from the noise of saws and other equipment which will be required to clear the corridor and construct the support structures will be of short duration.

A construction work crew of approximately 15-20 will be required, with work generally taking place between the hours of 7:00 a.m. and 7:00 p.m. The relatively small number of workers and minimal amount of equipment required for this effort are not expected to cause any significant impact on traffic conditions on area roads either during morning and evening peak traffic periods, or during the day.

6.1.6.4.6 Impact on Regional Scenic, Cultural and Natural Landmarks

As noted in Section 6.1.6.2.4, no state resources areas are crossed by the Pebbledale transmission line.

6.1.6.4.7 Impact on Archaeological and Historical Sites

Upon selection of a final ROW, a professional archaeological survey will be conducted for any areas within the ROW previously identified by DHR as

having potentially significant archaeological sites (see Appendix 11.3) and which will be disturbed by land clearing and construction activities.

These sites will be avoided during construction of the transmission line and subsequently during the maintenance of those properties to assure in-place site preservation. If avoidance is not feasible, impacts will be mitigated through archaeological salvage excavation conducted by a professional archaeologist. The DHR will be consulted regarding appropriate procedures for either preservation or excavation of any significant site(s).

If unforeseen artifacts or archaeological sites are discovered during construction, the DHR will be notified. Following a determination of the importance of these artifacts or sites, the Applicant will work with the DHR to assess mitigation measures necessary to minimize adverse impacts.

6.1.6.5 Post-Construction Impacts and Effects of Maintenance

6.1.6.5.1 Maintenance Techniques

TRANSMISSION LINE MAINTENANCE

The Pebbledale transmission line ROW will be patrolled and inspected regularly to identify structures in need of repair. Occasional maintenance will be required on the transmission structures. Insulators will be replaced when damaged as will supporting clamps and braces. Wood transmission poles are expected to be replaced on the average of every 15 years. Where steel or concrete poles are used, there will be minimum pole maintenance needed. The expected life of these poles is in excess of 30 years. The maintenance of the transmission line is expected to have a minimum impact on the surrounding area.

RIGHT-OF-WAY MAINTENANCE

Mechanical mowing and herbicides will be used to keep the ROW clear of unwanted vegetation. These chemicals will be used as needed. All herbicide application will be conducted in a manner consistent with all state and local regulations and will be carried out by trained personnel.

No burning is anticipated to be needed for the maintenance of the ROW.

6.1.6.5.2 Multiple Uses

Various activities including citrus farming, grazing, and agriculture are typically allowed within the ROW as long as these activities do not interfere with full use of the ROW. An easement will be obtained for the construction and operating of the Pebbledale transmission line, including ingress and egress to the transmission line. Specific uses within the ROW will be addressed individually with affected parties. Multiple use of the ROW may be restricted in certain areas, but in general, compatible multiple uses will be allowed.

6.1.6.5.3 Changes in Species Populations

WILDLIFE AND AQUATIC LIFE

Potential post-construction impacts along the Pebbledale transmission line fall into four major categories: 1) impacts related to the actual transmission lines and supporting poles; 2) impacts of ROW maintenance procedures; 3) disturbances associated with access roads; and 4) effects of electromagnetic fields (EMFs).

The primary concern associated with the actual transmission line is the potential increase in bird mortality due to collisions with the wires. The impacts of collisions with power lines on avian mortality are difficult to quantify. It is generally agreed, however, that collisions are a potentially significant cause of mortality among birds. It is also agreed that a large percentage of avian mortality from collisions with power lines can be avoided through careful planning (Anderson, 1978; Lee, 1978; Faanes, 1987). For this reason, the corridor was routed to minimize the potential for collisions by avoiding areas of known bird concentrations and areas used for foraging, roosting, or nesting by sensitive species. Special attention has been given to habitats used by bald eagles, wood storks and other wading birds and sandhill cranes.

The ROW must be maintained so that trees cannot grow into the overhead wires. This implies maintenance of a permanent gap in the canopy through any forested areas. In hydric or mesic habitats this may have a slight deleterious effect in drying and heating the microclimate of the adjacent

forest. Generally, however, in the habitat types prevalent in the corridor, creation of desirable edge habitat and maintenance of early successional vegetation could have a positive effect on sensitive species. Gopher tortoises, and several other species of concern in this region prefer relatively open habitats.

Herbicide use will be implemented in such a manner so as to minimize impact to wildlife or aquatic organisms.

Access roads can act as barriers to animals reluctant to cross openings, and can displace (or subject to routine trampling) a certain amount of vegetation. These impacts should be minimal, however, because Tampa Electric intends to use existing roads wherever feasible and minimize the lengths of any essential new roads.

6.1.6.5.4 Effects of Public Access

It is Tampa Electric's policy to install locked gates at all points where the transmission line access road intersects previously fenced property. Therefore, with the exception of Tampa Electric's personnel performing routine maintenance, no increased vehicle access is anticipated. Since no significant increase in human traffic into formerly inaccessible habitats will result, there will be no subsequent increased disturbance to wildlife.

6.1.6.5.5 Other Post Construction Effects

The transmission line will meet EMF limits set forth in Chapter 17-274, F.A.C. Maximum electric and magnetic field strengths at the edge of the ROW for the transmission line were calculated using the Bonneville Power Administration Corona and Fields Effects program. Input data used in the program were based on the generating capacity of the Hardee Power Station and included the following parameters:

1. A maximum current rating of 2,040 amperes;
2. A minimum conductor clearance of 27 ft from the earth;
3. Currents were assumed to be balanced in phase and in magnitude with no zero sequence current;
4. A maximum operating voltage of 242 kV; and
5. Voltages were assumed to be balanced in phase and in magnitude.

Where are calculations results?

Electromagnetic fields strengths will vary depending on the ROW width and structure type. The maximum field strengths at the edge of the transmission ROW will be below the field strength standards listed in Chapter 17-274.450, F.A.C. (i.e., 2.00 kV/m for electric field, and 150 milliGauss for magnetic field). The entire transmission line facility will meet the applicable sections of the National Electrical Safety Code. Due to the design and routing of the proposed transmission line and its location relative to residential areas, EMF and acoustic and electric noise will not be a problem.

6.1.7 Hardee Power Station to Vandolah and Lee Substations Transmission Line

6.1.7.1 Description of Preferred and Alternative Corridors

The preferred corridors from the Hardee Power Station to both the Vandolah and Lee Substations are described below. The corridor description starts at the Hardee Power Station and proceeds south to Vandolah Substation and from Vandolah Substation south to Lee Substation. These transmission lines will be constructed and maintained by SECI.

HARDEE POWER STATION TO VANDOLAH SUBSTATION

This section of the corridor starts at the Hardee Power Station and proceeds south, approximately 13 km (8 miles) to the Vandolah Substation located on Vandolah Road (see Figure 6.1.7-1 in Appendix 11.10). Much of the land between the Hardee Power Station and the Vandolah Substation is owned by various phosphate mining companies and may be mined in the future. Due to the potential for mining activities in this area, the siting study concentrated on routing the corridor adjacent to existing highway and railroad ROWs.

The Hardee Power Station to Vandolah corridor is approximately 13 km (8 miles) and starts at the switchyard of the Hardee Power Station and proceeds south along CR 663. The width of this section of corridor is 0.8 km (0.5 mile) with the exception of a 1.6-km (1-mile) section where it increases to 1.2 km (0.75 mile) near the town of Ft. Green Springs. The expanded corridor width near Ft. Green Springs is designed to allow additional flexibility in siting the ROW in this area to minimize potential impacts to developed areas.

Two parallel 230 kV transmission lines are planned for the Hardee Power Station to Vandolah section of the corridor. Separate ROWs and structures are needed for each of the two transmission lines in this area. Both lines

will start at the Hardee Power Station and one line will terminate at the Vandolah Substation while the other line continues south to the Lee Substation in North Ft. Myers. Both ROWs will be located within the 0.8 km (0.5 mile) corridor.

VANDOLAH SUBSTATION TO LEE SUBSTATION

The Vandolah to Lee corridor is approximately 113 km (70 miles) and starts at the Vandolah Substation and continues south parallel to CR 663, CR 661 and the CSX Railroad for a distance of approximately 26 km (16 miles). The width of the corridor decreases from its standard width of 0.8 km (0.5 mile) to a width of 0.4 km (0.25 mile) for a distance of approximately 0.8 km (0.5 mile) near Ona, and then increases to one mile for a short distance near the Town of Limestone. These changes in corridor width were incorporated to minimize impacts to populated areas. At the end of this section, the corridor turns slightly to the west and decreases in width to 0.4 km (0.25 miles) and continues for a distance of approximately 2.6 km (1.6 miles) to Lansing. The decrease in width to 0.4 km (0.25 mile) and the location of the corridor immediately west of the railroad was designed to avoid residential development to the east of the railroad.

At Lansing, the corridor turns to the west, away from the railroad for a distance of approximately 0.4 km (0.25 mile) and then heads south continuing along CR 661 to the intersection with SR 70. The corridor maintains a width of 0.8 km (0.5 mile) from Lansing to the intersection with SR 70. At SR 70 the corridor turns to the east for 2.4 km (1.5 miles) and follows the highway, maintaining a width of approximately 0.5 km (0.3 mile) (to avoid the Peace River to the north). The corridor then crosses the Peace River near the existing SR 70 crossing, west of the town of Arcadia. After the corridor crosses the Peace River near Arcadia, it turns to the south and follows the CSX Railroad just west of Arcadia for a distance of approximately 1.9 km (1.2 miles), maintaining a width of 0.4 km (0.25 mile). The corridor then increases in width to 0.8 km (0.5 mile), turns to the southwest and parallels an old railroad grade east of the Peace River and south of Arcadia for a distance of approximately 3 km (2 miles). The corridor then turns to the southeast for a distance of approximately 3.7 km

(2.3 miles), crossing the CSX Railroad, U.S. Highway 17, and SR 760. Approximately 0.4 km (0.25 mile) south of SR 760, the corridor decreases in width to 0.4 km (0.25 mile) and heads due south for approximately 15.7 km (9.8 miles). The corridor in this area crosses predominantly open land with scattered residential and agricultural uses. The corridor angles east for approximately 0.53 km (0.33 mile) to avoid a residential development to the west. The corridor then turns due south for 2.6 km (1.6 miles) to a point approximately 1.2 km (0.75 mile) north of Shell Creek. The corridor then angles southwest for about 5 km (3 miles), crossing Shell Creek.



The corridor turns due west parallelling SR 74 for 5 km (3 miles) and maintains a width of 0.8 km (0.5 mile). The center line of the corridor in this section follows along the northern boundary of the Cecil M. Webb Wildlife Management Area. At the western boundary of the management area, the corridor angles across the extreme northwest corner of the wildlife management area and proceeds due south for 15.8 km (9.85 miles). The width of the corridor in this section extends from 0.20 km (0.13 mile) west of the wildlife management area boundary to 0.60 km (0.38 mile) east of the wildlife management area boundary.

The corridor then turns southwest for about 0.8 km (0.5 mile), leaves the Cecil M. Webb Wildlife Management Area and crosses U.S. Highway 41. This section of the corridor was selected to minimize impacts to developed areas near U.S. Highway 41 and to align the corridor to proceed directly south through areas without residential development. The corridor then proceeds south for approximately 12 km (7.5 miles) to Gator Slough Canal in Lee County. The corridor width decreases to 0.4 km (0.25 mile) for 1.6 km (1 mile) immediately west of the Charlotte County Sanitary Landfill. This section of the corridor was selected due to the absence of any residential or commercial development in the immediate area. Just north of Gator Slough Canal, the corridor turns east for 1.6 km (1 mile). The corridor then turns due south for 1.6 km (1 mile) just west of the City of Cape Coral city limits and maintains with a width of 0.4 km (0.25 mile). The corridor then enters the City of Cape Coral, decreases in width to 61 m (200 ft), and angles toward the east for approximately 0.3 km (0.2 mile). The corridor

then heads south for 0.8 km (0.5 mile), at which point the corridor turns east and continues for 2.9 km (1.8 mile). The corridor then turns north for 0.5 km (0.3 mile) to avoid some residential development. At this point, the corridor then turns back toward the east and continues for 0.3 km (0.2 mile). The corridor then increases in width to 0.4 km (0.25 mile) and continues east for 1.0 km (0.6 mile), at which point the corridor turns south for 1.6 km (1.0 mile), terminating at the Lee Substation.

6.1.7.2 Socio-Political Environment of the Vandolah and Lee Substations Corridor Area

6.1.7.2.1 Governmental Jurisdictions

The preferred corridor is shown in Figure 6.1.7-1 (see Appendix 11.10) at a scale of 1:126,720 relative to governmental jurisdictions within 0.8 km (0.5 mile) of the edge of the corridor. The corridor runs in a north to south orientation through the counties of Hardee, DeSoto, Charlotte and Lee. The corridor crosses through a small section of the city of Cape Coral in northern Lee County and passes adjacent to the city of Arcadia in DeSoto County. No other incorporated municipalities are known to occur within 0.8 km (0.5 mile) of the corridor. The Cecil M. Webb Wildlife Management Area (located in Charlotte County) and the Peace River (canoe trail) which is crossed by the corridor near the city of Arcadia in DeSoto County are the only areas under governmental jurisdiction which are located within 0.8 km (0.5 mile) of the corridor.

6.1.7.2.2 Zoning and Land Use

HARDEE COUNTY

The relevant provisions of the Hardee County Comprehensive Plan are discussed in Section 2.2.2 of this document. No specific constraints on transmission line siting are set forth in the plan. The discussion in this section pertaining to planning approach, adjacent land uses, ecology, etc., demonstrates that the 230 kV transmission line corridors in Hardee County are consistent with the Hardee County Comprehensive Plan. Moreover, transmission lines are specifically authorized in all zoning districts in Hardee County as use exceptions pursuant to Section 2.3G of the Hardee County Zoning Ordinance.

Future land use maps showing the areas crossed by the Hardee Power Station to Vandolah and Lee Substation corridors are presented in Figure 6.1.7-2 (see Appendix 11.10).

DESOTO COUNTY

The DeSoto County Comprehensive Plan, including the Land Use Element, places no specific restrictions or preclusions on transmission line location. The Land Use Element, like those for Polk and Hardee Counties, essentially sets forth a series of narrative guidelines. The sections in this application addressing the ecological and land use features along the DeSoto County portion of the transmission line corridor demonstrate that the proposed corridor reflects requisite sensitivity to land use and environmental concerns. Moreover, Section 8-8 of the DeSoto County Zoning Ordinance provides that "electric cables" are "permitted uses" and "allowed as a matter of right" in all zoning districts.

CHARLOTTE COUNTY

The transmission line corridor in Charlotte County will avoid the majority of areas designated as residential on the Land Use Element of Charlotte County's Comprehensive Plan. The corridor will pass through some areas designated as agricultural and significant expanses of vacant or undeveloped land. Also, as shown on Figure 6.1.7-1 (see Appendix 11.10), the corridor will pass along the northwest border of the 26,440 ha (65,334 acres) Cecil M. Webb Wildlife Management Area, a "natural reserve" managed by the Florida Game and Fresh Water Fish Commission. It is designated as a "preservation area" in the Land Use Element. This designation requires that the county must stringently review any development plans for the Webb area for consistency with management goals and cooperate with wildlife management area managers. In practice, it means that county officials will generally voice support for FGFWFC's position on issues concerning transmission line routing in the vicinity of Webb.

The Charlotte County Comprehensive Plan contains no specific restriction on transmission lines. As shown elsewhere in this section of this application,

EMF

HARDEE POWER STATION TO PEBBLEDALE

SUBSTATION TRANSMISSION LINE

 * CORONA AND FIELD *
 * EFFECTS PROGRAM *
 * Source: Bonneville Power Administration *

*** INPUT DATA LIST ***

+HFRAME
 +PEBBLEDALE SUB. TO HARDEE SUB.
 + 1 0 3 5 242.0 2.00 1.00 .00

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 5 CONDUCTORS, OF WHICH 3 ARE ENERGIZED PHASES

+COMB	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
+ 5.000	5.000	30.000	5.000	1.000	75.000	3.280	4.000	3.280												
+PH.A-1	A	-17.50	27.00	1	1.502	.00	242.00	.0	2040.	.00										
+PH.B-1	A	.00	27.00	1	1.502	.00	242.00	120.0	2040.	.00										
+PH.C-1	A	17.50	27.00	1	1.502	.00	242.00	240.0	2040.	.00										
+OHG1-1	A	-8.75	43.00	1	.375	.00	.00	.0	0.	.00										
+OHG2-1	A	8.75	43.00	1	.375	.00	.00	.0	0.	.00										
+ 200	-100.0	1.0																		
+ 0	.0	.0																		

STRUCTURE TYPE 1
 H FRAME

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, ELECTRIC AND MAGNETIC FIELD

HFRAME

LEDALD SUB. TO HARDEE SUB.

	DIST. FROM ZERO REFERENCE (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-L (KV)	PHASE ANGLE (DEGREES)	CURRENT (AMPS)	CORONA LOSSES (KW/MI)
PH.A-1	-17.50	27.00	12.53	1.502	1.00	.00	242.00	.00	2040.0	2.948
PH.B-1	.00	27.00	13.37	1.502	1.00	.00	242.00	120.00	2040.0	4.514
PH.C-1	17.50	27.00	12.53	1.502	1.00	.00	242.00	240.00	2040.0	2.948
OHG1-1	-8.75	43.00	2.90	.375	1.00	.00	.00	.00	.0	.000
OHG2-1	8.75	43.00	2.90	.375	1.00	.00	.00	.00	.0	.000

AM MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 30.0 M, ALTITUDE= .0 FT

RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ) = 2.000 MPH, GROUND CONDUCTIVITY = 4.0 MMHOS/M

E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT. = 3.3FT

STRUCTURE TYPE 1
H FRAME

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI TOTAL RAIN DBUV/M	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M			
-100.0	37.6	12.6	41.1	24.1	9.7	.23	39.60
-99.0	37.6	12.6	41.2	24.2	9.7	.23	40.38
-98.0	37.7	12.7	41.4	24.4	9.8	.24	41.19
-97.0	37.7	12.7	41.5	24.5	9.9	.25	42.02
-96.0	37.8	12.8	41.7	24.7	10.0	.26	42.87
-95.0	37.8	12.8	41.8	24.8	10.1	.26	43.75
-94.0	37.9	12.9	42.0	25.0	10.2	.27	44.65
-93.0	37.9	12.9	42.1	25.1	10.3	.28	45.59
-92.0	38.0	13.0	42.3	25.3	10.4	.29	46.55
-91.0	38.0	13.0	42.4	25.4	10.5	.30	47.54
-90.0	38.1	13.1	42.6	25.6	10.6	.31	48.57
-89.0	38.1	13.1	42.8	25.8	10.7	.32	49.63
-88.0	38.2	13.2	42.9	25.9	10.8	.33	50.72
-87.0	38.3	13.3	43.1	26.1	10.9	.34	51.85
-86.0	38.3	13.3	43.2	26.2	11.0	.35	53.01
-85.0	38.4	13.4	43.4	26.4	11.1	.36	54.22
-84.0	38.4	13.4	43.6	26.6	11.2	.37	55.46
-83.0	38.5	13.5	43.8	26.8	11.3	.38	56.75
-82.0	38.5	13.5	44.0	27.0	11.4	.39	58.08
-81.0	38.6	13.6	44.2	27.2	11.5	.41	59.45
-80.0	38.7	13.7	44.4	27.4	11.6	.42	60.88
-79.0	38.7	13.7	44.6	27.6	11.7	.44	62.35
-78.0	38.8	13.8	44.9	27.9	11.8	.45	63.88
-77.0	38.8	13.8	45.1	28.1	11.9	.47	65.46
-76.0	38.9	13.9	45.4	28.4	12.0	.48	67.10
-75.0	39.0	14.0	45.6	28.6	12.2	.50	68.80
-74.0	39.0	14.0	45.9	28.9	12.3	.52	70.57
-73.0	39.1	14.1	46.1	29.1	12.4	.54	72.40
-72.0	39.2	14.2	46.4	29.4	12.5	.56	74.30
-71.0	39.2	14.2	46.6	29.6	12.6	.58	76.27
-70.0	39.3	14.3	46.9	29.9	12.8	.60	78.32
-69.0	39.4	14.4	47.1	30.1	12.9	.62	80.44
-68.0	39.4	14.4	47.4	30.4	13.0	.65	82.65
-67.0	39.5	14.5	47.7	30.7	13.1	.67	84.95
-66.0	39.6	14.6	48.0	31.0	13.3	.70	87.35
-65.0	39.6	14.6	48.3	31.3	13.4	.73	89.84
-64.0	39.7	14.7	48.5	31.5	13.5	.75	92.43
-63.0	39.8	14.8	48.8	31.8	13.7	.78	95.13
-62.0	39.9	14.9	49.1	32.1	13.8	.82	97.94
-61.0	39.9	14.9	49.4	32.4	13.9	.85	100.86
-60.0	40.0	15.0	49.7	32.7	14.1	.88	103.92
-59.0	40.1	15.1	50.1	33.1	14.2	.92	107.10
-58.0	40.2	15.2	50.4	33.4	14.4	.96	110.42
-57.0	40.2	15.2	50.7	33.7	14.5	1.00	113.88
-56.0	40.3	15.3	51.0	34.0	14.7	1.04	117.50
-55.0	40.4	15.4	51.3	34.3	14.8	1.08	121.28
-54.0	40.5	15.5	51.7	34.7	15.0	1.13	125.22
-53.0	40.6	15.6	52.0	35.0	15.2	1.18	129.33
-52.0	40.7	15.7	52.4	35.4	15.5	1.23	133.63
-51.0	40.7	15.7	52.7	35.7	15.7	1.28	138.13
-50.0	40.8	15.8	53.1	36.1	16.0	1.34	142.82
-49.0	40.9	15.9	53.4	36.4	16.2	1.40	147.73
-48.0	41.0	16.0	53.8	36.8	16.5	1.46	152.86
-47.0	41.1	16.1	54.2	37.2	16.8	1.52	158.22
-46.0	41.2	16.2	54.5	37.5	17.1	1.59	163.81

STRUCTURE TYPE 1
H FRAME

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI TOTAL	ELECTRIC	MAGNETIC
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	RAIN DBUV/M	FIELD KV/M	FIELD MG
-45.0	41.3	16.3	54.9	37.9	17.4	1.65	169.66
-44.0	41.4	16.4	55.3	38.3	17.7	1.73	175.77
-43.0	41.5	16.5	55.7	38.7	18.1	1.80	182.15
-42.0	41.6	16.6	56.0	39.0	18.4	1.88	188.80
-41.0	41.7	16.7	56.4	39.4	18.8	1.96	195.73
-40.0	41.8	16.8	56.8	39.8	19.1	2.04	202.96
-39.0	41.9	16.9	57.2	40.2	19.5	2.12	210.49
-38.0	42.0	17.0	57.6	40.6	19.9	2.20	218.31
-37.0	42.1	17.1	58.0	41.0	20.3	2.29	226.43
-36.0	42.2	17.2	58.4	41.4	20.8	2.38	234.86
-35.0	42.3	17.3	58.7	41.7	21.3	2.47	243.58
-34.0	42.4	17.4	59.1	42.1	21.8	2.55	252.58
-33.0	42.5	17.5	59.5	42.5	22.3	2.64	261.86
-32.0	42.6	17.6	59.8	42.8	22.8	2.72	271.40
-31.0	42.7	17.7	60.2	43.2	23.4	2.81	281.18
-30.0	42.8	17.8	60.5	43.5	24.1	2.88	291.16
-29.0	42.9	17.9	60.9	43.9	24.7	2.96	301.32
-28.0	43.0	18.0	61.2	44.2	25.5	3.02	311.61
-27.0	43.1	18.1	61.5	44.5	26.3	3.08	321.99
-26.0	43.1	18.1	61.7	44.7	27.1	3.14	332.41
-25.0	43.2	18.2	62.0	45.0	28.1	3.18	342.80
-24.0	43.3	18.3	62.2	45.2	29.1	3.21	353.11
-23.0	43.4	18.4	62.4	45.4	30.3	3.23	363.27
-22.0	43.5	18.5	62.6	45.6	31.6	3.23	373.21
-21.0	43.6	18.6	62.7	45.7	33.0	3.22	382.86
-20.0	43.7	18.7	62.8	45.8	34.4	3.20	392.15
-19.0	43.8	18.8	62.9	45.9	35.7	3.16	401.01
-18.0	43.8	18.8	62.9	45.9	36.6	3.10	409.40
-17.0	43.9	18.9	62.9	45.9	36.6	3.04	417.25
-16.0	44.0	19.0	62.9	45.9	35.7	2.96	424.52
-15.0	44.1	19.1	63.1	46.1	34.4	2.86	431.18
-14.0	44.1	19.1	63.4	46.4	33.0	2.76	437.21
-13.0	44.2	19.2	63.8	46.8	31.6	2.65	442.58
-12.0	44.2	19.2	64.1	47.1	30.3	2.53	447.32
-11.0	44.3	19.3	64.4	47.4	29.1	2.41	451.42
-10.0	44.3	19.3	64.7	47.7	29.3	2.29	454.92
-9.0	44.4	19.4	65.0	48.0	30.1	2.17	457.84
-8.0	44.4	19.4	65.3	48.3	31.0	2.05	460.24
-7.0	44.5	19.5	65.5	48.5	32.0	1.95	462.15
-6.0	44.5	19.5	65.7	48.7	33.1	1.85	463.65
-5.0	44.5	19.5	65.9	48.9	34.3	1.77	464.78
-4.0	44.5	19.5	66.1	49.1	35.7	1.70	465.61
-3.0	44.6	19.6	66.2	49.2	37.1	1.65	466.19
-2.0	44.6	19.6	66.3	49.3	38.5	1.61	466.56
-1.0	44.6	19.6	66.3	49.3	39.7	1.59	466.77
.0	44.6	19.6	66.4	49.4	40.1	1.58	466.84
1.0	44.6	19.6	66.3	49.3	39.7	1.59	466.77
2.0	44.6	19.6	66.3	49.3	38.5	1.61	466.56
3.0	44.6	19.6	66.2	49.2	37.1	1.65	466.19
4.0	44.5	19.5	66.1	49.1	35.7	1.70	465.61
5.0	44.5	19.5	65.9	48.9	34.3	1.77	464.78
6.0	44.5	19.5	65.7	48.7	33.1	1.85	463.65
7.0	44.5	19.5	65.5	48.5	32.0	1.95	462.15
8.0	44.4	19.4	65.3	48.3	31.0	2.05	460.24
9.0	44.4	19.4	65.0	48.0	30.1	2.17	457.84

STRUCTURE TYPE 1
H FRAME

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TOTAL RAIN DBUV/M		
10.0	44.3	19.3	64.7	47.7	29.3	2.29	454.92
11.0	44.3	19.3	64.4	47.4	29.1	2.41	451.42
12.0	44.2	19.2	64.1	47.1	30.3	2.53	447.32
13.0	44.2	19.2	63.8	46.8	31.6	2.65	442.58
14.0	44.1	19.1	63.4	46.4	33.0	2.76	437.21
15.0	44.1	19.1	63.1	46.1	34.4	2.86	431.18
16.0	44.0	19.0	62.9	45.9	35.7	2.96	424.52
17.0	43.9	18.9	62.9	45.9	36.6	3.04	417.25
18.0	43.8	18.8	62.9	45.9	36.6	3.10	409.40
19.0	43.8	18.8	62.9	45.9	35.7	3.16	401.01
20.0	43.7	18.7	62.8	45.8	34.4	3.20	392.15
21.0	43.6	18.6	62.7	45.7	33.0	3.22	382.86
22.0	43.5	18.5	62.6	45.6	31.6	3.23	373.21
23.0	43.4	18.4	62.4	45.4	30.3	3.23	363.27
24.0	43.3	18.3	62.2	45.2	29.1	3.21	353.11
25.0	43.2	18.2	62.0	45.0	28.1	3.18	342.80
26.0	43.1	18.1	61.7	44.7	27.1	3.14	332.41
27.0	43.1	18.1	61.5	44.5	26.3	3.08	321.99
28.0	43.0	18.0	61.2	44.2	25.5	3.02	311.61
29.0	42.9	17.9	60.9	43.9	24.7	2.96	301.32
30.0	42.8	17.8	60.5	43.5	24.1	2.88	291.16
31.0	42.7	17.7	60.2	43.2	23.4	2.81	281.18
32.0	42.6	17.6	59.8	42.8	22.8	2.72	271.40
33.0	42.5	17.5	59.5	42.5	22.3	2.64	261.86
34.0	42.4	17.4	59.1	42.1	21.8	2.55	252.58
35.0	42.3	17.3	58.7	41.7	21.3	2.47	243.58
36.0	42.2	17.2	58.4	41.4	20.8	2.38	234.86
37.0	42.1	17.1	58.0	41.0	20.3	2.29	226.43
38.0	42.0	17.0	57.6	40.6	19.9	2.20	218.31
39.0	41.9	16.9	57.2	40.2	19.5	2.12	210.49
40.0	41.8	16.8	56.8	39.8	19.1	2.04	202.96
41.0	41.7	16.7	56.4	39.4	18.8	1.96	195.73
42.0	41.6	16.6	56.0	39.0	18.4	1.88	188.80
43.0	41.5	16.5	55.7	38.7	18.1	1.80	182.15
44.0	41.4	16.4	55.3	38.3	17.7	1.73	175.77
45.0	41.3	16.3	54.9	37.9	17.4	1.65	169.66
46.0	41.2	16.2	54.5	37.5	17.1	1.59	163.81
47.0	41.1	16.1	54.2	37.2	16.8	1.52	158.22
48.0	41.0	16.0	53.8	36.8	16.5	1.46	152.86
49.0	40.9	15.9	53.4	36.4	16.2	1.40	147.73
50.0	40.8	15.8	53.1	36.1	16.0	1.34	142.82
51.0	40.7	15.7	52.7	35.7	15.7	1.28	138.13
52.0	40.7	15.7	52.4	35.4	15.5	1.23	133.63
53.0	40.6	15.6	52.0	35.0	15.2	1.18	129.33
54.0	40.5	15.5	51.7	34.7	15.0	1.13	125.22
55.0	40.4	15.4	51.3	34.3	14.8	1.08	121.28
56.0	40.3	15.3	51.0	34.0	14.7	1.04	117.50
57.0	40.2	15.2	50.7	33.7	14.5	1.00	113.88
58.0	40.2	15.2	50.4	33.4	14.4	.96	110.42
59.0	40.1	15.1	50.1	33.1	14.2	.92	107.10
60.0	40.0	15.0	49.7	32.7	14.1	.88	103.92
61.0	39.9	14.9	49.4	32.4	13.9	.85	100.86
62.0	39.9	14.9	49.1	32.1	13.8	.82	97.94
63.0	39.8	14.8	48.8	31.8	13.7	.78	95.13
64.0	39.7	14.7	48.5	31.5	13.5	.75	92.43

STRUCTURE TYPE 1
H FRAME

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE'		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
65.0	39.6	14.6	48.3	31.3	13.4	.73	89.84
66.0	39.6	14.6	48.0	31.0	13.3	.70	87.35
67.0	39.5	14.5	47.7	30.7	13.1	.67	84.95
68.0	39.4	14.4	47.4	30.4	13.0	.65	82.65
69.0	39.4	14.4	47.1	30.1	12.9	.62	80.44
70.0	39.3	14.3	46.9	29.9	12.8	.60	78.32
71.0	39.2	14.2	46.6	29.6	12.6	.58	76.27
72.0	39.2	14.2	46.4	29.4	12.5	.56	74.30
73.0	39.1	14.1	46.1	29.1	12.4	.54	72.40
74.0	39.0	14.0	45.9	28.9	12.3	.52	70.57
75.0	39.0	14.0	45.6	28.6	12.2	.50	68.80
76.0	38.9	13.9	45.4	28.4	12.0	.48	67.10
77.0	38.8	13.8	45.1	28.1	11.9	.47	65.46
78.0	38.8	13.8	44.9	27.9	11.8	.45	63.88
79.0	38.7	13.7	44.6	27.6	11.7	.44	62.35
80.0	38.7	13.7	44.4	27.4	11.6	.42	60.88
81.0	38.6	13.6	44.2	27.2	11.5	.41	59.45
82.0	38.5	13.5	44.0	27.0	11.4	.39	58.08
83.0	38.5	13.5	43.8	26.8	11.3	.38	56.75
84.0	38.4	13.4	43.6	26.6	11.2	.37	55.46
85.0	38.4	13.4	43.4	26.4	11.1	.36	54.22
86.0	38.3	13.3	43.2	26.2	11.0	.35	53.01
87.0	38.3	13.3	43.1	26.1	10.9	.34	51.85
88.0	38.2	13.2	42.9	25.9	10.8	.33	50.72
89.0	38.1	13.1	42.8	25.8	10.7	.32	49.63
90.0	38.1	13.1	42.6	25.6	10.6	.31	48.57
91.0	38.0	13.0	42.4	25.4	10.5	.30	47.54
92.0	38.0	13.0	42.3	25.3	10.4	.29	46.55
93.0	37.9	12.9	42.1	25.1	10.3	.28	45.59
94.0	37.9	12.9	42.0	25.0	10.2	.27	44.65
95.0	37.8	12.8	41.8	24.8	10.1	.26	43.75
96.0	37.8	12.8	41.7	24.7	10.0	.26	42.87
97.0	37.7	12.7	41.5	24.5	9.9	.25	42.02
98.0	37.7	12.7	41.4	24.4	9.8	.24	41.19
99.0	37.6	12.6	41.2	24.2	9.7	.23	40.38

STRUCTURE TYPE 1
H FRAME

 * CORONA AND FIELD *
 * EFFECTS PROGRAM *
 * Source: Bonneville Power Administration *

*** INPUT DATA LIST ***

+VERTICAL
 +PEBBLEDALE SUB. TO HARDEE SUB.
 + 1 0 3 4 242.0 2.00 1.00 .00

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 4 CONDUCTORS, OF WHICH 3 ARE ENERGIZED PHASES

+COMB	XX	XX	XX	XX	XX	XX	XX							
+ 5.000	5.000	30.000	5.000	1.000	75.000	3.280	4.000	3.280						
+PH.A-1	A	11.00	47.00	1	1.502	.00	242.00	.0	2040.	.00				
+PH.B-1	A	11.00	37.00	1	1.502	.00	242.00	120.0	2040.	.00				
+PH.C-1	A	11.00	27.00	1	1.502	.00	242.00	240.0	2040.	.00				
+OHG1-1	A	5.00	57.00	1	.375	.00	.00	.0	0.	.00				
+ 200	-100.0	1.0												
+ 0	.0	.0												

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, ELECTRIC AND MAGNETIC FIELD

VERTICAL

BBLEDALE SUB. TO HARDEE SUB.

	DIST. FROM ZERO REFERENCE (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-L (KV)	PHASE ANGLE (DEGREES)	CURRENT (AMPS)	CORONA LOSSES (KW/MI)
PH.A-1	11.00	47.00	13.72	1.502	1.00	.00	242.00	.00	2040.0	5.316
PH.B-1	11.00	37.00	14.77	1.502	1.00	.00	242.00	120.00	2040.0	8.602
PH.C-1	11.00	27.00	13.84	1.502	1.00	.00	242.00	240.00	2040.0	5.629
ONG1-1	5.00	57.00	5.98	.375	1.00	.00	.00	.00	.0	.000

AM MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 30.0 M, ALTITUDE= .0 FT

RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ) = 2.000 MPH, GROUND CONDUCTIVITY = 4.0 MMHOS/M

E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT. = 3.3FT

STRUCTURE TYPE 2
VERTICAL

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE'		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
-100.0	42.0	17.0	47.2	30.2	13.9	.08	17.12
-99.0	42.0	17.0	47.4	30.4	14.0	.09	17.40
-98.0	42.1	17.1	47.5	30.5	14.1	.09	17.69
-97.0	42.1	17.1	47.6	30.6	14.1	.09	17.99
-96.0	42.2	17.2	47.7	30.7	14.2	.09	18.30
-95.0	42.2	17.2	47.9	30.9	14.3	.09	18.61
-94.0	42.2	17.2	48.0	31.0	14.4	.09	18.93
-93.0	42.3	17.3	48.1	31.1	14.5	.09	19.26
-92.0	42.3	17.3	48.2	31.2	14.6	.09	19.60
-91.0	42.4	17.4	48.4	31.4	14.6	.09	19.95
-90.0	42.4	17.4	48.5	31.5	14.7	.09	20.30
-89.0	42.5	17.5	48.6	31.6	14.8	.09	20.67
-88.0	42.5	17.5	48.8	31.8	14.9	.09	21.04
-87.0	42.5	17.5	48.9	31.9	15.0	.10	21.43
-86.0	42.6	17.6	49.0	32.0	15.1	.10	21.82
-85.0	42.6	17.6	49.2	32.2	15.2	.10	22.22
-84.0	42.7	17.7	49.3	32.3	15.3	.10	22.64
-83.0	42.7	17.7	49.5	32.5	15.3	.10	23.07
-82.0	42.8	17.8	49.6	32.6	15.4	.10	23.51
-81.0	42.8	17.8	49.7	32.7	15.5	.10	23.96
-80.0	42.9	17.9	49.9	32.9	15.6	.10	24.42
-79.0	42.9	17.9	50.0	33.0	15.7	.10	24.90
-78.0	43.0	18.0	50.2	33.2	15.8	.10	25.38
-77.0	43.0	18.0	50.3	33.3	15.9	.10	25.89
-76.0	43.1	18.1	50.5	33.5	16.0	.10	26.41
-75.0	43.1	18.1	50.6	33.6	16.1	.10	26.94
-74.0	43.2	18.2	50.8	33.8	16.2	.10	27.49
-73.0	43.2	18.2	51.0	34.0	16.3	.10	28.05
-72.0	43.3	18.3	51.1	34.1	16.4	.10	28.63
-71.0	43.3	18.3	51.3	34.3	16.5	.10	29.23
-70.0	43.4	18.4	51.4	34.4	16.6	.10	29.85
-69.0	43.4	18.4	51.6	34.6	16.7	.10	30.48
-68.0	43.5	18.5	51.8	34.8	16.8	.10	31.13
-67.0	43.5	18.5	51.9	34.9	17.0	.10	31.81
-66.0	43.6	18.6	52.1	35.1	17.1	.10	32.50
-65.0	43.7	18.7	52.3	35.3	17.2	.10	33.22
-64.0	43.7	18.7	52.5	35.5	17.3	.10	33.96
-63.0	43.8	18.8	52.6	35.6	17.4	.10	34.72
-62.0	43.8	18.8	52.8	35.8	17.5	.10	35.51
-61.0	43.9	18.9	53.0	36.0	17.6	.10	36.32
-60.0	43.9	18.9	53.2	36.2	17.8	.10	37.15
-59.0	44.0	19.0	53.4	36.4	17.9	.10	38.02
-58.0	44.1	19.1	53.5	36.5	18.0	.10	38.91
-57.0	44.1	19.1	53.7	36.7	18.1	.10	39.83
-56.0	44.2	19.2	53.9	36.9	18.3	.10	40.79
-55.0	44.2	19.2	54.1	37.1	18.4	.09	41.77
-54.0	44.3	19.3	54.3	37.3	18.5	.09	42.79
-53.0	44.4	19.4	54.5	37.5	18.7	.09	43.85
-52.0	44.4	19.4	54.7	37.7	18.8	.09	44.93
-51.0	44.5	19.5	54.9	37.9	18.9	.08	46.06
-50.0	44.5	19.5	55.1	38.1	19.1	.08	47.23
-49.0	44.6	19.6	55.3	38.3	19.2	.08	48.43
-48.0	44.7	19.7	55.5	38.5	19.4	.07	49.68
-47.0	44.7	19.7	55.7	38.7	19.5	.07	50.98
-46.0	44.8	19.8	56.0	39.0	19.6	.06	52.31

STRUCTURE TYPE 2
VERTICAL

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
-45.0	44.9	19.9	56.2	39.2	19.8	.06	53.70
-44.0	44.9	19.9	56.4	39.4	20.0	.05	55.14
-43.0	45.0	20.0	56.6	39.6	20.1	.05	56.63
-42.0	45.1	20.1	56.8	39.8	20.3	.04	58.17
-41.0	45.2	20.2	57.1	40.1	20.4	.04	59.77
-40.0	45.2	20.2	57.3	40.3	20.6	.04	61.43
-39.0	45.3	20.3	57.5	40.5	20.8	.04	63.15
-38.0	45.4	20.4	57.7	40.7	20.9	.04	64.94
-37.0	45.4	20.4	58.0	41.0	21.1	.04	66.79
-36.0	45.5	20.5	58.2	41.2	21.3	.05	68.71
-35.0	45.6	20.6	58.5	41.5	21.5	.07	70.70
-34.0	45.7	20.7	58.7	41.7	21.7	.08	72.76
-33.0	45.7	20.7	58.9	41.9	21.9	.10	74.91
-32.0	45.8	20.8	59.2	42.2	22.0	.11	77.13
-31.0	45.9	20.9	59.4	42.4	22.2	.13	79.44
-30.0	46.0	21.0	59.7	42.7	22.5	.15	81.84
-29.0	46.0	21.0	59.9	42.9	22.7	.18	84.33
-28.0	46.1	21.1	60.2	43.2	22.9	.20	86.91
-27.0	46.2	21.2	60.4	43.4	23.1	.23	89.58
-26.0	46.3	21.3	60.7	43.7	23.3	.26	92.36
-25.0	46.4	21.4	61.0	44.0	23.5	.29	95.24
-24.0	46.4	21.4	61.2	44.2	23.8	.32	98.22
-23.0	46.5	21.5	61.5	44.5	24.0	.36	101.32
-22.0	46.6	21.6	61.7	44.7	24.3	.40	104.52
-21.0	46.7	21.7	62.0	45.0	24.5	.44	107.84
-20.0	46.8	21.8	62.3	45.3	24.8	.49	111.28
-19.0	46.8	21.8	62.5	45.5	25.1	.54	114.83
-18.0	46.9	21.9	62.8	45.8	25.3	.59	118.50
-17.0	47.0	22.0	63.0	46.0	25.6	.64	122.29
-16.0	47.1	22.1	63.3	46.3	25.9	.70	126.20
-15.0	47.2	22.2	63.6	46.6	26.2	.77	130.22
-14.0	47.3	22.3	63.8	46.8	26.5	.83	134.37
-13.0	47.3	22.3	64.1	47.1	26.9	.91	138.62
-12.0	47.4	22.4	64.3	47.3	27.2	.98	142.98
-11.0	47.5	22.5	64.6	47.6	27.6	1.06	147.45
-10.0	47.6	22.6	64.8	47.8	27.9	1.14	152.00
-9.0	47.7	22.7	65.0	48.0	28.3	1.23	156.64
-8.0	47.7	22.7	65.3	48.3	28.7	1.32	161.34
-7.0	47.8	22.8	65.5	48.5	29.1	1.41	166.10
-6.0	47.9	22.9	65.7	48.7	29.5	1.51	170.90
-5.0	48.0	23.0	66.0	49.0	30.0	1.61	175.71
-4.0	48.0	23.0	66.2	49.2	30.5	1.71	180.51
-3.0	48.1	23.1	66.4	49.4	30.9	1.82	185.27
-2.0	48.2	23.2	66.5	49.5	31.4	1.92	189.96
-1.0	48.2	23.2	66.7	49.7	32.0	2.02	194.54
.0	48.3	23.3	66.9	49.9	32.5	2.12	198.99
1.0	48.3	23.3	67.1	50.1	33.1	2.22	203.25
2.0	48.4	23.4	67.2	50.2	33.7	2.32	207.29
3.0	48.4	23.4	67.3	50.3	34.3	2.41	211.05
4.0	48.5	23.5	67.4	50.4	34.9	2.49	214.51
5.0	48.5	23.5	67.6	50.6	35.5	2.56	217.61
6.0	48.6	23.6	67.7	50.7	36.1	2.63	220.32
7.0	48.6	23.6	67.8	50.8	37.5	2.69	222.59
8.0	48.6	23.6	68.0	51.0	38.9	2.73	224.39
9.0	48.6	23.6	68.1	51.1	40.3	2.76	225.70

STRUCTURE TYPE 2
VERTICAL

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
10.0	48.6	23.6	68.1	51.1	41.4	2.78	226.50
11.0	48.6	23.6	68.1	51.1	41.9	2.79	226.76
12.0	48.6	23.6	68.1	51.1	41.4	2.78	226.50
13.0	48.6	23.6	68.1	51.1	40.3	2.76	225.70
14.0	48.6	23.6	68.0	51.0	38.9	2.72	224.39
15.0	48.6	23.6	67.8	50.8	37.5	2.68	222.59
16.0	48.6	23.6	67.7	50.7	36.1	2.62	220.32
17.0	48.5	23.5	67.6	50.6	35.5	2.55	217.61
18.0	48.5	23.5	67.4	50.4	34.9	2.48	214.51
19.0	48.4	23.4	67.3	50.3	34.3	2.39	211.05
20.0	48.4	23.4	67.2	50.2	33.7	2.30	207.29
21.0	48.3	23.3	67.1	50.1	33.1	2.20	203.25
22.0	48.3	23.3	66.9	49.9	32.5	2.10	198.99
23.0	48.2	23.2	66.7	49.7	32.0	2.00	194.54
24.0	48.2	23.2	66.5	49.5	31.4	1.90	189.96
25.0	48.1	23.1	66.4	49.4	30.9	1.79	185.27
26.0	48.0	23.0	66.2	49.2	30.5	1.69	180.51
27.0	48.0	23.0	66.0	49.0	30.0	1.58	175.71
28.0	47.9	22.9	65.7	48.7	29.5	1.48	170.90
29.0	47.8	22.8	65.5	48.5	29.1	1.38	166.10
30.0	47.7	22.7	65.3	48.3	28.7	1.29	161.34
31.0	47.7	22.7	65.0	48.0	28.3	1.20	156.64
32.0	47.6	22.6	64.8	47.8	27.9	1.11	152.00
33.0	47.5	22.5	64.6	47.6	27.6	1.03	147.45
34.0	47.4	22.4	64.3	47.3	27.2	.95	142.98
35.0	47.3	22.3	64.1	47.1	26.9	.87	138.62
36.0	47.3	22.3	63.8	46.8	26.5	.80	134.37
37.0	47.2	22.2	63.6	46.6	26.2	.73	130.22
38.0	47.1	22.1	63.3	46.3	25.9	.67	126.20
39.0	47.0	22.0	63.0	46.0	25.6	.61	122.29
40.0	46.9	21.9	62.8	45.8	25.3	.55	118.50
41.0	46.8	21.8	62.5	45.5	25.1	.50	114.83
42.0	46.8	21.8	62.3	45.3	24.8	.45	111.28
43.0	46.7	21.7	62.0	45.0	24.5	.40	107.84
44.0	46.6	21.6	61.7	44.7	24.3	.36	104.52
45.0	46.5	21.5	61.5	44.5	24.0	.32	101.32
46.0	46.4	21.4	61.2	44.2	23.8	.28	98.22
47.0	46.4	21.4	61.0	44.0	23.5	.25	95.24
48.0	46.3	21.3	60.7	43.7	23.3	.22	92.36
49.0	46.2	21.2	60.4	43.4	23.1	.19	89.58
50.0	46.1	21.1	60.2	43.2	22.9	.16	86.91
51.0	46.0	21.0	59.9	42.9	22.7	.14	84.33
52.0	46.0	21.0	59.7	42.7	22.5	.12	81.84
53.0	45.9	20.9	59.4	42.4	22.2	.10	79.44
54.0	45.8	20.8	59.2	42.2	22.0	.08	77.13
55.0	45.7	20.7	58.9	41.9	21.9	.07	74.91
56.0	45.7	20.7	58.7	41.7	21.7	.06	72.76
57.0	45.6	20.6	58.5	41.5	21.5	.05	70.70
58.0	45.5	20.5	58.2	41.2	21.3	.04	68.71
59.0	45.4	20.4	58.0	41.0	21.1	.05	66.79
60.0	45.4	20.4	57.7	40.7	20.9	.05	64.94
61.0	45.3	20.3	57.5	40.5	20.8	.06	63.15
62.0	45.2	20.2	57.3	40.3	20.6	.06	61.43
63.0	45.2	20.2	57.1	40.1	20.4	.07	59.77
64.0	45.1	20.1	56.8	39.8	20.3	.08	58.17

STRUCTURE TYPE 2
VERTICAL

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) L50 DBA	NOISE (FAIR) L50 DBA	RADIO INTERFERENCE (RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TVI TOTAL RAIN DBUV/M	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
65.0	45.0	20.0	56.6	39.6	20.1	.08	56.63
66.0	44.9	19.9	56.4	39.4	20.0	.09	55.14
67.0	44.9	19.9	56.2	39.2	19.8	.09	53.70
68.0	44.8	19.8	56.0	39.0	19.6	.10	52.31
69.0	44.7	19.7	55.7	38.7	19.5	.10	50.98
70.0	44.7	19.7	55.5	38.5	19.4	.11	49.68
71.0	44.6	19.6	55.3	38.3	19.2	.11	48.43
72.0	44.5	19.5	55.1	38.1	19.1	.11	47.23
73.0	44.5	19.5	54.9	37.9	18.9	.11	46.06
74.0	44.4	19.4	54.7	37.7	18.8	.12	44.93
75.0	44.4	19.4	54.5	37.5	18.7	.12	43.85
76.0	44.3	19.3	54.3	37.3	18.5	.12	42.79
77.0	44.2	19.2	54.1	37.1	18.4	.12	41.77
78.0	44.2	19.2	53.9	36.9	18.3	.12	40.79
79.0	44.1	19.1	53.7	36.7	18.1	.12	39.83
80.0	44.1	19.1	53.5	36.5	18.0	.13	38.91
81.0	44.0	19.0	53.4	36.4	17.9	.13	38.02
82.0	43.9	18.9	53.2	36.2	17.8	.13	37.15
83.0	43.9	18.9	53.0	36.0	17.6	.13	36.32
84.0	43.8	18.8	52.8	35.8	17.5	.13	35.51
85.0	43.8	18.8	52.6	35.6	17.4	.13	34.72
86.0	43.7	18.7	52.5	35.5	17.3	.13	33.96
87.0	43.7	18.7	52.3	35.3	17.2	.13	33.22
88.0	43.6	18.6	52.1	35.1	17.1	.13	32.50
89.0	43.5	18.5	51.9	34.9	17.0	.13	31.81
90.0	43.5	18.5	51.8	34.8	16.8	.13	31.13
91.0	43.4	18.4	51.6	34.6	16.7	.13	30.48
92.0	43.4	18.4	51.4	34.4	16.6	.13	29.85
93.0	43.3	18.3	51.3	34.3	16.5	.13	29.23
94.0	43.3	18.3	51.1	34.1	16.4	.12	28.63
95.0	43.2	18.2	51.0	34.0	16.3	.12	28.05
96.0	43.2	18.2	50.8	33.8	16.2	.12	27.49
97.0	43.1	18.1	50.6	33.6	16.1	.12	26.94
98.0	43.1	18.1	50.5	33.5	16.0	.12	26.41
99.0	43.0	18.0	50.3	33.3	15.9	.12	25.89

STRUCTURE TYPE 2
VERTICAL

 * CORONA AND FIELD *
 * EFFECTS PROGRAM *
 * Source: Bonneville Power Administration *

*** INPUT DATA LIST ***

+TRIANGULAR
 +PEBBLEDALE SUB. TO HARDEE SUB.
 + 1 0 3 4 242.0 2.00 1.00 .00

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 4 CONDUCTORS, OF WHICH 3 ARE ENERGIZED PHASES

+COMB	XX	XX	XX	XX	XX	XX	XX					
+	5.000	5.000	30.000	5.000	1.000	75.000	3.280	4.000	3.280			
+PH.A-1		A	11.00	37.00	1	1.502	.00	242.00	.0	2040.	.00	
+PH.B-1		A	-11.00	32.00	1	1.502	.00	242.00	120.0	2040.	.00	
+PH.C-1		A	11.00	27.00	1	1.502	.00	242.00	240.0	2040.	.00	
+OHG1-1		A	5.00	57.00	1	.375	.00	.00	.0	0.	.00	
+	200	-100.0	1.0									
+	0	.0	.0									

STRUCTURE TYPE 3
 SINGLE POLE TRIANGULAR

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, ELECTRIC AND MAGNETIC FIELD

TRIANGULAR

PLEDALE SUB. TO HARDEE SUB.

	DIST. FROM ZERO REFERENCE (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-L (KV)	PHASE ANGLE (DEGREES)	CURRENT (AMPS)	CORONA LOSSES (KW/MI)
PH.A-1	11.00	37.00	13.70	1.502	1.00	.00	242.00	.00	2040.0	5.287
PH.B-1	-11.00	32.00	12.37	1.502	1.00	.00	242.00	120.00	2040.0	2.718
PH.C-1	11.00	27.00	13.92	1.502	1.00	.00	242.00	240.00	2040.0	5.860
OHG1-1	5.00	57.00	2.62	.375	1.00	.00	.00	.00	.0	.000

AN MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 30.0 M, ALTITUDE= .0 FT

RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ) = 2.000 MPH, GROUND CONDUCTIVITY = 4.0 MMHOS/M

E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT. = 3.3FT

STRUCTURE TYPE 3
SINGLE POLE TRIANGULAR

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
-100.0	39.5	14.5	43.3	26.3	10.8	.22	27.68
-99.0	39.6	14.6	43.5	26.5	10.9	.23	28.21
-98.0	39.6	14.6	43.6	26.6	11.0	.23	28.74
-97.0	39.7	14.7	43.7	26.7	11.1	.24	29.30
-96.0	39.7	14.7	43.8	26.8	11.2	.25	29.87
-95.0	39.8	14.8	44.0	27.0	11.2	.25	30.45
-94.0	39.8	14.8	44.1	27.1	11.3	.26	31.06
-93.0	39.9	14.9	44.2	27.2	11.4	.26	31.68
-92.0	39.9	14.9	44.3	27.3	11.5	.27	32.31
-91.0	39.9	14.9	44.5	27.5	11.6	.28	32.97
-90.0	40.0	15.0	44.6	27.6	11.7	.29	33.65
-89.0	40.0	15.0	44.7	27.7	11.7	.29	34.35
-88.0	40.1	15.1	44.9	27.9	11.8	.30	35.06
-87.0	40.1	15.1	45.0	28.0	11.9	.31	35.80
-86.0	40.2	15.2	45.1	28.1	12.0	.32	36.57
-85.0	40.2	15.2	45.3	28.3	12.1	.33	37.35
-84.0	40.3	15.3	45.4	28.4	12.2	.34	38.16
-83.0	40.3	15.3	45.6	28.6	12.3	.35	39.00
-82.0	40.4	15.4	45.7	28.7	12.4	.36	39.86
-81.0	40.4	15.4	45.8	28.8	12.5	.37	40.75
-80.0	40.5	15.5	46.0	29.0	12.6	.38	41.67
-79.0	40.5	15.5	46.1	29.1	12.7	.39	42.62
-78.0	40.6	15.6	46.3	29.3	12.8	.40	43.61
-77.0	40.6	15.6	46.4	29.4	12.9	.41	44.62
-76.0	40.7	15.7	46.6	29.6	13.0	.42	45.67
-75.0	40.8	15.8	46.7	29.7	13.1	.44	46.75
-74.0	40.8	15.8	46.9	29.9	13.2	.45	47.87
-73.0	40.9	15.9	47.1	30.1	13.3	.47	49.03
-72.0	40.9	15.9	47.2	30.2	13.4	.48	50.23
-71.0	41.0	16.0	47.4	30.4	13.5	.49	51.47
-70.0	41.0	16.0	47.5	30.5	13.6	.51	52.75
-69.0	41.1	16.1	47.7	30.7	13.7	.53	54.08
-68.0	41.2	16.2	47.9	30.9	13.8	.54	55.46
-67.0	41.2	16.2	48.0	31.0	13.9	.56	56.89
-66.0	41.3	16.3	48.2	31.2	14.0	.58	58.37
-65.0	41.3	16.3	48.4	31.4	14.1	.60	59.90
-64.0	41.4	16.4	48.6	31.6	14.2	.62	61.49
-63.0	41.5	16.5	48.7	31.7	14.4	.64	63.14
-62.0	41.5	16.5	48.9	31.9	14.5	.66	64.85
-61.0	41.6	16.6	49.1	32.1	14.6	.68	66.63
-60.0	41.6	16.6	49.3	32.3	14.7	.71	68.47
-59.0	41.7	16.7	49.5	32.5	14.8	.73	70.39
-58.0	41.8	16.8	49.6	32.6	15.0	.76	72.38
-57.0	41.8	16.8	49.8	32.8	15.1	.78	74.44
-56.0	41.9	16.9	50.0	33.0	15.2	.81	76.59
-55.0	42.0	17.0	50.2	33.2	15.4	.84	78.82
-54.0	42.0	17.0	50.4	33.4	15.5	.87	81.14
-53.0	42.1	17.1	50.6	33.6	15.6	.90	83.55
-52.0	42.2	17.2	50.8	33.8	15.8	.93	86.05
-51.0	42.2	17.2	51.0	34.0	15.9	.97	88.66
-50.0	42.3	17.3	51.2	34.2	16.0	1.00	91.37
-49.0	42.4	17.4	51.4	34.4	16.2	1.04	94.19
-48.0	42.5	17.5	51.6	34.6	16.3	1.07	97.12
-47.0	42.5	17.5	51.8	34.8	16.5	1.11	100.17
-46.0	42.6	17.6	52.1	35.1	16.6	1.15	103.34

STRUCTURE TYPE 3
SINGLE POLE TRIANGULAR

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TOTAL RAIN DBUV/M		
-45.0	42.7	17.7	52.3	35.3	16.8	1.19	106.64
-44.0	42.8	17.8	52.5	35.5	16.9	1.24	110.07
-43.0	42.8	17.8	52.8	35.8	17.1	1.28	113.64
-42.0	42.9	17.9	53.1	36.1	17.3	1.33	117.35
-41.0	43.0	18.0	53.4	36.4	17.4	1.37	121.21
-40.0	43.1	18.1	53.7	36.7	17.6	1.42	125.22
-39.0	43.1	18.1	54.0	37.0	17.8	1.47	129.39
-38.0	43.2	18.2	54.4	37.4	17.9	1.52	133.71
-37.0	43.3	18.3	54.7	37.7	18.1	1.57	138.19
-36.0	43.4	18.4	55.0	38.0	18.3	1.62	142.84
-35.0	43.5	18.5	55.3	38.3	18.5	1.67	147.66
-34.0	43.6	18.6	55.6	38.6	18.7	1.72	152.65
-33.0	43.6	18.6	55.9	38.9	18.9	1.78	157.81
-32.0	43.7	18.7	56.2	39.2	19.1	1.83	163.15
-31.0	43.8	18.8	56.5	39.5	19.5	1.88	168.65
-30.0	43.9	18.9	56.8	39.8	20.0	1.93	174.31
-29.0	44.0	19.0	57.1	40.1	20.4	1.98	180.14
-28.0	44.1	19.1	57.4	40.4	20.9	2.03	186.13
-27.0	44.2	19.2	57.7	40.7	21.4	2.07	192.26
-26.0	44.2	19.2	58.0	41.0	22.0	2.11	198.54
-25.0	44.3	19.3	58.2	41.2	22.6	2.15	204.94
-24.0	44.4	19.4	58.5	41.5	23.2	2.18	211.45
-23.0	44.5	19.5	58.7	41.7	23.9	2.21	218.06
-22.0	44.6	19.6	58.9	41.9	24.6	2.24	224.75
-21.0	44.7	19.7	59.1	42.1	25.4	2.25	231.49
-20.0	44.8	19.8	59.3	42.3	26.3	2.27	238.27
-19.0	44.9	19.9	59.5	42.5	27.3	2.27	245.05
-18.0	44.9	19.9	59.8	42.8	28.3	2.26	251.81
-17.0	45.0	20.0	60.2	43.2	29.6	2.25	258.51
-16.0	45.1	20.1	60.6	43.6	31.0	2.23	265.14
-15.0	45.2	20.2	61.0	44.0	32.6	2.20	271.65
-14.0	45.3	20.3	61.4	44.4	34.5	2.16	278.01
-13.0	45.4	20.4	61.7	44.7	36.6	2.11	284.19
-12.0	45.5	20.5	62.1	45.1	38.6	2.05	290.15
-11.0	45.5	20.5	62.5	45.5	39.6	1.99	295.87
-10.0	45.6	20.6	62.9	45.9	38.6	1.91	301.31
-9.0	45.7	20.7	63.3	46.3	36.6	1.84	306.44
-8.0	45.8	20.8	63.7	46.7	34.5	1.75	311.23
-7.0	45.9	20.9	64.1	47.1	32.6	1.67	315.65
-6.0	45.9	20.9	64.4	47.4	31.0	1.59	319.67
-5.0	46.0	21.0	64.8	47.8	29.6	1.51	323.28
-4.0	46.1	21.1	65.2	48.2	28.3	1.44	326.44
-3.0	46.2	21.2	65.5	48.5	28.6	1.39	329.13
-2.0	46.2	21.2	65.9	48.9	29.2	1.36	331.33
-1.0	46.3	21.3	66.2	49.2	29.9	1.37	333.02
.0	46.3	21.3	66.5	49.5	30.6	1.40	334.18
1.0	46.4	21.4	66.8	49.8	31.4	1.46	334.78
2.0	46.5	21.5	67.1	50.1	32.2	1.54	334.83
3.0	46.5	21.5	67.4	50.4	33.1	1.63	334.29
4.0	46.5	21.5	67.6	50.6	34.1	1.73	333.16
5.0	46.6	21.6	67.8	50.8	35.2	1.84	331.44
6.0	46.6	21.6	68.0	51.0	36.4	1.94	329.11
7.0	46.6	21.6	68.2	51.2	37.8	2.04	326.19
8.0	46.7	21.7	68.3	51.3	39.2	2.13	322.69
9.0	46.7	21.7	68.4	51.4	40.6	2.21	318.61

STRUCTURE TYPE 3
SINGLE POLE TRIANGULAR

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE'		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
10.0	46.7	21.7	68.4	51.4	41.8	2.28	313.98
11.0	46.7	21.7	68.4	51.4	42.2	2.34	308.83
12.0	46.7	21.7	68.4	51.4	41.8	2.38	303.20
13.0	46.6	21.6	68.4	51.4	40.6	2.42	297.14
14.0	46.6	21.6	68.3	51.3	39.2	2.43	290.68
15.0	46.6	21.6	68.2	51.2	37.8	2.44	283.88
16.0	46.5	21.5	68.0	51.0	36.4	2.43	276.80
17.0	46.5	21.5	67.8	50.8	35.2	2.42	269.49
18.0	46.4	21.4	67.6	50.6	34.1	2.39	262.01
19.0	46.4	21.4	67.4	50.4	33.1	2.35	254.42
20.0	46.3	21.3	67.1	50.1	32.2	2.31	246.76
21.0	46.2	21.2	66.8	49.8	31.4	2.25	239.08
22.0	46.2	21.2	66.5	49.5	30.6	2.20	231.43
23.0	46.1	21.1	66.2	49.2	29.9	2.13	223.85
24.0	46.0	21.0	65.9	48.9	29.2	2.07	216.38
25.0	45.9	20.9	65.5	48.5	28.6	2.00	209.04
26.0	45.8	20.8	65.2	48.2	28.1	1.93	201.85
27.0	45.8	20.8	64.8	47.8	27.5	1.86	194.85
28.0	45.7	20.7	64.4	47.4	27.0	1.79	188.04
29.0	45.6	20.6	64.1	47.1	26.5	1.72	181.44
30.0	45.5	20.5	63.7	46.7	26.1	1.65	175.05
31.0	45.4	20.4	63.3	46.3	25.6	1.59	168.88
32.0	45.3	20.3	62.9	45.9	25.2	1.52	162.93
33.0	45.2	20.2	62.5	45.5	24.8	1.46	157.20
34.0	45.1	20.1	62.1	45.1	24.4	1.40	151.70
35.0	45.0	20.0	61.7	44.7	24.1	1.34	146.41
36.0	44.9	19.9	61.4	44.4	23.7	1.28	141.34
37.0	44.8	19.8	61.0	44.0	23.4	1.23	136.47
38.0	44.7	19.7	60.6	43.6	23.1	1.18	131.81
39.0	44.6	19.6	60.2	43.2	22.8	1.13	127.34
40.0	44.5	19.5	59.8	42.8	22.5	1.08	123.06
41.0	44.4	19.4	59.5	42.5	22.2	1.04	118.96
42.0	44.3	19.3	59.1	42.1	21.9	1.00	115.03
43.0	44.2	19.2	58.8	41.8	21.6	.96	111.27
44.0	44.2	19.2	58.4	41.4	21.3	.92	107.67
45.0	44.1	19.1	58.0	41.0	21.1	.88	104.22
46.0	44.0	19.0	57.7	40.7	20.8	.85	100.91
47.0	43.9	18.9	57.4	40.4	20.6	.81	97.74
48.0	43.8	18.8	57.0	40.0	20.4	.78	94.71
49.0	43.7	18.7	56.7	39.7	20.1	.75	91.80
50.0	43.6	18.6	56.4	39.4	19.9	.72	89.01
51.0	43.5	18.5	56.0	39.0	19.7	.70	86.34
52.0	43.4	18.4	55.8	38.8	19.5	.67	83.77
53.0	43.4	18.4	55.5	38.5	19.3	.65	81.31
54.0	43.3	18.3	55.3	38.3	19.1	.62	78.95
55.0	43.2	18.2	55.0	38.0	18.9	.60	76.68
56.0	43.1	18.1	54.8	37.8	18.7	.58	74.50
57.0	43.0	18.0	54.6	37.6	18.5	.56	72.40
58.0	43.0	18.0	54.3	37.3	18.3	.54	70.39
59.0	42.9	17.9	54.1	37.1	18.1	.52	68.45
60.0	42.8	17.8	53.8	36.8	17.9	.50	66.59
61.0	42.7	17.7	53.6	36.6	17.8	.49	64.80
62.0	42.7	17.7	53.4	36.4	17.6	.47	63.07
63.0	42.6	17.6	53.2	36.2	17.4	.45	61.41
64.0	42.5	17.5	52.9	35.9	17.3	.44	59.81

STRUCTURE TYPE 3
SINGLE POLE TRIANGULAR

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
65.0	42.4	17.4	52.7	35.7	17.1	.42	58.27
66.0	42.4	17.4	52.5	35.5	16.9	.41	56.78
67.0	42.3	17.3	52.3	35.3	16.8	.40	55.35
68.0	42.2	17.2	52.1	35.1	16.6	.39	53.97
69.0	42.1	17.1	51.8	34.8	16.5	.37	52.64
70.0	42.1	17.1	51.6	34.6	16.3	.36	51.35
71.0	42.0	17.0	51.4	34.4	16.2	.35	50.11
72.0	41.9	16.9	51.2	34.2	16.0	.34	48.91
73.0	41.9	16.9	51.0	34.0	15.9	.33	47.75
74.0	41.8	16.8	50.8	33.8	15.8	.32	46.63
75.0	41.7	16.7	50.6	33.6	15.6	.31	45.54
76.0	41.7	16.7	50.4	33.4	15.5	.30	44.50
77.0	41.6	16.6	50.2	33.2	15.4	.29	43.48
78.0	41.6	16.6	50.0	33.0	15.2	.28	42.50
79.0	41.5	16.5	49.8	32.8	15.1	.28	41.56
80.0	41.4	16.4	49.6	32.6	15.0	.27	40.64
81.0	41.4	16.4	49.5	32.5	14.8	.26	39.75
82.0	41.3	16.3	49.3	32.3	14.7	.25	38.89
83.0	41.2	16.2	49.1	32.1	14.6	.25	38.05
84.0	41.2	16.2	48.9	31.9	14.5	.24	37.24
85.0	41.1	16.1	48.7	31.7	14.4	.23	36.46
86.0	41.1	16.1	48.6	31.6	14.2	.23	35.70
87.0	41.0	16.0	48.4	31.4	14.1	.22	34.96
88.0	41.0	16.0	48.2	31.2	14.0	.21	34.24
89.0	40.9	15.9	48.0	31.0	13.9	.21	33.55
90.0	40.8	15.8	47.9	30.9	13.8	.20	32.87
91.0	40.8	15.8	47.7	30.7	13.7	.20	32.22
92.0	40.7	15.7	47.5	30.5	13.6	.19	31.58
93.0	40.7	15.7	47.4	30.4	13.5	.19	30.97
94.0	40.6	15.6	47.2	30.2	13.4	.18	30.36
95.0	40.6	15.6	47.1	30.1	13.3	.18	29.78
96.0	40.5	15.5	46.9	29.9	13.2	.17	29.21
97.0	40.5	15.5	46.7	29.7	13.1	.17	28.66
98.0	40.4	15.4	46.6	29.6	13.0	.17	28.12
99.0	40.4	15.4	46.4	29.4	12.9	.16	27.60

STRUCTURE TYPE 3
SINGLE POLE TRIANGULAR

 * CORONA AND FIELD *
 * EFFECTS PROGRAM *
 * Source: Bonneville Power Administration *

*** INPUT DATA LIST ***

+TRIANGULAR w/ 69 kV underbuild
 +PEBBLEDALE SUB. TO HARDEE SUB.
 + 1 0 6 7 242.0 2.00 1.00 .00

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 7 CONDUCTORS, OF WHICH 6 ARE ENERGIZED PHASES

+COMB	XX	XX	XX	XX	XX	XX	XX						
+	5.000	5.000	30.000	5.000	1.000	75.000	3.280	4.000	3.280				
+PH.A-1		A	11.00	45.00	1	1.502	.00	242.00	.0	2040.	.00		
+PH.B-1		A	-11.00	40.00	1	1.502	.00	242.00	120.0	2040.	.00		
+PH.C-1		A	11.00	35.00	1	1.502	.00	242.00	240.0	2040.	.00		
+PH.A-2		A	3.50	26.00	1	1.124	.00	72.00	.0	1171.	.00		
+PH.B-2		A	-3.50	22.00	1	1.124	.00	72.00	120.0	1171.	.00		
+PH.C-2		A	3.50	18.00	1	1.124	.00	72.00	240.0	1171.	.00		
+OHG1-1		A	.00	65.00	1	.375	.00	.00	.0	0.	.00		
+	200	-100.0	1.0										
+	0	.0	.0										

STRUCTURE TYPE 4
 SINGLE POLE TRIANGULAR
 W/69KV UNDERBUILD

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, ELECTRIC AND MAGNETIC FIELD

TRIANGULAR

LEDALE SUB. TO HARDEE SUB.

	DIST. FROM ZERO REFERENCE (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-L (KV)	PHASE ANGLE (DEGREES)	CURRENT (AMPS)	CORONA LOSSES (KW/MI)
PH.A-1	11.00	45.00	13.49	1.502	1.00	.00	242.00	.00	2040.0	4.766
PH.B-1	-11.00	40.00	12.23	1.502	1.00	.00	242.00	120.00	2040.0	2.527
PH.C-1	11.00	35.00	14.21	1.502	1.00	.00	242.00	240.00	2040.0	6.697
PH.A-2	3.50	26.00	6.48	1.124	1.00	.00	72.00	.00	1171.0	.013
PH.B-2	-3.50	22.00	4.98	1.124	1.00	.00	72.00	120.00	1171.0	.002
PH.C-2	3.50	18.00	5.24	1.124	1.00	.00	72.00	240.00	1171.0	.003
OHG1-1	.00	65.00	2.67	.375	1.00	.00	.00	.00	.0	.000

AN MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 30.0 M, ALTITUDE= .0 FT

RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ) = 2.000 MPH, GROUND CONDUCTIVITY = 4.0 MMHOS/M

E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT. = 3.3FT

STRUCTURE TYPE 4
SINGLE POLE TRIANGULAR
W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
-100.0	39.7	14.7	44.8	27.8	11.9	.26	31.46
-99.0	39.7	14.7	44.9	27.9	12.0	.26	32.03
-98.0	39.7	14.7	45.1	28.1	12.1	.27	32.62
-97.0	39.8	14.8	45.2	28.2	12.1	.27	33.22
-96.0	39.8	14.8	45.3	28.3	12.2	.28	33.84
-95.0	39.9	14.9	45.4	28.4	12.3	.29	34.47
-94.0	39.9	14.9	45.6	28.6	12.4	.29	35.13
-93.0	40.0	15.0	45.7	28.7	12.5	.30	35.80
-92.0	40.0	15.0	45.8	28.8	12.6	.31	36.49
-91.0	40.0	15.0	46.0	29.0	12.6	.32	37.19
-90.0	40.1	15.1	46.1	29.1	12.7	.32	37.92
-89.0	40.1	15.1	46.2	29.2	12.8	.33	38.67
-88.0	40.2	15.2	46.4	29.4	12.9	.34	39.44
-87.0	40.2	15.2	46.5	29.5	13.0	.35	40.23
-86.0	40.3	15.3	46.6	29.6	13.1	.36	41.04
-85.0	40.3	15.3	46.8	29.8	13.2	.37	41.88
-84.0	40.4	15.4	46.9	29.9	13.3	.38	42.74
-83.0	40.4	15.4	47.1	30.1	13.3	.39	43.63
-82.0	40.5	15.5	47.2	30.2	13.4	.40	44.55
-81.0	40.5	15.5	47.4	30.4	13.5	.41	45.49
-80.0	40.6	15.6	47.5	30.5	13.6	.42	46.45
-79.0	40.6	15.6	47.7	30.7	13.7	.43	47.45
-78.0	40.7	15.7	47.8	30.8	13.8	.44	48.48
-77.0	40.7	15.7	48.0	31.0	13.9	.45	49.54
-76.0	40.8	15.8	48.1	31.1	14.0	.47	50.63
-75.0	40.8	15.8	48.3	31.3	14.1	.48	51.76
-74.0	40.9	15.9	48.4	31.4	14.2	.49	52.92
-73.0	40.9	15.9	48.6	31.6	14.3	.51	54.12
-72.0	41.0	16.0	48.8	31.8	14.4	.52	55.35
-71.0	41.0	16.0	48.9	31.9	14.5	.54	56.63
-70.0	41.1	16.1	49.1	32.1	14.6	.55	57.95
-69.0	41.1	16.1	49.2	32.2	14.7	.57	59.30
-68.0	41.2	16.2	49.4	32.4	14.9	.58	60.71
-67.0	41.2	16.2	49.6	32.6	15.0	.60	62.16
-66.0	41.3	16.3	49.8	32.8	15.1	.62	63.65
-65.0	41.3	16.3	49.9	32.9	15.2	.64	65.20
-64.0	41.4	16.4	50.1	33.1	15.3	.66	66.79
-63.0	41.5	16.5	50.3	33.3	15.4	.67	68.44
-62.0	41.5	16.5	50.5	33.5	15.5	.69	70.15
-61.0	41.6	16.6	50.7	33.7	15.7	.71	71.91
-60.0	41.6	16.6	50.8	33.8	15.8	.74	73.74
-59.0	41.7	16.7	51.0	34.0	15.9	.76	75.62
-58.0	41.7	16.7	51.2	34.2	16.0	.78	77.57
-57.0	41.8	16.8	51.4	34.4	16.2	.80	79.59
-56.0	41.9	16.9	51.6	34.6	16.3	.83	81.68
-55.0	41.9	16.9	51.8	34.8	16.4	.85	83.84
-54.0	42.0	17.0	52.0	35.0	16.5	.88	86.07
-53.0	42.0	17.0	52.2	35.2	16.7	.90	88.38
-52.0	42.1	17.1	52.4	35.4	16.8	.93	90.78
-51.0	42.2	17.2	52.6	35.6	16.9	.96	93.26
-50.0	42.2	17.2	52.8	35.8	17.1	.99	95.82
-49.0	42.3	17.3	53.1	36.1	17.2	1.02	98.48
-48.0	42.4	17.4	53.3	36.3	17.4	1.05	101.23
-47.0	42.4	17.4	53.5	36.5	17.5	1.08	104.08
-46.0	42.5	17.5	53.7	36.7	17.7	1.11	107.04

STRUCTURE TYPE 4
SINGLE POLE TRIANGULAR
W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI TOTAL RAIN	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M			
-45.0	42.6	17.6	53.9	36.9	17.8	1.14	110.09
-44.0	42.6	17.6	54.2	37.2	18.0	1.17	113.26
-43.0	42.7	17.7	54.4	37.4	18.1	1.20	116.54
-42.0	42.8	17.8	54.6	37.6	18.3	1.24	119.94
-41.0	42.8	17.8	54.8	37.8	18.5	1.27	123.46
-40.0	42.9	17.9	55.1	38.1	18.6	1.31	127.11
-39.0	43.0	18.0	55.3	38.3	18.8	1.34	130.88
-38.0	43.0	18.0	55.6	38.6	19.0	1.38	134.80
-37.0	43.1	18.1	55.8	38.8	19.2	1.41	138.85
-36.0	43.2	18.2	56.1	39.1	19.3	1.44	143.06
-35.0	43.2	18.2	56.3	39.3	19.5	1.48	147.41
-34.0	43.3	18.3	56.6	39.6	19.7	1.51	151.92
-33.0	43.4	18.4	56.8	39.8	19.9	1.55	156.60
-32.0	43.5	18.5	57.1	40.1	20.1	1.58	161.44
-31.0	43.5	18.5	57.3	40.3	20.3	1.61	166.47
-30.0	43.6	18.6	57.6	40.6	20.5	1.64	171.68
-29.0	43.7	18.7	57.8	40.8	20.7	1.67	177.08
-28.0	43.7	18.7	58.1	41.1	20.9	1.70	182.68
-27.0	43.8	18.8	58.4	41.4	21.2	1.73	188.50
-26.0	43.9	18.9	58.7	41.7	21.4	1.75	194.53
-25.0	44.0	19.0	58.9	41.9	21.6	1.77	200.80
-24.0	44.0	19.0	59.2	42.2	21.9	1.79	207.31
-23.0	44.1	19.1	59.5	42.5	22.1	1.81	214.06
-22.0	44.2	19.2	59.8	42.8	22.4	1.82	221.09
-21.0	44.2	19.2	60.0	43.0	22.6	1.83	228.38
-20.0	44.3	19.3	60.3	43.3	22.9	1.84	235.96
-19.0	44.4	19.4	60.6	43.6	23.2	1.84	243.83
-18.0	44.5	19.5	60.9	43.9	23.4	1.83	252.00
-17.0	44.5	19.5	61.1	44.1	23.7	1.82	260.46
-16.0	44.6	19.6	61.4	44.4	24.1	1.81	269.21
-15.0	44.7	19.7	61.7	44.7	24.4	1.79	278.23
-14.0	44.7	19.7	62.0	45.0	24.7	1.76	287.51
-13.0	44.8	19.8	62.3	45.3	25.0	1.73	297.00
-12.0	44.9	19.9	62.5	45.5	25.4	1.69	306.64
-11.0	44.9	19.9	62.8	45.8	25.8	1.64	316.37
-10.0	45.0	20.0	63.1	46.1	26.1	1.59	326.09
-9.0	45.0	20.0	63.3	46.3	26.5	1.53	335.68
-8.0	45.1	20.1	63.6	46.6	27.0	1.47	345.00
-7.0	45.2	20.2	63.8	46.8	27.4	1.41	353.88
-6.0	45.2	20.2	64.1	47.1	27.9	1.35	362.14
-5.0	45.3	20.3	64.3	47.3	28.3	1.30	369.58
-4.0	45.3	20.3	64.6	47.6	28.8	1.26	375.97
-3.0	45.4	20.4	64.8	47.8	29.4	1.25	381.13
-2.0	45.4	20.4	65.0	48.0	29.9	1.25	384.84
-1.0	45.5	20.5	65.2	48.2	30.5	1.29	386.95
.0	45.5	20.5	65.4	48.4	31.2	1.34	387.32
1.0	45.5	20.5	65.6	48.6	31.9	1.41	385.88
2.0	45.6	20.6	65.7	48.7	32.6	1.48	382.64
3.0	45.6	20.6	65.9	48.9	33.3	1.56	377.67
4.0	45.6	20.6	66.0	49.0	34.1	1.63	371.10
5.0	45.7	20.7	66.1	49.1	35.0	1.69	363.15
6.0	45.7	20.7	66.2	49.2	35.8	1.74	354.06
7.0	45.7	20.7	66.3	49.3	36.7	1.78	344.13
8.0	45.7	20.7	66.4	49.4	37.5	1.81	333.63
9.0	45.7	20.7	66.4	49.4	38.2	1.84	322.84

STRUCTURE TYPE 4
SINGLE POLE TRIANGULAR
W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI	ELECTRIC	MAGNETIC
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TOTAL RAIN DBUV/M	FIELD KV/M	FIELD MG
10.0	45.7	20.7	66.4	49.4	38.7	1.85	311.98
11.0	45.7	20.7	66.5	49.5	38.8	1.86	301.26
12.0	45.7	20.7	66.4	49.4	38.7	1.86	290.80
13.0	45.7	20.7	66.4	49.4	38.2	1.85	280.70
14.0	45.7	20.7	66.4	49.4	37.5	1.84	271.03
15.0	45.6	20.6	66.3	49.3	36.7	1.83	261.79
16.0	45.6	20.6	66.2	49.2	35.8	1.81	253.00
17.0	45.6	20.6	66.1	49.1	35.0	1.79	244.63
18.0	45.6	20.6	66.0	49.0	34.1	1.77	236.66
19.0	45.5	20.5	65.9	48.9	33.3	1.74	229.05
20.0	45.5	20.5	65.7	48.7	32.6	1.71	221.79
21.0	45.4	20.4	65.6	48.6	31.9	1.68	214.84
22.0	45.4	20.4	65.4	48.4	31.2	1.65	208.17
23.0	45.3	20.3	65.2	48.2	30.5	1.62	201.76
24.0	45.3	20.3	65.0	48.0	29.9	1.58	195.60
25.0	45.2	20.2	64.8	47.8	29.4	1.55	189.66
26.0	45.2	20.2	64.6	47.6	28.8	1.51	183.93
27.0	45.1	20.1	64.3	47.3	28.3	1.47	178.41
28.0	45.0	20.0	64.1	47.1	27.9	1.43	173.07
29.0	45.0	20.0	63.8	46.8	27.4	1.40	167.91
30.0	44.9	19.9	63.6	46.6	27.0	1.36	162.93
31.0	44.9	19.9	63.3	46.3	26.5	1.32	158.11
32.0	44.8	19.8	63.1	46.1	26.1	1.28	153.45
33.0	44.7	19.7	62.8	45.8	25.8	1.25	148.94
34.0	44.6	19.6	62.5	45.5	25.4	1.21	144.59
35.0	44.6	19.6	62.3	45.3	25.0	1.17	140.38
36.0	44.5	19.5	62.0	45.0	24.7	1.14	136.31
37.0	44.4	19.4	61.7	44.7	24.4	1.10	132.37
38.0	44.3	19.3	61.4	44.4	24.1	1.07	128.57
39.0	44.3	19.3	61.1	44.1	23.7	1.04	124.89
40.0	44.2	19.2	60.9	43.9	23.4	1.00	121.34
41.0	44.1	19.1	60.6	43.6	23.2	.97	117.91
42.0	44.1	19.1	60.3	43.3	22.9	.94	114.60
43.0	44.0	19.0	60.0	43.0	22.6	.91	111.40
44.0	43.9	18.9	59.8	42.8	22.4	.88	108.31
45.0	43.8	18.8	59.5	42.5	22.1	.85	105.32
46.0	43.8	18.8	59.2	42.2	21.9	.83	102.44
47.0	43.7	18.7	58.9	41.9	21.6	.80	99.65
48.0	43.6	18.6	58.7	41.7	21.4	.78	96.96
49.0	43.5	18.5	58.4	41.4	21.2	.75	94.36
50.0	43.5	18.5	58.1	41.1	20.9	.73	91.85
51.0	43.4	18.4	57.8	40.8	20.7	.71	89.42
52.0	43.3	18.3	57.6	40.6	20.5	.69	87.08
53.0	43.2	18.2	57.3	40.3	20.3	.66	84.82
54.0	43.2	18.2	57.1	40.1	20.1	.64	82.63
55.0	43.1	18.1	56.8	39.8	19.9	.62	80.51
56.0	43.0	18.0	56.6	39.6	19.7	.61	78.47
57.0	43.0	18.0	56.3	39.3	19.5	.59	76.49
58.0	42.9	17.9	56.1	39.1	19.3	.57	74.58
59.0	42.8	17.8	55.8	38.8	19.2	.55	72.74
60.0	42.7	17.7	55.6	38.6	19.0	.54	70.95
61.0	42.7	17.7	55.3	38.3	18.8	.52	69.22
62.0	42.6	17.6	55.1	38.1	18.6	.51	67.55
63.0	42.5	17.5	54.8	37.8	18.5	.49	65.93
64.0	42.5	17.5	54.6	37.6	18.3	.48	64.37

STRUCTURE TYPE 4
SINGLE POLE TRIANGULAR
W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN)	(FAIR)	(RAIN)	(FAIR)	TOTAL		
	L50 DBA	L50 DBA	L50 DBUV/M	L50 DBUV/M	RAIN DBUV/M		
65.0	42.4	17.4	54.4	37.4	18.1	.46	62.85
66.0	42.3	17.3	54.2	37.2	18.0	.45	61.38
67.0	42.3	17.3	53.9	36.9	17.8	.44	59.96
68.0	42.2	17.2	53.7	36.7	17.7	.43	58.59
69.0	42.2	17.2	53.5	36.5	17.5	.41	57.25
70.0	42.1	17.1	53.3	36.3	17.4	.40	55.96
71.0	42.0	17.0	53.1	36.1	17.2	.39	54.71
72.0	42.0	17.0	52.8	35.8	17.1	.38	53.50
73.0	41.9	16.9	52.6	35.6	16.9	.37	52.32
74.0	41.8	16.8	52.4	35.4	16.8	.36	51.18
75.0	41.8	16.8	52.2	35.2	16.7	.35	50.08
76.0	41.7	16.7	52.0	35.0	16.5	.34	49.00
77.0	41.7	16.7	51.8	34.8	16.4	.33	47.96
78.0	41.6	16.6	51.6	34.6	16.3	.32	46.95
79.0	41.5	16.5	51.4	34.4	16.2	.32	45.97
80.0	41.5	16.5	51.2	34.2	16.0	.31	45.02
81.0	41.4	16.4	51.0	34.0	15.9	.30	44.09
82.0	41.4	16.4	50.8	33.8	15.8	.29	43.19
83.0	41.3	16.3	50.7	33.7	15.7	.28	42.32
84.0	41.3	16.3	50.5	33.5	15.5	.28	41.47
85.0	41.2	16.2	50.3	33.3	15.4	.27	40.65
86.0	41.2	16.2	50.1	33.1	15.3	.26	39.85
87.0	41.1	16.1	49.9	32.9	15.2	.26	39.07
88.0	41.0	16.0	49.8	32.8	15.1	.25	38.31
89.0	41.0	16.0	49.6	32.6	15.0	.25	37.57
90.0	40.9	15.9	49.4	32.4	14.9	.24	36.86
91.0	40.9	15.9	49.2	32.2	14.7	.23	36.16
92.0	40.8	15.8	49.1	32.1	14.6	.23	35.48
93.0	40.8	15.8	48.9	31.9	14.5	.22	34.82
94.0	40.7	15.7	48.8	31.8	14.4	.22	34.18
95.0	40.7	15.7	48.6	31.6	14.3	.21	33.55
96.0	40.6	15.6	48.4	31.4	14.2	.21	32.94
97.0	40.6	15.6	48.3	31.3	14.1	.20	32.35
98.0	40.5	15.5	48.1	31.1	14.0	.20	31.77
99.0	40.5	15.5	48.0	31.0	13.9	.19	31.20

STRUCTURE TYPE 4
SINGLE POLE TRIANGULAR
W/69KV UNDERBUILD

 * CORONA AND FIELD *
 * EFFECTS PROGRAM *
 * Source: Bonneville Power Administration *

*** INPUT DATA LIST ***

+VERTICAL w/ 69 kV underbuild
 +PEBBLEDALE SUB. TO HARDEE SUB.
 + 1 0 6 7 242.0 2.00 1.00 .00

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 7 CONDUCTORS, OF WHICH 6 ARE ENERGIZED PHASES

+COMB	XX	XX	XX	XX	XX	XX	XX						
+ 5.000	5.000	30.000	5.000	1.000	75.000	3.280	4.000	3.280					
+PH.A-1	A	11.00	59.00	1	1.502	.00	242.00	.0	2040.	.00			
+PH.B-1	A	11.00	49.00	1	1.502	.00	242.00	120.0	2040.	.00			
+PH.C-1	A	11.00	39.00	1	1.502	.00	242.00	240.0	2040.	.00			
+PH.A-2	A	4.00	32.00	1	1.124	.00	72.00	.0	1171.	.00			
+PH.B-2	A	4.00	25.00	1	1.124	.00	72.00	120.0	1171.	.00			
+PH.C-2	A	4.00	18.00	1	1.124	.00	72.00	240.0	1171.	.00			
+OHG1-1	A	.00	69.00	1	.375	.00	.00	.0	0.	.00			
+ 200	-100.0	1.0											
+ 0	.0	.0											

STRUCTURE TYPE 5
 VERTICAL W/69KV UNDERBUILD

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, ELECTRIC AND MAGNETIC FIELD

VERTICAL

BLEDALE SUB. TO HARDEE SUB.

	DIST. FROM ZERO REFERENCE (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON DIAM. (IN)	NO. OF SUBCON	SUBCON SPACING (IN)	VOLTAGE L-L (KV)	PHASE ANGLE (DEGREES)	CURRENT (AMPS)	CORONA LOSSES (KW/MI)
PH.A-1	11.00	59.00	13.47	1.502	1.00	.00	242.00	.00	2040.0	4.722
PH.B-1	11.00	49.00	14.80	1.502	1.00	.00	242.00	120.00	2040.0	8.699
PH.C-1	11.00	39.00	14.40	1.502	1.00	.00	242.00	240.00	2040.0	7.307
PH.A-2	4.00	32.00	6.89	1.124	1.00	.00	72.00	.00	1171.0	.019
PH.B-2	4.00	25.00	6.25	1.124	1.00	.00	72.00	120.00	1171.0	.010
PH.C-2	4.00	18.00	5.13	1.124	1.00	.00	72.00	240.00	1171.0	.003
OHG1-1	.00	69.00	5.24	.375	1.00	.00	.00	.00	.0	.000

AN MICROPHONE HT.= 5.0 FT, RI ANT. HT.= 5.0 FT, TV ANT. HT.= 30.0 M, ALTITUDE= .0 FT

RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ) = 2.000 MPH, GROUND CONDUCTIVITY = 4.0 MMHOS/M

E-FIELD TRANSDUCER HT.= 3.3FT, B-FIELD TRANSDUCER HT. = 3.3FT

STRUCTURE TYPE 5
VERTICAL W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE ¹		TVI	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TOTAL RAIN DBUV/M		
-100.0	42.3	17.3	49.3	32.3	13.9	.11	23.86
-99.0	42.4	17.4	49.4	32.4	14.0	.11	24.25
-98.0	42.4	17.4	49.5	32.5	14.0	.11	24.65
-97.0	42.5	17.5	49.6	32.6	14.1	.11	25.06
-96.0	42.5	17.5	49.8	32.8	14.2	.11	25.48
-95.0	42.5	17.5	49.9	32.9	14.3	.11	25.91
-94.0	42.6	17.6	50.0	33.0	14.4	.11	26.35
-93.0	42.6	17.6	50.1	33.1	14.4	.12	26.80
-92.0	42.7	17.7	50.2	33.2	14.5	.12	27.26
-91.0	42.7	17.7	50.3	33.3	14.6	.12	27.74
-90.0	42.7	17.7	50.5	33.5	14.7	.12	28.22
-89.0	42.8	17.8	50.6	33.6	14.8	.12	28.72
-88.0	42.8	17.8	50.7	33.7	14.9	.12	29.23
-87.0	42.9	17.9	50.8	33.8	14.9	.12	29.76
-86.0	42.9	17.9	51.0	34.0	15.0	.12	30.29
-85.0	43.0	18.0	51.1	34.1	15.1	.12	30.84
-84.0	43.0	18.0	51.2	34.2	15.2	.13	31.41
-83.0	43.0	18.0	51.3	34.3	15.3	.13	31.99
-82.0	43.1	18.1	51.5	34.5	15.4	.13	32.59
-81.0	43.1	18.1	51.6	34.6	15.5	.13	33.20
-80.0	43.2	18.2	51.7	34.7	15.6	.13	33.83
-79.0	43.2	18.2	51.9	34.9	15.6	.13	34.48
-78.0	43.3	18.3	52.0	35.0	15.7	.13	35.15
-77.0	43.3	18.3	52.1	35.1	15.8	.13	35.83
-76.0	43.4	18.4	52.3	35.3	15.9	.13	36.53
-75.0	43.4	18.4	52.4	35.4	16.0	.13	37.26
-74.0	43.4	18.4	52.5	35.5	16.1	.13	38.00
-73.0	43.5	18.5	52.7	35.7	16.2	.13	38.77
-72.0	43.5	18.5	52.8	35.8	16.3	.14	39.56
-71.0	43.6	18.6	53.0	36.0	16.4	.14	40.37
-70.0	43.6	18.6	53.1	36.1	16.5	.14	41.20
-69.0	43.7	18.7	53.3	36.3	16.6	.14	42.06
-68.0	43.7	18.7	53.4	36.4	16.7	.14	42.95
-67.0	43.8	18.8	53.5	36.5	16.8	.14	43.86
-66.0	43.8	18.8	53.7	36.7	16.9	.14	44.80
-65.0	43.9	18.9	53.8	36.8	17.0	.14	45.77
-64.0	43.9	18.9	54.0	37.0	17.1	.14	46.77
-63.0	44.0	19.0	54.2	37.2	17.3	.14	47.81
-62.0	44.0	19.0	54.3	37.3	17.4	.14	48.87
-61.0	44.1	19.1	54.5	37.5	17.5	.14	49.97
-60.0	44.1	19.1	54.6	37.6	17.6	.14	51.11
-59.0	44.2	19.2	54.8	37.8	17.7	.14	52.28
-58.0	44.2	19.2	54.9	37.9	17.8	.14	53.49
-57.0	44.3	19.3	55.1	38.1	17.9	.14	54.75
-56.0	44.4	19.4	55.3	38.3	18.1	.14	56.04
-55.0	44.4	19.4	55.4	38.4	18.2	.14	57.38
-54.0	44.5	19.5	55.6	38.6	18.3	.13	58.76
-53.0	44.5	19.5	55.7	38.7	18.4	.13	60.20
-52.0	44.6	19.6	55.9	38.9	18.6	.13	61.68
-51.0	44.6	19.6	56.1	39.1	18.7	.13	63.22
-50.0	44.7	19.7	56.3	39.3	18.8	.13	64.81
-49.0	44.7	19.7	56.4	39.4	18.9	.13	66.46
-48.0	44.8	19.8	56.6	39.6	19.1	.12	68.18
-47.0	44.8	19.8	56.8	39.8	19.2	.12	69.95
-46.0	44.9	19.9	56.9	39.9	19.3	.12	71.79

STRUCTURE TYPE 5
VERTICAL W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE		RADIO INTERFERENCE		TVI TOTAL RAIN	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
	(RAIN) L50 DBA	(FAIR) L50 DBA	(RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M			
-45.0	45.0	20.0	57.1	40.1	19.5	.11	73.71
-44.0	45.0	20.0	57.3	40.3	19.6	.11	75.70
-43.0	45.1	20.1	57.5	40.5	19.8	.11	77.76
-42.0	45.1	20.1	57.6	40.6	19.9	.10	79.91
-41.0	45.2	20.2	57.8	40.8	20.1	.10	82.14
-40.0	45.2	20.2	58.0	41.0	20.2	.09	84.47
-39.0	45.3	20.3	58.2	41.2	20.4	.09	86.89
-38.0	45.4	20.4	58.4	41.4	20.5	.08	89.41
-37.0	45.4	20.4	58.5	41.5	20.7	.07	92.04
-36.0	45.5	20.5	58.7	41.7	20.8	.07	94.78
-35.0	45.5	20.5	58.9	41.9	21.0	.06	97.64
-34.0	45.6	20.6	59.1	42.1	21.1	.05	100.62
-33.0	45.7	20.7	59.3	42.3	21.3	.05	103.74
-32.0	45.7	20.7	59.5	42.5	21.5	.05	107.00
-31.0	45.8	20.8	59.7	42.7	21.6	.05	110.41
-30.0	45.8	20.8	59.8	42.8	21.8	.05	113.98
-29.0	45.9	20.9	60.0	43.0	22.0	.06	117.72
-28.0	46.0	21.0	60.2	43.2	22.2	.07	121.63
-27.0	46.0	21.0	60.4	43.4	22.4	.09	125.74
-26.0	46.1	21.1	60.6	43.6	22.5	.11	130.04
-25.0	46.2	21.2	60.8	43.8	22.7	.13	134.56
-24.0	46.2	21.2	60.9	43.9	22.9	.15	139.30
-23.0	46.3	21.3	61.1	44.1	23.1	.18	144.27
-22.0	46.3	21.3	61.3	44.3	23.3	.21	149.50
-21.0	46.4	21.4	61.5	44.5	23.5	.24	155.00
-20.0	46.5	21.5	61.7	44.7	23.7	.27	160.77
-19.0	46.5	21.5	61.8	44.8	23.9	.31	166.84
-18.0	46.6	21.6	62.0	45.0	24.1	.35	173.22
-17.0	46.6	21.6	62.2	45.2	24.3	.40	179.91
-16.0	46.7	21.7	62.3	45.3	24.5	.44	186.93
-15.0	46.7	21.7	62.5	45.5	24.8	.50	194.29
-14.0	46.8	21.8	62.7	45.7	25.0	.55	202.00
-13.0	46.9	21.9	62.8	45.8	25.3	.61	210.04
-12.0	46.9	21.9	63.0	46.0	25.7	.68	218.43
-11.0	47.0	22.0	63.1	46.1	26.0	.75	227.13
-10.0	47.0	22.0	63.3	46.3	26.3	.82	236.14
-9.0	47.1	22.1	63.5	46.5	26.7	.90	245.39
-8.0	47.1	22.1	63.7	46.7	27.1	.98	254.85
-7.0	47.2	22.2	63.9	46.9	27.4	1.07	264.44
-6.0	47.2	22.2	64.1	47.1	27.8	1.16	274.05
-5.0	47.2	22.2	64.3	47.3	28.2	1.25	283.56
-4.0	47.3	22.3	64.5	47.5	28.7	1.34	292.82
-3.0	47.3	22.3	64.6	47.6	29.1	1.43	301.65
-2.0	47.4	22.4	64.8	47.8	29.5	1.52	309.85
-1.0	47.4	22.4	65.0	48.0	30.0	1.61	317.21
.0	47.4	22.4	65.1	48.1	30.5	1.69	323.50
1.0	47.5	22.5	65.3	48.3	30.9	1.76	328.52
2.0	47.5	22.5	65.4	48.4	31.4	1.82	332.07
3.0	47.5	22.5	65.5	48.5	31.9	1.86	334.03
4.0	47.5	22.5	65.6	48.6	32.4	1.89	334.30
5.0	47.6	22.6	65.7	48.7	32.8	1.91	332.88
6.0	47.6	22.6	65.8	48.8	33.3	1.91	329.83
7.0	47.6	22.6	65.8	48.8	33.7	1.90	325.28
8.0	47.6	22.6	65.9	48.9	34.0	1.88	319.40
9.0	47.6	22.6	65.9	48.9	34.2	1.85	312.41

STRUCTURE TYPE 5
VERTICAL W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) L50 DBA	NOISE (FAIR) L50 DBA	RADIO INTERFERENCE ¹ (RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TVI TOTAL RAIN DBUV/M	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
10.0	47.6	22.6	66.0	49.0	34.4	1.81	304.55
11.0	47.6	22.6	66.0	49.0	34.4	1.76	296.04
12.0	47.6	22.6	66.0	49.0	34.4	1.71	287.11
13.0	47.6	22.6	65.9	48.9	34.2	1.65	277.95
14.0	47.6	22.6	65.9	48.9	34.0	1.59	268.72
15.0	47.6	22.6	65.8	48.8	33.7	1.53	259.56
16.0	47.6	22.6	65.8	48.8	33.3	1.47	250.57
17.0	47.6	22.6	65.7	48.7	32.8	1.41	241.84
18.0	47.5	22.5	65.6	48.6	32.4	1.36	233.40
19.0	47.5	22.5	65.5	48.5	31.9	1.30	225.30
20.0	47.5	22.5	65.4	48.4	31.4	1.24	217.56
21.0	47.5	22.5	65.3	48.3	30.9	1.19	210.17
22.0	47.4	22.4	65.1	48.1	30.5	1.14	203.14
23.0	47.4	22.4	65.0	48.0	30.0	1.08	196.45
24.0	47.4	22.4	64.8	47.8	29.5	1.03	190.09
25.0	47.3	22.3	64.6	47.6	29.1	.98	184.05
26.0	47.3	22.3	64.5	47.5	28.7	.94	178.29
27.0	47.2	22.2	64.3	47.3	28.2	.89	172.81
28.0	47.2	22.2	64.1	47.1	27.8	.85	167.59
29.0	47.2	22.2	63.9	46.9	27.4	.80	162.60
30.0	47.1	22.1	63.7	46.7	27.1	.76	157.84
31.0	47.1	22.1	63.5	46.5	26.7	.72	153.28
32.0	47.0	22.0	63.3	46.3	26.3	.68	148.91
33.0	47.0	22.0	63.1	46.1	26.0	.64	144.72
34.0	46.9	21.9	63.0	46.0	25.7	.60	140.69
35.0	46.9	21.9	62.8	45.8	25.3	.56	136.82
36.0	46.8	21.8	62.7	45.7	25.0	.53	133.09
37.0	46.7	21.7	62.5	45.5	24.8	.49	129.50
38.0	46.7	21.7	62.3	45.3	24.5	.46	126.03
39.0	46.6	21.6	62.2	45.2	24.3	.43	122.69
40.0	46.6	21.6	62.0	45.0	24.1	.40	119.45
41.0	46.5	21.5	61.8	44.8	23.9	.37	116.33
42.0	46.5	21.5	61.7	44.7	23.7	.34	113.31
43.0	46.4	21.4	61.5	44.5	23.5	.32	110.38
44.0	46.3	21.3	61.3	44.3	23.3	.29	107.55
45.0	46.3	21.3	61.1	44.1	23.1	.27	104.81
46.0	46.2	21.2	60.9	43.9	22.9	.24	102.16
47.0	46.2	21.2	60.8	43.8	22.7	.22	99.59
48.0	46.1	21.1	60.6	43.6	22.5	.20	97.10
49.0	46.0	21.0	60.4	43.4	22.4	.18	94.68
50.0	46.0	21.0	60.2	43.2	22.2	.16	92.34
51.0	45.9	20.9	60.0	43.0	22.0	.14	90.07
52.0	45.8	20.8	59.8	42.8	21.8	.13	87.86
53.0	45.8	20.8	59.7	42.7	21.6	.11	85.73
54.0	45.7	20.7	59.5	42.5	21.5	.10	83.65
55.0	45.7	20.7	59.3	42.3	21.3	.09	81.64
56.0	45.6	20.6	59.1	42.1	21.1	.07	79.69
57.0	45.5	20.5	58.9	41.9	21.0	.06	77.80
58.0	45.5	20.5	58.7	41.7	20.8	.05	75.96
59.0	45.4	20.4	58.5	41.5	20.7	.05	74.18
60.0	45.4	20.4	58.4	41.4	20.5	.04	72.45
61.0	45.3	20.3	58.2	41.2	20.4	.04	70.77
62.0	45.2	20.2	58.0	41.0	20.2	.04	69.14
63.0	45.2	20.2	57.8	40.8	20.1	.04	67.56
64.0	45.1	20.1	57.6	40.6	19.9	.05	66.02

STRUCTURE TYPE 5
VERTICAL W/69KV UNDERBUILD

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) L50 DBA	NOISE (FAIR) L50 DBA	RADIO INTERFERENCE' (RAIN) L50 DBUV/M	(FAIR) L50 DBUV/M	TVI TOTAL RAIN DBUV/M	ELECTRIC FIELD KV/M	MAGNETIC FIELD MG
65.0	45.1	20.1	57.5	40.5	19.8	.05	64.53
66.0	45.0	20.0	57.3	40.3	19.6	.06	63.08
67.0	45.0	20.0	57.1	40.1	19.5	.06	61.67
68.0	44.9	19.9	56.9	39.9	19.3	.07	60.30
69.0	44.8	19.8	56.8	39.8	19.2	.07	58.97
70.0	44.8	19.8	56.6	39.6	19.1	.08	57.68
71.0	44.7	19.7	56.4	39.4	18.9	.08	56.43
72.0	44.7	19.7	56.3	39.3	18.8	.08	55.21
73.0	44.6	19.6	56.1	39.1	18.7	.09	54.03
74.0	44.6	19.6	55.9	38.9	18.6	.09	52.88
75.0	44.5	19.5	55.7	38.7	18.4	.09	51.76
76.0	44.5	19.5	55.6	38.6	18.3	.10	50.67
77.0	44.4	19.4	55.4	38.4	18.2	.10	49.61
78.0	44.4	19.4	55.3	38.3	18.1	.10	48.59
79.0	44.3	19.3	55.1	38.1	17.9	.11	47.59
80.0	44.2	19.2	54.9	37.9	17.8	.11	46.61
81.0	44.2	19.2	54.8	37.8	17.7	.11	45.67
82.0	44.1	19.1	54.6	37.6	17.6	.11	44.75
83.0	44.1	19.1	54.5	37.5	17.5	.11	43.85
84.0	44.0	19.0	54.3	37.3	17.4	.11	42.98
85.0	44.0	19.0	54.2	37.2	17.3	.11	42.13
86.0	43.9	18.9	54.0	37.0	17.1	.12	41.31
87.0	43.9	18.9	53.8	36.8	17.0	.12	40.50
88.0	43.8	18.8	53.7	36.7	16.9	.12	39.72
89.0	43.8	18.8	53.5	36.5	16.8	.12	38.96
90.0	43.7	18.7	53.4	36.4	16.7	.12	38.22
91.0	43.7	18.7	53.3	36.3	16.6	.12	37.49
92.0	43.6	18.6	53.1	36.1	16.5	.12	36.79
93.0	43.6	18.6	53.0	36.0	16.4	.12	36.10
94.0	43.5	18.5	52.8	35.8	16.3	.12	35.44
95.0	43.5	18.5	52.7	35.7	16.2	.12	34.78
96.0	43.4	18.4	52.5	35.5	16.1	.12	34.15
97.0	43.4	18.4	52.4	35.4	16.0	.12	33.53
98.0	43.4	18.4	52.3	35.3	15.9	.12	32.93
99.0	43.3	18.3	52.1	35.1	15.8	.12	32.34

STRUCTURE TYPE 5
VERTICAL W/69KV UNDERBUILD

EMF

HARDEE POWER STATION TO VANDOLAH AND

LEE SUBSTATIONS TRANSMISSION LINE

COMP	MF	UZ	RI	EF	TV	AN	CL					
+	4.	921	6.5	62	9.342	0.000	1.000	75.000	3.000	2.000	3.0	
+	PH.	A-1	A	11.00	47.00	1	1.55	0.00	139.7	0.0	0.00	
+	PH.	B-1	A	11.00	37.00	1	1.55	0.00	139.7	-120.0	0.00	
+	PH.	C-1	A	11.00	27.00	1	1.55	0.00	139.7	120.0	0.00	
+	GND	-1	A	4.00	63.00	1	0.39	0.00	0.0	0.0	0.00	
+	50			0.0	2.0							
+	0			0.0	0.0							

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, OZONE CONCENTRATION, GROUND GRADIENT AND MAGNETIC FIELD

COMBINED CYCLE 230KV SINGLE CIRCUIT VERTICAL
1-1.545 IN., VERT CONFIG, WITH ONE GROUND WIRE PER CIRCUIT

0
0

242. KV

	DIST. FROM CENTER OF TOWER (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON. DIAM. (IN)	NO. OF SUBCON.	SUBCON SPACING (IN)	VOLTAGE L-N (KV)	PHASE ANGLE (DEGREES)	CORONA LOSSES (KW/MI)
PH. A-1	11.00	47.00	13.24	1.55	1.	0.00	139.70	0.00	4.795
PH. B-1	11.00	37.00	14.42	1.55	1.	0.00	139.70	-120.00	8.345
PH. C-1	11.00	27.00	13.50	1.55	1.	0.00	139.70	120.00	5.451
GND -1	4.00	63.00	4.41	0.39	1.	0.00	0.00	0.00	0.000

AN MICROPHONE HT.= 4.9 FT. RI ANT. HT.= 6.6 FT. TV ANT. HT.= 9.8 FT. ALTITUDE= 0.0 FT
RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ)= 1.500 MPH, GROUND CONDUCTIVITY = 2.0 MMHOS /M
E-FIELD TRANSDUCER HT.= 3.0 FT, B-FIELD TRANSDUCER HT.= 3.0 FT

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) (FAIR) L50 DBA	AUDIBLE NOISE (RAIN) (FAIR) L50 DBA	RADIO INTERFERENCE (RAIN) (FAIR) L50 DBUV/M	RADIO INTERFERENCE (RAIN) (FAIR) L50 DBUV/M	TVI TOTAL RAIN DBUV/M	OZONE FOR RAIN RATE OF 1.00 IN/HR AT PPB	ELECTRIC FIELD KV/M	MAGNETIC FIELD GAUSS/1000AMP
0.0	47.7	22.7	66.9	49.9	24.8	0.000000	2.099	0.09601
2.0	47.8	22.8	67.3	50.3	25.0	0.000000	2.293	0.09994
4.0	47.9	22.9	67.7	50.7	25.4	0.000000	2.466	0.10336
6.0	48.0	23.0	68.2	51.2	25.7	0.000000	2.607	0.10610
8.0	48.0	23.0	68.5	51.5	25.9	0.000000	2.707	0.10802
10.0	48.0	23.0	68.7	51.7	26.0	0.000000	2.759	0.10901
12.0	48.0	23.0	68.7	51.7	26.0	0.000000	2.757	0.10901
14.0	48.0	23.0	68.5	51.5	25.9	0.000000	2.703	0.10802
16.0	48.0	23.0	68.2	51.2	25.7	0.000159	2.600	0.10610
18.0	47.9	22.9	67.7	50.7	25.4	0.005971	2.456	0.10336
20.0	47.8	22.8	67.3	50.3	25.0	0.029454	2.281	0.09994
22.0	47.7	22.7	66.9	49.9	24.8	0.071023	2.085	0.09601
24.0	47.6	22.6	66.6	49.6	24.6	0.123364	1.878	0.09173
26.0	47.4	22.4	66.1	49.1	24.3	0.178738	1.669	0.08723
28.0	47.3	22.3	65.7	48.7	24.0	0.231474	1.466	0.08266
30.0	47.1	22.1	65.2	48.2	23.7	0.278316	1.272	0.07810
32.0	47.0	22.0	64.7	47.7	23.4	0.317916	1.092	0.07363
34.0	46.8	21.8	64.2	47.2	23.1	0.350146	0.923	0.06931
36.0	46.6	21.6	63.6	46.6	22.8	0.375544	0.780	0.06518
38.0	46.5	21.5	63.1	46.1	22.5	0.394939	0.648	0.06126
40.0	46.3	21.3	62.5	45.5	22.1	0.409236	0.532	0.05756
42.0	46.1	21.1	62.0	45.0	21.8	0.419299	0.431	0.05408
44.0	46.0	21.0	61.4	44.4	21.5	0.425897	0.343	0.05082
46.0	45.8	20.8	60.9	43.9	21.2	0.429693	0.268	0.04778
48.0	45.7	20.7	60.3	43.3	20.9	0.431241	0.204	0.04495
50.0	45.5	20.5	59.8	42.8	20.6	0.431001	0.150	0.04231
52.0	45.3	20.3	59.3	42.3	20.3	0.429347	0.106	0.03986
54.0	45.2	20.2	58.8	41.8	20.0	0.426585	0.071	0.03758
56.0	45.0	20.0	58.3	41.3	19.7	0.422963	0.047	0.03547
58.0	44.9	19.9	57.8	40.8	19.4	0.418679	0.049	0.03350
60.0	44.7	19.7	57.3	40.3	19.2	0.413894	0.062	0.03167
62.0	44.6	19.6	56.8	39.8	18.9	0.408738	0.076	0.02997
64.0	44.5	19.5	56.3	39.3	18.6	0.403314	0.089	0.02839
66.0	44.3	19.3	55.9	38.9	18.4	0.397706	0.100	0.02691
68.0	44.2	19.2	55.4	38.4	18.1	0.391980	0.110	0.02554
70.0	44.1	19.1	55.0	38.0	17.9	0.386190	0.117	0.02426
72.0	43.9	18.9	54.6	37.6	17.6	0.380378	0.124	0.02306
74.0	43.8	18.8	54.2	37.2	17.4	0.374578	0.128	0.02195
76.0	43.7	18.7	53.8	36.8	17.2	0.368817	0.132	0.02091
78.0	43.6	18.6	53.4	36.4	16.9	0.363115	0.134	0.01993
80.0	43.4	18.4	53.0	36.0	16.7	0.357489	0.136	0.01902
82.0	43.3	18.3	52.6	35.6	16.5	0.351951	0.137	0.01816
84.0	43.2	18.2	52.2	35.2	16.3	0.346510	0.137	0.01736
86.0	43.1	18.1	51.9	34.9	16.1	0.341173	0.137	0.01660
88.0	43.0	18.0	51.5	34.5	15.9	0.335945	0.136	0.01589
90.0	42.9	17.9	51.2	34.2	15.7	0.330830	0.135	0.01522
92.0	42.8	17.8	50.8	33.8	15.5	0.325828	0.134	0.01460
94.0	42.7	17.7	50.5	33.5	15.3	0.320942	0.132	0.01400
96.0	42.6	17.6	50.2	33.2	15.1	0.316171	0.131	0.01344
98.0	42.5	17.5	49.9	32.9	14.9	0.311514	0.129	0.01292

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, OZONE CONCENTRATION, GROUND GRADIENT AND MAGNETIC FIELD

230KV H-FRAME SINGLE CIRCUIT COMBINED CYCLE
1-1.545 IN., HORT CONFIG, WITH TWO GROUND WIRE PER CIRCUIT

0
0

242. KV

	DIST. FROM CENTER OF TOWER (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON. DIAM. (IN.)	NO. OF SUBCON.	SUBCON SPACING (IN)	VOLTAGE L-N (KV)	PHASE ANGLE (DEGREES)	CORONA LOSSES (KW/MI)
PH. A-1	17.50	27.00	12.20	1.55	1.	0.00	139.70	0.00	2.816
PH. B-1	0.00	27.00	13.02	1.55	1.	0.00	139.70	-120.00	4.297
PH. C-1	-17.50	27.00	12.20	1.55	1.	0.00	139.70	120.00	2.816
GND -1	8.75	45.00	2.46	0.39	1.	0.00	0.00	0.00	0.000
GND -2	-8.75	45.00	2.46	0.39	1.	0.00	0.00	0.00	0.000

AN MICROPHONE HT.= 4.9 FT. RI ANT. HT.= 6.6 FT. TV ANT. HT.= 9.8 FT. ALTITUDE= 0.0 FT
RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ)= 1.500 MPH, GROUND CONDUCTIVITY = 2.0 MMHOS /M
E-FIELD TRANSDUCER HT.= 3.0 FT, B-FIELD TRANSDUCER HT.= 3.0 FT

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) (FAIR) L50 L50 DBA DBA		RADIO INTERFERENCE (RAIN) (FAIR) L50 L50 DBUV/M DBUV/M		TVI TOTAL RAIN DBUV/M	OZONE FOR RAIN RATE OF 1.00 IN/HR AT 0. FT.LEVEL PPH	ELECTRIC FIELD KV/M	MAGNETIC FIELD GAUSS/1000AMP
0.0	43.9	13.9	66.8	49.8	24.1	0.058194	1.584	0.22538
2.0	43.9	13.9	66.7	49.7	24.1	0.063143	1.613	0.22523
4.0	43.9	13.9	66.4	49.4	23.9	0.066253	1.704	0.22473
6.0	43.8	13.8	66.1	49.1	23.6	0.069075	1.854	0.22373
8.0	43.8	13.8	65.5	48.5	23.3	0.079382	2.055	0.22202
10.0	43.7	13.7	64.9	47.9	22.8	0.099752	2.288	0.21940
12.0	43.6	13.6	64.2	47.2	22.4	0.122992	2.531	0.21571
14.0	43.5	13.5	63.5	46.5	21.9	0.143251	2.781	0.21083
16.0	43.3	13.3	63.3	46.3	21.4	0.158524	2.959	0.20474
18.0	43.2	13.2	63.4	46.4	20.9	0.168947	3.109	0.19750
20.0	43.0	13.0	63.3	46.3	20.6	0.175336	3.203	0.18925
22.0	42.9	12.9	63.0	46.0	20.4	0.178802	3.238	0.18021
24.0	42.7	12.7	62.5	45.5	20.1	0.181315	3.217	0.17063
26.0	42.5	12.5	62.0	45.0	19.8	0.188169	3.147	0.16074
28.0	42.3	12.3	61.4	44.4	19.3	0.199281	3.036	0.15081
30.0	42.1	12.1	60.6	43.6	18.9	0.210481	2.897	0.14103
32.0	41.9	11.9	59.9	42.9	18.4	0.219167	2.737	0.13157
34.0	41.7	11.7	59.1	42.1	17.9	0.224718	2.566	0.12254
36.0	41.5	11.5	58.2	41.2	17.4	0.227463	2.391	0.11403
38.0	41.3	11.3	57.4	40.4	16.9	0.227996	2.217	0.10607
40.0	41.1	11.1	56.6	39.6	16.4	0.226895	2.048	0.09868
42.0	40.9	10.9	55.7	38.7	15.9	0.224635	1.888	0.09185
44.0	40.7	10.7	54.9	37.9	15.4	0.221578	1.737	0.08556
46.0	40.5	10.5	54.1	37.1	15.0	0.217993	1.596	0.07979
48.0	40.4	10.4	53.4	36.4	14.7	0.214074	1.466	0.07448
50.0	40.2	10.2	52.6	35.6	14.3	0.209961	1.347	0.06963
52.0	40.0	10.0	51.9	34.9	14.0	0.205755	1.238	0.06517
54.0	39.8	9.8	51.2	34.2	13.7	0.201525	1.138	0.06109
56.0	39.7	9.7	50.5	33.5	13.4	0.197323	1.047	0.05734
58.0	39.5	9.5	49.8	32.8	13.2	0.193182	0.964	0.05390
60.0	39.4	9.4	49.2	32.2	12.9	0.189126	0.889	0.05074
62.0	39.2	9.2	48.5	31.5	12.6	0.185170	0.821	0.04783
64.0	39.1	9.1	47.9	30.9	12.4	0.181325	0.759	0.04515
66.0	38.9	8.9	47.3	30.3	12.1	0.177596	0.702	0.04268
68.0	38.8	8.8	46.8	29.8	11.9	0.173985	0.651	0.04039
70.0	38.6	8.6	46.2	29.2	11.6	0.170493	0.604	0.03828
72.0	38.5	8.5	45.7	28.7	11.4	0.167119	0.561	0.03632
74.0	38.4	8.4	45.2	28.2	11.2	0.163861	0.522	0.03450
76.0	38.3	8.3	44.7	27.7	11.0	0.160715	0.487	0.03281
78.0	38.1	8.1	44.2	27.2	10.8	0.157679	0.454	0.03124
80.0	38.0	8.0	43.7	26.7	10.5	0.154748	0.424	0.02978
82.0	37.9	7.9	43.2	26.2	10.3	0.151919	0.397	0.02841
84.0	37.8	7.8	42.8	25.8	10.1	0.149188	0.372	0.02713
86.0	37.7	7.7	42.4	25.4	9.9	0.146551	0.349	0.02594
88.0	37.6	7.6	42.1	25.1	9.8	0.144003	0.327	0.02482
90.0	37.5	7.5	41.8	24.8	9.6	0.141541	0.308	0.02377
92.0	37.3	7.3	41.5	24.5	9.4	0.139162	0.289	0.02278
94.0	37.2	7.2	41.2	24.2	9.2	0.136862	0.273	0.02185
96.0	37.1	7.1	40.9	23.9	9.0	0.134637	0.257	0.02098
98.0	37.0	7.0	40.6	23.6	8.8	0.132483	0.243	0.02016

 * B. P. A. CORONA AND *
 * FIELD EFFECTS PROGRAM *

+++++
 + INPUT DATA LIST +

+++++
 + COMBINED CYCLE 230KV DOUBLE CIRCUIT LINES
 + 1-1.545 IN., VERT.CONFIG, WITH ONE GROUND WIRE PER CIRCUIT
 + 1 0 6 8 242.0 1.50 1.00

0
 0

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 8 CONDUCTORS, WHICH 6 ARE ENERGIZED PHASES

+COMB	MF	OZ	RI	EF	TV	AN	CL					
+ 4.921		6.562		9.842		0.000		1.000	75.000	3.000	2.000	3.0
+ PH. A-1	A		11.00		47.00		1	1.55	0.00	139.7	0.0	0.00
+ PH. B-1	A		11.00		37.00		1	1.55	0.00	139.7	-120.0	0.00
+ PH. C-1	A		11.00		27.00		1	1.55	0.00	139.7	120.0	0.00
+ PH. A-2	A		-11.00		47.00		1	1.55	0.00	139.7	0.0	0.00
+ PH. B-2	A		-11.00		37.00		1	1.55	0.00	139.7	-120.0	0.00
+ PH. C-2	A		-11.00		27.00		1	1.55	0.00	139.7	120.0	0.00
+ GND -1	A		4.00		63.00		1	0.39	0.00	0.0	0.0	0.00
+ GND -2	A		-4.00		63.00		1	0.39	0.00	0.0	0.0	0.00
+ 50		0.0			2.0							
+ 0		0.0			0.0							

COMBINED OUT OF AUDIBLE NOISE, RADIO NOISE, TVI, OZONE CONCENTRATION, GROUND GRADIENT AND MAGNETIC FIELD

COMBINED CYCLE 230KV DOUBLE CIRCUIT LINES
1-1.545 IN., VERT.CONFIG, WITH ONE GROUND WIRE PER CIRCUIT0
0

242. KV

	DIST. FROM CENTER OF TOWER (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON. DIAM. (IN)	NO. OF SUBCON.	SUBCON SPACING (IN)	VOLTAGE L-N (KV)	PHASE ANGLE (DEGREES)	CORONA LOSSES (KV/MI)
PH. A-1	11.00	47.00	12.96	1.55	1.	0.00	139.70	0.00	4.175
PH. B-1	11.00	37.00	14.33	1.55	1.	0.00	139.70	-120.00	8.017
PH. C-1	11.00	27.00	13.19	1.55	1.	0.00	139.70	120.00	4.681
PH. A-2	-11.00	47.00	12.96	1.55	1.	0.00	139.70	0.00	4.175
PH. B-2	-11.00	37.00	14.33	1.55	1.	0.00	139.70	-120.00	8.017
PH. C-2	-11.00	27.00	13.19	1.55	1.	0.00	139.70	120.00	4.681
GND -1	4.00	63.00	5.95	0.39	1.	0.00	0.00	0.00	0.000
GND -2	-4.00	63.00	5.95	0.39	1.	0.00	0.00	0.00	0.000

AN MICROPHONE HT.= 4.9 FT. RI ANT. HT.= 6.6 FT. TV ANT. HT.= 9.8 FT. ALTITUDE= 0.0 FT
 RI FREQ= 1.000 MHZ, TV FREQ= 75.000 MHZ, WIND VEL.(OZ)= 1.500 MPH, GROUND CONDUCTIVITY = 2.0 MNOS /M
 E-FIELD TRANSDUCER HT.= 3.0 FT, B-FIELD TRANSDUCER HT.= 3.0 FT

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) (FAIR) L50 L50 DBA DBA	RADIO INTERFERENCE (RAIN) (FAIR) L50 L50 DBUV/M DBUV/M	TVI TOTAL RAIN DBUV/M	OZONE FOR RAIN RATE OF 1.00 IN/HR AT 0. FT.LEVEL PPB	ELECTRIC FIELD KV/M	MAGNETIC FIELD GAUSS/1000AMP		
0.0	50.0	25.0	66.6	49.6	24.5	0.059777	4.167	0.14916
2.0	50.0	25.0	67.0	50.0	24.7	0.105236	4.157	0.14929
4.0	50.0	25.0	67.2	50.2	24.8	0.154068	4.126	0.14963
6.0	49.9	24.9	67.4	50.4	25.0	0.201018	4.071	0.15002
8.0	49.9	24.9	67.6	50.6	25.1	0.242962	3.986	0.15024
10.0	49.8	24.8	67.7	50.7	25.1	0.278550	3.866	0.15005
12.0	49.8	24.8	67.7	50.7	25.1	0.307587	3.710	0.14923
14.0	49.7	24.7	67.6	50.6	25.1	0.330516	3.518	0.14762
16.0	49.6	24.6	67.4	50.4	25.0	0.348195	3.293	0.14517
18.0	49.5	24.5	67.2	50.2	24.8	0.365941	3.042	0.14188
20.0	49.4	24.4	67.0	50.0	24.7	0.394639	2.775	0.13783
22.0	49.2	24.2	66.6	49.6	24.5	0.436032	2.499	0.13317
24.0	49.1	24.1	66.2	49.2	24.2	0.485023	2.224	0.12803
26.0	48.9	23.9	65.8	48.8	24.0	0.535366	1.957	0.12257
28.0	48.8	23.8	65.4	48.4	23.7	0.582217	1.703	0.11694
30.0	48.6	23.6	64.9	47.9	23.4	0.622791	1.467	0.11126
32.0	48.5	23.5	64.4	47.4	23.1	0.656010	1.252	0.10563
34.0	48.3	23.3	63.8	46.8	22.8	0.681903	1.057	0.10011
36.0	48.2	23.2	63.3	46.3	22.5	0.701092	0.883	0.09478
38.0	48.0	23.0	62.8	45.8	22.1	0.714447	0.730	0.08966
40.0	47.9	22.9	62.2	45.2	21.8	0.722889	0.595	0.08479
42.0	47.7	22.7	61.7	44.7	21.5	0.727283	0.478	0.08016
44.0	47.6	22.6	61.1	44.1	21.2	0.728396	0.378	0.07580
46.0	47.4	22.4	60.6	43.6	20.9	0.726880	0.292	0.07168
48.0	47.3	22.3	60.0	43.0	20.6	0.723282	0.219	0.06782
50.0	47.1	22.1	59.5	42.5	20.3	0.718054	0.158	0.06420
52.0	47.0	22.0	59.0	42.0	20.0	0.711561	0.110	0.06081
54.0	46.8	21.8	58.4	41.4	19.7	0.704103	0.073	0.05763
56.0	46.7	21.7	57.9	40.9	19.4	0.695921	0.058	0.05466
58.0	46.5	21.5	57.4	40.4	19.1	0.687207	0.075	0.05189
60.0	46.4	21.4	57.0	40.0	18.8	0.678117	0.092	0.04929
62.0	46.3	21.3	56.5	39.5	18.6	0.668777	0.109	0.04686
64.0	46.2	21.2	56.0	39.0	18.3	0.659285	0.124	0.04458
66.0	46.0	21.0	55.6	38.6	18.0	0.649720	0.137	0.04245
68.0	45.9	20.9	55.1	38.1	17.8	0.640146	0.148	0.04046
70.0	45.8	20.8	54.7	37.7	17.6	0.630612	0.157	0.03859
72.0	45.7	20.7	54.3	37.3	17.3	0.621157	0.164	0.03684
74.0	45.5	20.5	53.8	36.8	17.1	0.611812	0.169	0.03519
76.0	45.4	20.4	53.4	36.4	16.8	0.602600	0.173	0.03364
78.0	45.3	20.3	53.0	36.0	16.6	0.593540	0.176	0.03219
80.0	45.2	20.2	52.7	35.7	16.4	0.584642	0.178	0.03082
82.0	45.1	20.1	52.3	35.3	16.2	0.575919	0.179	0.02954
84.0	45.0	20.0	51.9	34.9	16.0	0.567376	0.179	0.02833
86.0	44.9	19.9	51.5	34.5	15.8	0.559017	0.178	0.02718
88.0	44.8	19.8	51.2	34.2	15.6	0.550844	0.177	0.02610
90.0	44.7	19.7	50.8	33.8	15.4	0.542859	0.176	0.02508
92.0	44.6	19.6	50.5	33.5	15.2	0.535060	0.174	0.02412
94.0	44.5	19.5	50.2	33.2	15.0	0.527447	0.172	0.02321
96.0	44.4	19.4	49.9	32.9	14.8	0.520017	0.170	0.02235
98.0	44.3	19.3	49.6	32.6	14.6	0.512767	0.168	0.02153

 * U. P. A. CORONA AND *
 * FIELD EFFECTS PROGRAM *

 + INPUT DATA LIST +

 + COMBINED CYCLE 230KV SINGLE CIRCUIT DELTA
 + 1-1.545 IN., DELT.CONFIG, WITH ONE GROUND WIRE PER CIRCUIT
 + 1 0 3 4 242.0 1.50 1.00

0
0

(ENGLISH UNITS OPTION)

LINE GRADIENTS COMPUTED BY PROGRAM

PHYSICAL SYSTEM CONSISTS OF 4 CONDUCTORS, WHICH 3 ARE ENERGIZED PHASES

+CONB	HF	DZ	RI	EF	TV	AN	CL					
+ 4.921		6.562		9.342		0.000		1.000	75.000	3.000	2.000	3.0
+ PH. A-1	A		11.00		47.00		1	1.55	0.00	139.7	0.0	0.00
+ PH. B-1	A		-11.00		37.00		1	1.55	0.00	139.7	-120.0	0.00
+ PH. C-1	A		11.00		27.00		1	1.55	0.00	139.7	120.0	0.00
+ GND	-1	A		4.00		63.00	1	0.39	0.00	0.0	0.0	0.00
+ 50			0.0		2.0							
+ 0			0.0		0.0							

COMBINED OUTPUT OF AUDIBLE NOISE, RADIO NOISE, TVI, OZONE CONCENTRATION, GROUND GRADIENT AND MAGNETIC FIELD

COMBINED CYCLE 230KV SINGLE CIRCUIT DELTA
1-1.545 IN., DELT.CONFIG, WITH ONE GROUND WIRE PER CIRCUIT0
0

242. KV

	DIST. FROM CENTER OF TOWER (FEET)	HEIGHT (FEET)	MAXIMUM GRADIENT (KV/CM)	SUBCON. DIAM. (IN)	NO. OF SUBCON.	SUBCON SPACING (IN)	VOLTAGE L-N (KV)	PHASE ANGLE (DEGREES)	CORONA LOSSES (KW/MI)
PH. A-1	11.00	47.00	12.26	1.55	1.	0.00	139.70	0.00	2.914
PH. B-1	-11.00	37.00	12.00	1.55	1.	0.00	139.70	-120.00	2.525
PH. C-1	11.00	27.00	12.57	1.55	1.	0.00	139.70	120.00	3.411
GND -1	4.00	63.00	4.34	0.39	1.	0.00	0.00	0.00	0.000

AN MICROPHONE HT. = 4.9 FT. RI ANT. HT. = 6.6 FT. TV ANT. HT. = 9.3 FT. ALTITUDE = 0.0 FT
 RI FREQ = 1.000 MHZ, TV FREQ = 75.000 MHZ, WIND VEL. (OZ) = 1.500 MPH, GROUND CONDUCTIVITY = 2.0 MMHOS / M
 E-FIELD TRANSDUCER HT. = 3.0 FT, B-FIELD TRANSDUCER HT. = 3.0 FT

LATERAL DIST FROM REFERENCE (FEET)	AUDIBLE NOISE (RAIN) (FAIR) L50 DBA L50 DBA	RADIO INTERFERENCE (RAIN) (FAIR) L50 DBUV/M L50 DBUV/M	TVI TOTAL RAIN DBUV/M	OZONE FOR RAIN RATE OF 1.00 IN/HR AT 0. FT. LEVEL PPB	ELECTRIC FIELD KV/M	MAGNETIC FIELD GAUSS/1000AMP		
0.0	41.8	16.8	62.7	45.7	20.8	0.002547	2.046	0.14574
2.0	41.9	16.9	63.4	46.4	21.2	0.006670	2.262	0.14761
4.0	41.9	16.9	64.0	47.0	21.6	0.012178	2.479	0.14856
6.0	42.0	17.0	64.4	47.4	21.9	0.018087	2.678	0.14851
8.0	42.0	17.0	64.7	47.7	22.1	0.023672	2.843	0.14738
10.0	42.0	17.0	64.9	47.9	22.2	0.028556	2.962	0.14516
12.0	42.0	17.0	64.9	47.9	22.2	0.032609	3.026	0.14187
14.0	41.9	16.9	64.7	47.7	22.1	0.035849	3.033	0.13761
16.0	41.8	16.8	64.4	47.4	21.9	0.038443	2.986	0.13251
18.0	41.7	16.7	64.0	47.0	21.6	0.043420	2.891	0.12677
20.0	41.6	16.6	63.4	46.4	21.2	0.056294	2.758	0.12057
22.0	41.5	16.5	62.7	45.7	20.8	0.074416	2.597	0.11410
24.0	41.3	16.3	62.0	45.0	20.3	0.092670	2.419	0.10753
26.0	41.2	16.2	61.2	44.2	19.8	0.108669	2.234	0.10102
28.0	41.0	16.0	60.4	43.4	19.3	0.121939	2.048	0.09467
30.0	40.8	15.8	59.6	42.6	18.8	0.132650	1.868	0.08856
32.0	40.6	15.6	58.7	41.7	18.3	0.141104	1.699	0.08274
34.0	40.5	15.5	57.9	40.9	17.8	0.147605	1.542	0.07726
36.0	40.3	15.3	57.1	40.1	17.3	0.152438	1.399	0.07213
38.0	40.1	15.1	56.3	39.3	16.9	0.155865	1.270	0.06734
40.0	39.9	14.9	55.5	38.5	16.4	0.158122	1.155	0.06290
42.0	39.8	14.8	54.7	37.7	16.0	0.159416	1.053	0.05878
44.0	39.6	14.6	54.0	37.0	15.5	0.159926	0.963	0.05497
46.0	39.4	14.4	53.2	36.2	15.1	0.159805	0.884	0.05145
48.0	39.3	14.3	52.5	35.5	14.7	0.159178	0.814	0.04821
50.0	39.1	14.1	51.8	34.8	14.4	0.158153	0.753	0.04522
52.0	39.0	14.0	51.2	34.2	14.0	0.154815	0.698	0.04246
54.0	38.8	13.8	50.5	33.5	13.6	0.155236	0.650	0.03991
56.0	38.7	13.7	50.1	33.1	13.3	0.153473	0.607	0.03756
58.0	38.5	13.5	49.7	32.7	13.0	0.151573	0.569	0.03539
60.0	38.4	13.4	49.4	32.4	12.6	0.149573	0.535	0.03338
62.0	38.2	13.2	49.0	32.0	12.3	0.147506	0.504	0.03152
64.0	38.1	13.1	48.6	31.6	12.0	0.145394	0.475	0.02981
66.0	37.9	12.9	48.2	31.2	11.7	0.143258	0.450	0.02821
68.0	37.8	12.8	47.8	30.8	11.5	0.141113	0.426	0.02673
70.0	37.7	12.7	47.5	30.5	11.2	0.138972	0.404	0.02536
72.0	37.6	12.6	47.1	30.1	10.9	0.136845	0.384	0.02408
74.0	37.4	12.4	46.7	29.7	10.7	0.134740	0.366	0.02289
76.0	37.3	12.3	46.4	29.4	10.4	0.132663	0.349	0.02178
78.0	37.2	12.2	46.0	29.0	10.3	0.130617	0.333	0.02075
80.0	37.1	12.1	45.7	28.7	9.9	0.128608	0.318	0.01979
82.0	37.0	12.0	45.4	28.4	9.7	0.126637	0.303	0.01888
84.0	36.9	11.9	45.0	28.0	9.5	0.124706	0.290	0.01804
86.0	36.7	11.7	44.7	27.7	9.2	0.122817	0.278	0.01725
88.0	36.6	11.6	44.4	27.4	9.0	0.120969	0.266	0.01651
90.0	36.5	11.5	44.1	27.1	8.8	0.119164	0.255	0.01581
92.0	36.4	11.4	43.8	26.8	8.6	0.117402	0.245	0.01516
94.0	36.3	11.3	43.5	26.5	8.4	0.115681	0.235	0.01455
96.0	36.2	11.2	43.2	26.2	8.2	0.114003	0.226	0.01397
98.0	36.1	11.1	42.9	25.9	8.0	0.112366	0.217	0.01342

the transmission line routing is sensitive to adjacent land uses and therefore is consistent with the Comprehensive Plan.

LEE COUNTY

Approximately 8 km (5 miles) of the corridor in Lee County will pass through areas designated as open land with the remaining approximately 4.8 km (3 miles) passing through central urban land as designated by the Lee County Future Land Use Plan Map. Crossing through central urban designated land was unavoidable due to urban development in the area immediately surrounding the Lee Substation. The route selected for the corridor in Lee County was designed to minimize crossing into urban designated areas to the fullest extent possible.

The electric power element of Lee County's Comprehensive Plan provides, in part, as follows:

- o GOAL VII.S

To assist the electric power utilities in achieving their objective(s) of providing "... an adequate and reliable electric power supply for its customers as economically as possible with due regard to environmental and other established guidelines and policies."

- o OBJECTIVE VII.S.1

To protect local land uses and environmental quality from the impacts of electric power facilities through reasonable standards of design and construction.

- o POLICY VII.S.1

Insofar as it lies within its regulatory authority, the county shall ensure that sufficient land is available for the erection of electric power facilities.

o POLICY VII.S.2

Where conflict or incompatibility occur between power facilities and adjacent land uses, the County shall require that compatible design criteria, landscaping and buffering be invoked to protect those adjacent land uses.

o POLICY VII.S.3

The County shall encourage that power line easements or ROWs be designed for multiple use consistent with the type of area; e.g., recreation and transportation in urban areas and wildlife management or recreation in non-urban areas, if feasible and safe.

o POLICY VII.S.4

The County shall require that in the non-urban areas, power line easements shall be designed so that:

- service trails will not impede or divert surface water flow; and
- secondary land uses, including recreation, agriculture, and wildlife management, will not be unnecessarily inhibited or prohibited.

o POLICY VII.S.5

The County shall maintain a cooperative program of information exchange with the local electric utilities.

The transmission line corridor routing in Lee County will be duly sensitive to all relevant goals, objectives, and policies of the Lee County Comprehensive Plan, and will be consistent with the Comprehensive Plan.

The transmission line qualifies as an "essential service" under Section 1001.13 of the Lee County Zoning Ordinance. As such, the transmission line and related appurtenances "are permitted by right in all zoning districts when necessary for the day-to-day operation of the service," subject to enumerated requirements pertaining to setbacks, visibility, location, and

compliance with the National Electrical Safety Code (See Lee County Zoning Ordinance, 516B).

CITY OF CAPE CORAL

Approximately 5.3 km (3.2 miles) of the transmission line corridor will pass through the northernmost portion of the City of Cape Coral. Review of the Cape Coral Future Land Use Map reflects that approximately 2 km (1.2 miles) of the corridor will pass through an area designated for single family residential usage. Approximately 1.6 km (1 mile) of corridor will traverse an area designated for mixed use, and another 1.6 km (1 mile) through an area classified for parks/recreation utilization.

The Cape Coral Comprehensive Plan contains no specific restriction on transmission lines. Because the proposed transmission line corridor planning approach is sensitive to adjacent land uses and ecological features, it is consistent and in compliance with the City of Cape Coral Comprehensive Plan.

The transmission line constitutes a "public service structure" as that term is defined under the City of Cape Coral Land Use and Development Regulations, and is listed as a "special exception use" under one or more of the zoning districts that it will traverse. Special exception uses are described in Article XI of the City of Cape Coral Zoning Ordinance as uses that are "essential to or would promote the public health, safety, or welfare in one or more districts," but require conditions in order to avoid impairment of the integrity and character of the area. The transmission line corridor is consistent with and will comply with all appropriate conditions.

6.1.7.2.3 Easements, Title, Agency Works

Easements will be required for the transmission line corridor to cross lands under the jurisdiction of the Board of Trustees of the Internal Improvement Trust Fund. A list of roads, canals, and railroads within the preferred corridor between the Hardee Power Station and the Lee Substation which will be crossed is presented in Table 6.1.7-1.

Table 6.1.7-1. Easements, Title, Crossing Approvals Normally Required for Transmission Line Construction in the Preferred Corridor Between the Hardee Power Station and Vandolah and Lee Substations

Facility	Corridor	Affected Agency	Previous Approval	Changes
<u>Roads</u>				
CR 663	C2	Hardee County	Utility Permit	None
SR 63	C2	FDOT	Utility Permit	None
SR 70	C2	FDOT	Utility Permit	None
SR 72	C2	FDOT	Utility Permit	None
CR 661	C2	Hardee County	Utility Permit	None
CR 661	C2	DeSoto County	Utility Permit	None
US Hwy 17	C3	FDOT	Utility Permit	None
SR 35	C3	FDOT	Utility Permit	None
Reynolds Street	C3	DeSoto County	Utility Permit	None
CR 760A	C3	DeSoto County	Utility Permit	None
CR 74	C3	Charlotte County	Utility Permit	None
I-75	C3	FDOT	Utility Permit	None
US Hwy 41	C3	FDOT	Utility Permit	None
(Tamiami Trail)				
Andalusia Boulevard	C3	Cape Coral	Utility Permit	None
Jacaranda Parkway	C3	Cape Coral	Utility Permit	None
<u>Canals</u>				
Gator Slough Canal	C3	South Florida Water Management District	Utility Permit	None
<u>Railroads</u>				
Seaboard Coastline	C2,C3	FDOT	Utility Permit	None

Note: C2 - Hardee Power Station to Vandolah Substation
C3 - Vandolah Substation South to Lee Substation

6.1.7.2.4 Vicinity Scenic, Cultural, and Natural Landmarks

As identified in Section 6.1.7.2.1, two state resource areas will be crossed by the proposed transmission line corridor from the Hardee Power Station to Vandolah and Lee Substations. The transmission line corridor will follow along the northwest boundary of the Cecil M. Webb Wildlife Management Area Charlotte County. This state-owned tract is managed by the FGFWFC with four goals: 1) "To manage for healthy and productive wildlife and plant communities"; 2) "To provide public hunting, fishing and other compatible outdoor activities"; 3) "To manage all natural resources in an efficient, productive manner which is compatible with wildlife management practices"; and 4) "To manage real estate in a manner that is productive but still maintains the integrity and purpose of the area" (FGFWFC, 1982). Quail hunting is the focus of the area's management program.

An existing Florida Power and Light Transmission line runs northwest to southeast across the western part of the wildlife management area. However, FGFWFC is very concerned about any potential habitat fragmentation or management complications that might arise from additional corridors across the area. DNR's Division of State Lands has prepared a policy statement on "Incompatible Use of Natural Resource Lands". This document, dated August 9, 1988 (Mallison, 1989), states that uses other than those for which an area is intended may be permitted if 1) the use is in the public interest; 2) it is not incompatible with the primary purpose for which the lands were acquired; 3) there is no practicable alternative; and 4) the project will provide a net positive benefit to the lands on which it is located.

The section of the corridor routed along the Cecil M. Webb Wildlife Management Area northwestern boundary was done so to minimize impacting developed areas to the west. The corridor was specifically routed along the boundary of the Wildlife Management Area in a region that was previously impacted. Impacts to the Wildlife Management Area as a result of the proposed Vandolah to Lee Substation corridor will be minimal based on results of a site specific habitat study in the corridor area.

The transmission line corridor will also cross the Peace River Canoe Trail west of Arcadia in DeSoto County. This state designated trail covers 67 miles from its start in Fort Meade at the U.S. Highway 98 bridge to its termination where the river ends at Charlotte Harbor. The corridor will cross the canoe trail at approximately the same location as the existing SR 70 bridge immediately west of the City of Arcadia. No additional bridges will be constructed in association with the corridor. Adequate vertical clearance will be maintained between the river and the transmission lines. The transmission line will span the river without the use of any structures within the canoe trail.

No other regional scenic, cultural and natural landmarks which could be impacted by the transmission line are known to exist within 0.8 km (0.5 mile) of the corridor.

6.1.7.2.5 Archaeological and Historical Sites

DHR was contacted to determine whether any archaeological or historic sites listed or eligible for listing in the National Register of Historic Places, or otherwise of national, state, or local significance might be affected by the proposed 230 kV transmission line corridor between the Hardee Power Station and the Vandolah and Lee Substations. A set of USGS quadrangle maps (1:24,000) and a set of 1984 Mark Hurd aerial photographs (1:24,000) showing the locations of the corridor were reviewed by the DHR personnel. Known sites and potential historical and archaeological site locations within the corridor were identified by the DHR staff.

Seven known sites exist in or partially within the Hardee Power Station to Vandolah and Lee corridors (Table 6.1.7-2). These sites are located in areas previously surveyed by archaeologists. However, only one is considered significant. The significant site is 8-Hr-17, the Ona Mound site, a mound located in the SW 1/4 of the NE 1/4 of the NW 1/4 of Section 29, Township 33 South, Range 24 East. Another site, 8-Hr-13, the Sawmill site, was not considered significant, but should be considered potentially significant if impacted by the ROW. This site is located in the NW 1/4 of the NE 1/4 of the SE 1/4 of Section 7, Township 33 South, Range 24 East.

Table 6.1.7-2. Archaeological and Historic Sites Within the Preferred Transmission Line Corridor Between the Hardee Power Station and the Vandolah and Lee Substations

Site	Name	Significance	Reference
8-Hr-6	Aboriginal Site #2	No	Milanich, J.T., R.A. Marrinan and C. Martinez. 1975
8-Hr-13	Sawmill Site	No*	Wood, L.N. 1976
8-Hr-14	Terri's Site	No*	Wood, L.N. 1976
8-Hr-17	Ona Road Mound	Yes	Wood, L.N. 1976
8-Hr-20	Green Meadow Site	No	Wood, L.N. 1976
8-Hr-55	Aboriginal Site #3	No	Willis, R.F. and Milanich, J.T. 1977
8-De-392	Fletcher Road Site	No	Ballo, G. 1988

* Should be reevaluated.

Archaeologically sensitive areas were also identified by the DHR in the corridors. Recommendations as to how these sensitive areas should be dealt with are contained in the April 4, 1989 letter from the DHR (see Appendix 11.3).

6.1.7.3 Bio-Physical Environment of the Corridor Area

6.1.7.3.1 Land Use/Vegetation

Existing land use and vegetation cover within 0.8 km (0.5 mile) and vegetation cover within 0.4 km (0.25 mile) from the edge of the Hardee Power Station to Vandolah and Lee corridors (see Figure 6.1.7-3 in Appendix 11.10) were determined using USGS 1:24,000 topographic quadrangle maps alongside recent aerial photographs at the same scale. Generalized 1985 Land Use Maps prepared by the COE for the SWFWMD were also examined. Helicopter flights and ground inspections were used to clarify interpretations. The maps have been prepared according to the FLUCCS (FDOT, 1985). Aerial photographs at a scale of 1:24,000 depicting the preferred corridors between the Hardee Power Station and Vandolah and Lee Substations are included in Appendix 11.9.

To adapt the FLUCCS codes to best reflect meaningful aerial interpretation of the actual vegetation of the corridor, the following conventions were consistently used:

Code 411, Pine Flatwoods, was used to include a wide variety of flatwoods from seasonally flooded slash pine systems to xeric longleaf communities with many scrub and sandhill species in the understory. Pines are so sparse in many of these areas that they might be considered dry prairies. Most of this land has been clearly impacted by grazing and associated cattle management activities and could be coded as 310, 320, or 320 rangeland.

Code 427, Live Oak, includes all xeric to mesic oak dominated forests, including those sometimes classified as 432, Sand Live Oak. Some of these forests are apparently recently overgrown remnants of scrub, flatwoods, or sandhill communities and include a number of species typical of these associations. Others grade into riverine forests through subtle xeric to hydric transitions not obvious from the canopy cover.

Code 643, Wet Prairie, was used for all herbaceous wetlands, many of which included some deeper areas that could be categorized as 641, Freshwater Marsh. Wet prairies grade very subtly into dry prairies in this region. The areas mapped as 643 probably include substantial areas which would not be legally delineated as wetlands.

Code 616, Cypress Ponds and Sloughs, was used for the few examples of cypress-dominated wetlands. Code 429, Wax Myrtle - Willow, was applied to all shrub swamps. Buttonbush and other shrubs are also common in some of these areas, and, especially in the phosphate region, many of these sites are tangled thickets with a number of other weedy shrubs and vines. Mesic to hydric hardwoods clearly associated with a stream were coded 615, Stream and Lake Swamp (Bottomland). The remaining wooded wetlands were coded 630, Wetland Forested Mixed. They include some ecotonal hydric to mesic hardwoods as well as a few sites that might have appropriate species composition for characterization as 611, Bay Swamp.

LAND USE

For the most part, land along the corridor is undeveloped. The segment of the corridor from the Hardee Power Station to the Vandolah Substation passes through citrus groves and the unincorporated communities of Ft. Green and Ft. Green Springs for the first 3.2 km (2 miles) south of the site. Between Ft. Green Springs and the Vandolah substation site the land is generally undeveloped with the exception of the CSX railroad corridor along which this segment is located.

Between the Vandolah and Lee Substations, the corridor follows the railroad ROW in a southeasterly direction through undeveloped land until it reaches the unincorporated community of Ona, at which point the corridor jogs to the west to avoid that residential area. South of Ona the corridor runs through about 3.2 km (2 miles) of undeveloped land and 6.4 km (4 miles) of citrus groves. A short undeveloped area is then crossed before the line leaves the railroad ROW to avoid the unincorporated community of Limestone. South of Limestone the transmission line no longer follows the railroad but passes through occasional groves till it reaches the wetlands associated

with the Peace River. The line crosses the Peace River adjacent to the CR 70 bridge and then heads south along the western border of the City of Arcadia. After Arcadia, the land is once again undeveloped until the line reaches Nocatee, about 4.8 km (3 miles) southeast of Arcadia. From Nocatee, the corridor heads south through citrus groves along the community's eastern border. Between Nocatee and the point where the corridor crosses I-75, the land is predominantly undeveloped. The corridor runs along portions of the north and west boundary of the Cecil M. Webb Wildlife Management Area. The corridor crosses I-75 and SR 41 east of Punta Gorda. After crossing SR 41, the line heads south, crossing about 9.6 km (6 miles) of undeveloped land until it reaches North Fort Myers. At this point the line passes adjacent to a sparsely developed residential area and several parcels containing streets but very few other structures in the City of Cape Coral, before arriving at the Lee Substation.

VEGETATION

Going from north to south, the proposed corridor passes from heavily mined phosphate lands into a region dominated by prairie and flatwoods rangeland with occasional small isolated marshes and ponds. Live oak hammocks and wetland forests occur in small patches and along streams. There is a substantial area of open scrublike pine-oak forest south of Arcadia.

Most of the vegetation in the proposed corridor has been disturbed. Farming, phosphate mining, and other land clearing activities have eliminated the original vegetation from many sites. Practically all the forested communities have been cut over to some extent. Open range practices have exposed the whole region to grazing in the past and most of it is still used as pasture. Roads, clearings, and customary fire management interfere with the natural burning processes essential to native ecosystem maintenance.

The major natural communities are pine flatwoods and prairies, with a full range of hydric, mesic, and xeric types represented. There are areas of flatwoods and xeric hammock with many shrubs and some scrub species, but no sizeable tracts of classic scrub. Occasional hammocks range from hydric to

xeric in character. Marshes are the primary wetland type. Floodplain communities occur along other streams.

Hammocks are relatively fire-intolerant hardwood forests. In the study area they are usually dominated by live oak (Quercus virginiana), sand live oak (Q. geminata), laurel oak (Q. hemisphaerica), and cabbage palm (Sabal palmetto). Water oak (Q. nigra), sweetgum (Liquidambar styraciflua), and sugarberry (Celtis laevigata) are also common.

Flatwoods usually occur on low-lying, level lands with a high water table and, consequently, a hardpan layer within a few feet of the soil surface. Slash pine (Pinus elliotii) is usually the dominant species in these stands of scattered pines, but longleaf (Pinus palustris) occurs on many sites in the corridor area. Natural flatwoods have a very diverse grassy understory dominated by wiregrass (Aristida stricta) but most of those in the corridor have been subjected to repeated artificial winter burning and thus have a dense thicket of saw palmetto (Serenoa repens) beneath the pines. Treeless prairies typically support the same wiregrass/palmetto groundcover community as pine flatwoods with similar hydrological conditions.

Scrub communities are shrubby thickets and/or sand pine (Pinus clausa) forests adapted to catastrophic fires at less frequent intervals. The typical shrubs include sand live oak (Q. geminata), scrub oak (Q. inopina), Chapman's oak (Q. chapmanii), myrtle oak (Q. myrtifolia), rosemary (Ceratiola ericoides), fetterbush (Lyonia ferruginea), and other leathery-leaved species. The forest floor is usually white sand with patches of deer moss (Cladonia spp.), prickly pear (Opuntia humifusa), and occasional grasses and forbs. There are only a few tiny patches of clearly defined scrub in the corridor, but there are several substantial areas of xeric flatwoods with admixtures of scrub and sandhill species including turkey oak (Q. laevis) and bluejack oak (Q. incana).

Red maple (Acer rubrum), sweetbay Magnolia virginiana), loblolly bay (Gordonia lasianthus), swamp bay (Persea palustris), dahoon holly (Ilex cassine), sweetgum (Liquidambar styraciflua), and cypress (Taxodium

distichum and T. ascendens) are the most common wetland forest species. Was myrtle (Myrica cerifera) coastal plain willow (Salix caroliniana) and button bush (Cephalanthus occidentalis) are disturbed wetlands.

Where fires occur too often for trees to become established, marshes are the wetland vegetation. These are typically composed of herbaceous emergents like maidencane (Panicum hemitomon), bulltongue sagittaria (Sagittaria lancifolia), and pickerel weed (Pontederia cordata). These communities may grow on either organic or mineral soils, though the latter are usually termed wet prairies.

6.1.7.3.2 Affected Water and Wetlands

The area between the Hardee Power Station and the Vandolah and Lee Substations contains various scattered water bodies and wetland areas. Any corridor located in this area of Florida state is likely to traverse through some water bodies and wetlands.

Water bodies crossed by these corridors are listed in Table 6.1.7-3. All water bodies encountered within the corridor can be spanned without the need for placing supporting structures within the water bodies. No bridge construction will be required for the associated access road. The potential impact of the transmission line on water bodies will be minimal, since the width of the final ROW selected within the corridor will be considerably less than the 0.8-km (0.5-mile) corridor. Most of the wetlands located in the corridor are small and isolated and efforts will be made to avoid wetland areas during selection of the ROW.

The section of corridor between the Hardee Power Station and the Vandolah Substation crosses three water bodies; Payne Creek, Little Payne Creek and Shirttail Branch. All are relatively small creeks and are classified as Class III surface water by Chapter 17-3 F.A.C. Several small unnamed drainage areas are also located in this section of the corridor.

The section of corridor between Vandolah Substation and Lee Substation crosses six creeks, Gator Slough Canal and the Peace River. The corridor

Table 6.1.7-3. Water Bodies Within Preferred and Alternative Corridors Between the Hardee Power Station and Vandolah and Lee Substations

Waterbody	Receiving Water	Corridor	Comments
Payne Creek	Peace River	C2	South of Ft. Green
Little Payne Creek	Peace River	C2	South of Ft. Green
Shirttail Branch	Payne Creek	C2	At Ft. Green Springs
Unnamed Drainages	Unknown	C2,C3	Various Small Drainages Along Corridor
Oak Creek	Peace River	C3	South of Ona
Limestone Creek	Peace River	C3	South of Limestone
Peace River	Gulf of Mexico	C3	West of Arcadia
Joshua Creek	Peace River	C3	Two Miles South of Arcadia
Prairie Creek	Peace River	C3	DeSoto/Charlotte County Line
Shell Creek		C3	One Mile North of Highway 74
South Prong Alligator Creek		C3	Near Tuckers Grade Interchange
Gator Slough Canal	Gulf of Mexico	C3	North of Cape Coral in Lee County

C2 - Hardee Power Station to Vandolah Station

C3 - Vandolah Substation to Lee Substation

crosses Oak Creek south of the community of Ona, and crosses Limestone Creek south of the community of Limestone. Both creeks are classified as Class III Surface Waters by Chapter 17-3 F.A.C. and are relatively narrow where crossed by the corridor. The corridor crosses the Peace River immediately west of Arcadia adjacent to the crossing of Highway 70. Crossing of the Peace River could not be reasonably avoided due to the location of the river relative to the substations. The corridor was designed to allow crossing of the Peace River at a location with an existing facility crossing. This will minimize potential visual impacts to the river and surrounding area and will eliminate the need for bridge and access road construction. The Peace River is classified as a Class III Surface Water by Chapter 17-3 F.A.C.

Continuing south of the Peace River, the corridor crosses Joshua Creek approximately 3.2 km (2 miles) south of Arcadia, Prairie Creek near the DeSoto-Charlotte County line and Shell Creek 1.6 km (1 mile) north of Highway 74 in Charlotte County. Joshua Creek is classified as a Class III Surface Water by Chapter 17-3 F.A.C. Shell Creek and Prairie Creek are classified as Class I Surface Waters. The corridor crosses the South Prong of Alligator Creek near the western boundary of Cecil M. Webb Wildlife Management Area. This water body is classified as a Class I Surface Water by Chapter 17-3 F.A.C. Finally, in Lee County, the corridor crosses Gator Slough Canal just north of the city of Cape Coral. This water body is primarily a man-made drainage canal which may have originated as a natural drainage area. Gator Slough Canal is classified as a Class III Surface Water by Chapter 17-3 F.A.C.

The corridor contains some isolated wetlands, many of which are less than 0.4 km (0.25 mile) in diameter and could therefore be spanned by the transmission line. The corridor location was selected to minimize impacts to wetlands.

6.1.7.3.3 Ecology

This section discusses species which are designated as endangered, threatened, or species of special concern by the USFWS or the FGFWFC and which, based on a literature survey and consultations with state, regional, and local agencies, are known or expected to occur in or near the proposed transmission corridor between the Hardee Power Station and Vandolah and Lee Substations. The species addressed may occur as residents, migrants, or transients. The lists of plant and animal species (Tables 6.1.7-4 and 6.1.7-5) which are discussed in the following sections were prepared in consultation with FGFWFC and FNAI.

The probability of occurrence for threatened, endangered, and species of special concern within the corridor was based on known locations (e.g., red-cockaded woodpecker colonies, wading bird rookeries), recent and historical reports, and information in the scientific literature, and discussions with biologists familiar with the region. Locations of known occurrences of these species and habitat features critical to their survival within 457 m (1,500 ft) of the corridor are depicted in Figure 6.1.7-4.

PLANT SPECIES

No genuinely rare plant species have been reported within the proposed transmission corridor and very few have been documented nearby. There have not been many botanical surveys of the region, however. Habitat information suggests that some moderately rare species might occur in wet pinelands, hammocks, or scrubby flatwoods in this general area.

Scrub-like open xeric habitats might possibly support scrub holly, Curtiss' milkweed, Ashe's savory, scrub milkwort, Florida beardgrass, nodding pinweed, wild coco, and/or sand butterfly pea. Scientific names and federal and state statuses of these species are given in Table 6.1.7-4. Scrub milkwort is the only one of these plant species that is more than moderately rare.

White squirrel banana and Florida beargrass have recently been found in dry flatwoods along Burnt Store Road a few miles west of the corridor. These

Table 6.1.7-4. Protected Rare Plant Species Potentially Present within Five Miles of Proposed Transmission Line Corridor Between the Hardee Power Station and the Vandolah and Lee Substations

Common Name	Scientific Name	Status	
		USFWS*	FDA**
Curtiss' milkweed	<u>Asclepias curtissii</u>		T
Ashe's savory	<u>Calamintha ashei</u>	UR1	T
Sand butterfly pea	<u>Centrosema arenicola</u>	UR5	
White squirrel banana	<u>Deeringothamnus pulchellus</u>	E	E
Spoon-leaved sundew	<u>Drosera intermedia</u>		T
Florida beardgrass	<u>Gymnopogon floridanus</u>	UR2	
Water spider orchid	<u>Habenaria repens</u>		T
Hartwrightia	<u>Hartwrightia floridana</u>	UR2	T
Edison's ascyrum	<u>Hypericum edsonianum</u>	UR1	T
Scrub holly	<u>Ilex opaca</u> var. <u>arenicola</u>	UR5	
Thick-leaved water-willow	<u>Justicia crassifolia</u>	UR2	
Nodding pinweed	<u>Lechea cernua</u>	UR2	
Florida beargrass	<u>Nolina atopocarpa</u>	UR2	E
Serpent fern	<u>Phlebodium aureum</u>		T
Scrub milkwort	<u>Polygala lewtonii</u>	UR1	E
Wild coco	<u>Pteroglossapis ecristata</u>	UR2	T
Banded wild pine	<u>Tillandsia flexuosa</u>		T
Red needleleaf airplant	<u>Tillandsia setacea</u>		T
Shoestring fern	<u>Vittaria lineata</u>		T
Rain lily	<u>Zephyranthes simpsonii</u>	UR5	E

Note: E - Endangered

T - Threatened

UR1 - Under review for listing, with substantial evidence indicating some degree of biological vulnerability and/or threat

UR2 - Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking

UR5 - Still formally under review, but no longer considered a likely candidate for listing because recent information indicates species is more widespread or abundant than previously believed

* USFWS - U.S. Fish and Wildlife Service

** FDA - Florida Department of Agriculture

Table 6.1.7-5. Protected Rare Animal Species Potentially Present within Five Miles of Proposed Transmission Line Corridor Between the Hardee Power Station and the Vandolah and Lee Substations

Common Name	Scientific Name	Status	
		FGFWFC*	USFWS**
<u>MAMMALS</u>			
Florida black bear	<u>Ursus americanus floridanus</u>	T	UR2
Sherman's fox squirrel	<u>Sciurus niger shermani</u>	SSC	UR2
Round-tailed muskrat	<u>Neofiber alleni</u>		UR2
Pine Island rice rat	<u>Oryzomys palustris planirostri</u>		UR2
Florida mastiff bat	<u>Eumops glaucinus floridanus</u>		UR2
<u>BIRDS</u>			
Bald eagle	<u>Haliaeetus leucocephalus</u>	T	E
Red-cockaded woodpecker	<u>Picoides borealis</u>	T	E
Little blue heron	<u>Egretta caerulea</u>	SSC	
Crested caracara	<u>Polyborus plancus audubonii</u>	T	
Southeastern American kestrel	<u>Falco sparverius paulus</u>	T	UR2
Swallow-tailed kite	<u>Elanoides forficatus</u>		UR2
Sandhill crane	<u>Grus canadensis pratensis</u>	T	
Florida scrub jay	<u>Aphelocoma coerulescens</u> <u>coerulescens</u>	T	T
Snowy egret	<u>Egretta thula</u>	SSC	
Tricolored heron	<u>Egretta tricolor</u>	SSC	
Wood stork	<u>Mycteria americana</u>	E	E
Florida burrowing owl	<u>Athene cunicularia floridana</u>	SSC	
<u>REPTILES</u>			
Gopher tortoise	<u>Gopherus polyphemus</u>	SSC	UR2
Eastern indigo snake	<u>Drymarchon corais couperi</u>	T	T
Blue-tailed mole skink	<u>Eumeces egregius lividus</u>	T	T
Florida pine snake	<u>Pituophis melanoleucus mugitus</u>	SSC	UR2
American alligator	<u>Alligator mississippiensis</u>	SSC	T(S/A)

Note: E - Endangered

T - Threatened

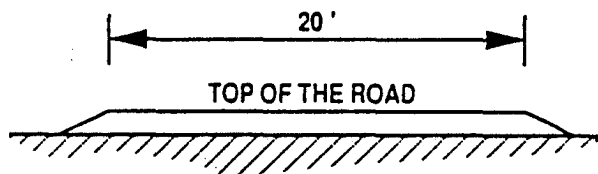
T(S/A) - Threatened due to similarity of appearance

SSC - Species of special concern

UR2 - Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

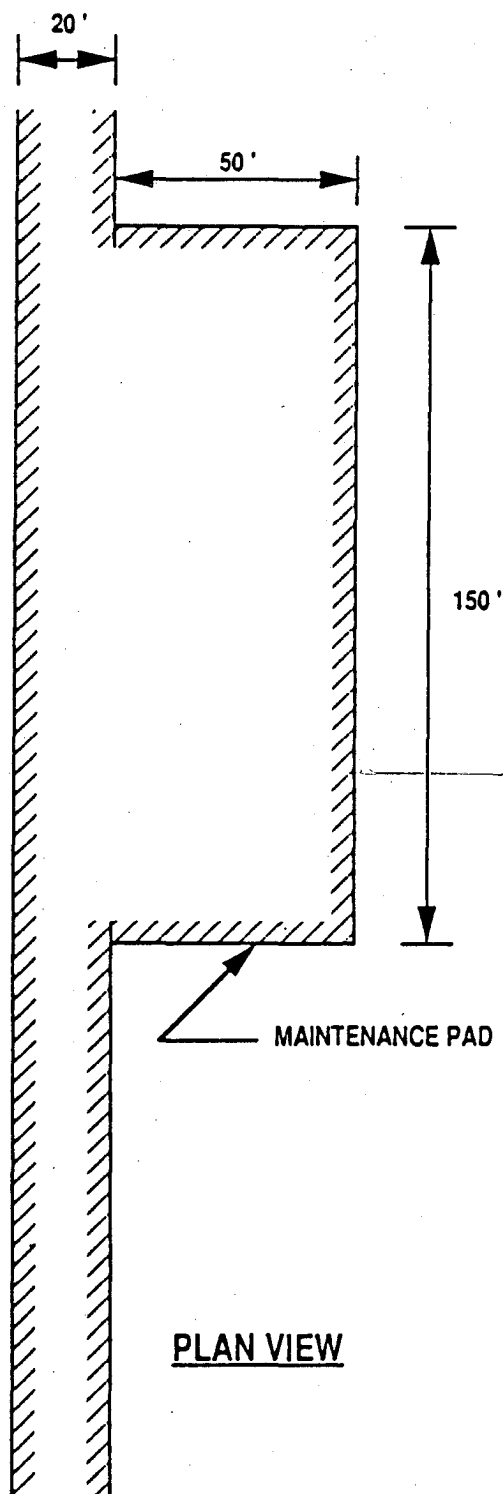
* Florida Game and Fresh Water Fish Commission

** U.S. Fish and Wildlife Service



NOTE: FILL TO BE ADDED AS REQUIRED

CROSS-SECTION



PLAN VIEW

Figure 6.1.7-4 HARDEE POWER STATION TO LEE AND
VANDOLAH SUBSTATIONS TYPICAL ACCESS
ROAD PLAN AND CROSS SECTION

**Hardee
Power Station**

species are not expected to occur in the wet flatwoods typical of the southern end of corridor route, but might be found in patches of dry soil in Charlotte and Lee County flatwoods. Such areas will be identified and surveyed during ROW selection. Squirrel banana thrives in mowed habitats and would not be significantly impacted by a sensitively constructed and maintained ROW.

Edison's ascyrum, hartwrightia, rain lily, water spider orchid, thick-leaved water willow, and/or spoon-leaved sundew may be found in wet depressions or seepage areas. Rain lily, a moderately rare species, might be encountered in appropriate habitats in this region, but there is no reason to expect that the more seriously threatened wetland species occur in the corridor.

Redberry stopper, shoestring fern, red needleleaf airplant, serpent fern, and/or banded wild pine might be encountered in hammock habitats at the southern end of the corridor, but these are not very rare plants. Serpent fern, also known as golden polypody, was observed on cabbage palms in pine flatwoods just north of the Cecil M. Webb Wildlife Management Area headquarters. It is actually quite common as a cabbage palm epiphyte in southwest Florida.

WILDLIFE SPECIES

The presence or potential for occurrence of the wildlife species listed in Table 6.1.7-5 within a given area is primarily related to the presence of suitable habitat for cover, feeding, and reproduction. In general, the type and quality of wildlife habitat depends upon vegetation, surrounding land use, and hydrology. Wildlife habitat types, therefore, frequently correspond to vegetation types.

The natural communities which serve as the principal wildlife habitats in the corridor are xeric, mesic, and hydric flatwoods, prairies, and hammocks.

A total of 19 vertebrate species, including 5 reptiles and amphibians, 10 birds, and 4 mammals were identified as important species occurring or

possibly occurring within 8 km (5 miles) of the proposed corridor between the Hardee Power Station and the Vandolah and Lee Substations (Table 6.1.7-5). The status and potential for occurrence of each of these species is discussed below.

REPTILES

Most of the rare xeric habitat reptiles of conservation concern to the north and east of the study area have not been documented within the region between the Lake Wales Ridge and the southwest Florida coastal zone. The few known to occur in the vicinity are as follows:

Gopher Tortoise (Gopherus polyphemus)

The gopher tortoise is listed as a species of special concern by FGFWFC and UR2 by USFWS. Gopher tortoise populations have declined due to collection as food and to habitat losses associated with urban growth and conversion of land to commercial pine plantations. Gopher tortoises occupy open grassy areas in xeric habitats such as sandhills, xeric hammocks, pine flatwoods, scrubs, and old fields. The burrow excavated by the gopher tortoise is also used by a variety of other organisms, including gopher frogs and indigo snakes. The best known of these, the gopher frog, does not occur in the corridor area, however. Areas of suitable habitat along the corridor could be expected to support gopher tortoises.

Eastern Indigo Snake (Drymarchon corais couperi)

The eastern indigo snake is listed as threatened by USFWS and FGFWFC. Reasons for its decline include habitat destruction, capture by snake collectors, and mortality from rattlesnake roundups. Eastern indigo snakes are found in dry, sandy areas such as pine flatwoods as well as in hardwood hammocks. Indigo snakes may be expected to occur in appropriate habitats in the corridor area.

Florida Pine Snake (Pituophis melanoleucus mugitus)

The pine snake is listed as a species of special concern by FGFWFC and UR2 by USFWS. It uses sandhills and other open, xeric habitats where pocket gophers, mice, and similar prey are abundant. Although pine snakes have

been recorded from Charlotte County, the bulk of the species' range is north of the corridor. It is thus not likely to be found within the affected area.

American Alligator (Alligator mississippiensis)

The alligator is listed as a species of special concern by FGFWFC and threatened due to similarity of appearance by USFWS. The alligator is found even in most wetland communities including lakes, ponds, rivers, and marshes. Alligators adapt fairly well to the presence of humans and can be found in urban areas if not molested. Populations have recovered to the point where USFWS has retained their status as threatened only in order to protect the similar endangered American crocodile. Alligators probably occur in almost all suitable habitats in the study area.

Blue-tailed Mole Skink (Eumeces egregius lividus)

This lizard is listed as threatened by FGFWFC and USFWS. It is confined to scrub and sometimes shrubby sandhill habitats in south-central Florida. The blue-tailed mole skink has been observed approximately 4 miles east of the Vandolah and Lee corridors, 13 km (8 miles) south of Vandolah. It might be found in xeric shrub communities in the northern part of the corridor.

MAMMALS

Few mammals of concern occur in the corridor area.

Florida Black Bear (Ursus americanus floridanus)

Florida's subspecies of the black bear is listed as threatened by FGFWFC in peninsular Florida, and under review for listing by USFWS. Bears inhabit areas of dense cover, which are not abundant in the corridor. They have been documented to travel through the area, however.

Fox Squirrel (Sciurus niger)

There is a fox squirrel population in the northwest corner of the Cecil M. Webb Wildlife Management Area just southeast of the sewage treatment plant and they may occur in open pine/oak forests elsewhere in the corridor.

The Webb population has not been studied and identified as to subspecies, but it is suspected to represent the Big Cypress fox squirrel (Sciurus niger avicennia), or possibly a form intermediate between that and Sherman's fox squirrel (Sciurus niger shermani), the subspecies found to the north. As a distinct population outside the usual range of each subspecies, it has particular scientific importance and conservation significance.

Fox squirrels require open, frequently burned sandhills with scattered pines and oaks as habitat.

Round-tailed Muskrat (Neofiber alleni)

The round-tailed muskrat is listed UR2 by USFWS. It utilizes marshes with dense stands of maidencane, pickerel weed, and sagittaria. This species has an irregular spotty distribution encompassing most of the Florida peninsula, including the study area. It may occur in appropriate habitats within the corridor.

Pine Island Rice Rat (Oryzomys palustris planirostris)

The Pine Island rice rat is under review for listing by USFWS, but recent taxonomic studies by Florida Museum of Natural History scientists indicate that it may not be a valid subspecies. This rodent utilizes marshy habitats and has been historically recorded north of Fort Myers several miles south of the corridor.

Florida Mastiff Bat (Eumops glaucinus floridanus)

The Florida mastiff bat, which was previously known only from the Miami area, has recently been discovered using an abandoned red-cockaded woodpecker cavity a few miles northeast of the Cecil M. Webb Wildlife Management Area headquarters. Hollow trees potentially inhabited by these bats will be inspected and appropriately considered during the ROW selection process. Bats navigate by a very sensitive sonar system (unaffected by EMF) which enables them to avoid collisions with wires, therefore no impacts on this species are expected if potential roosting cavities are protected.

BIRDS

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle is listed as threatened by FGFWFC and endangered by USFWS. Eagles in peninsular Florida include permanent residents and seasonal migrants. Migrants occasionally occur along rivers or lakes. Eagle nests are generally located in tall pines or cypress. No active nests are known to occur along the Vandolah and Lee corridors.

Crested Caracara (Polyborus plancus audubonii)

The caracara is considered threatened by both FGFWFC and USFWS. This is a large hawk whose Florida range is restricted to the open prairie region of the south-central portion of the peninsula. It forages in pastures and sparse pinelands, feeding on both carrion and live prey, and nests in cabbage palm trees. The heart of the species' territory is east of the study area, but the birds have historically ranged through the region and could potentially be found in the corridor.

Southeastern Kestrel (Falco sparverius paulus)

The southeastern kestrel is listed as threatened by FGFWFC and UR2 by USFWS. The practically indistinguishable unlisted eastern kestrel also winters in Florida. These small hawks utilize sandhills and similar open upland habitats where they hunt from perches and nest in cavities such as old woodpecker holes in pine trees. They may occur in appropriate habitats in the corridor area.

Swallow-tailed Kite (Elanoides forficatus)

The swallow-tailed kite is listed as UR2 by USFWS. These birds range throughout Florida, but prefer habitat that is a mosaic of forested and open wetlands. They feed on insects and reptiles in wet prairies or marshes and nest in large cypress or pine trees. Since the study region has areas of suitable habitat, swallow-tailed kites can be expected to occasionally be observed within the corridor.

Burrowing Owl (Athene cunicularia)

Due to habitat loss, the burrowing owl is listed as a species of special concern by FGFWFC. This owl requires well drained sandy soil in areas of sparse growth such as prairies, sandhills, and pastures. Burrowing owls are expected in open upland habitats in the southern part of corridor.

WADING BIRDS

Three species of protected wading birds are known or expected to occur in the vicinity of the corridor. These species are the snowy egret (Egretta thula), little blue heron (Egretta caerulea), and tricolored heron (Hydranassa tricolor). All three species are designated as species of special concern by FGFWFC. These birds utilize similar habitats, requiring wetlands for feeding and shrub swamp or cypress swamp for roosting and nesting. They can be expected to forage in suitable wetlands along the corridor. A nesting colony of snowy egrets, great egrets, and great blue herons is located 16 km (10 miles) south of Vandolah and 1.2 km (0.75 mile) west of the corridor centerline. Wading birds have nested at other nearby locations in the past, but this is the only currently active rookery documented by FGFWFC.

Wood Stork (Mycteria americana)

Wood storks are listed as endangered by FGFWFC and USFWS. Reasons for their decline include loss of feeding and nesting areas. Wood storks nest primarily in cypress or mangrove swamps, and forage where fish populations concentrate in freshwater marshes, ditches, and flooded pastures. Wood storks are expected to occasionally forage throughout the corridor in areas of suitable habitat. No active rookeries are known within five miles of the corridor.

Florida Sandhill Crane (Grus canadensis pratensis)

The resident Florida subspecies of the sandhill crane is listed as threatened by FGFWFC. Unlisted migratory birds join these flocks in the winter. The sandhill crane uses large open pastures and dry prairies as foraging habitat and breeds in associated wet prairies and marshes. These habitats are abundant in the study region and are heavily utilized.

Regions the Florida Natural Areas Inventory has identified as crane concentration areas are indicated on Figure 6.1.7-3 (see Appendix 11.10). The only such area crossed by the corridor is the stretch from just north of the I-75 interchange at Tuckers Grade south to Cape Coral. This habitat is not proposed for preservation and will probably be lost to residential development in the not too distant future.

Since the endangered whooping crane has similar habitat requirements, several Florida sites have been evaluated as potential reintroduction sites for the extirpated species. The Cecil M. Webb Wildlife Management Area was rated as an alternate to a preferred Kissimmee Prairie site.

Red-cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker is listed as threatened by FGFWFC and endangered by USFWS. The bird nests in "overmature" pines affected by a fungus disease that softens the heartwood. Timber management practices have greatly reduced the numbers of these trees.

Since there were numerous old records of red-cockaded woodpeckers in the vicinity of the Cecil M. Webb Wildlife Management Area, but no current data, a careful field survey of alternative transmission line routes across the area was conducted. Colonies previously numbered 11, 2, and 18 by the Webb staff were not found at their former locations, but active colonies were located near the centers of Sections 16 and 17 and at the center of the boundary between 8 and 9 as indicated on (Figure 6.1.7-3 in Appendix 11.10). FGFWFC personnel believe that the locations of these colonies "drift" over time.

No red-cockaded woodpeckers have been documented within the proposed corridor. None have been recorded nearby north of Charlotte County, but their regional abundance and characteristics of the habitat suggest that they may be encountered in other pinelands at the south end of the region.

Florida Scrub Jay (Aphelocoma coerulescens coerulescens)

The scrub jay is listed as threatened by both FGFWFC and USFWS. This species is very restricted in its habitat requirements, utilizing brushy early successional scrub habitats virtually exclusively. Scrub jays have been historically documented a mile and a half north of the Ft. Myers substation. There are no recent data on this population, but it is doubtful that affected habitats are important to them since the corridor encompasses only small areas of suitable patchy oak thicket. Scrub jays might occur in appropriate habitats anywhere along the corridor.

6.1.7.3.4. Other Environmental Features

All relevant environmental features associated with the transmission line corridor between the Hardee Power Station and the Vandolah and Lee Substations have been presented in the preceding subsections. No additional information is deemed necessary to describe environmental characteristics of the transmission line corridor.

6.1.7.4 Effects of Right-of-Way Preparation and Transmission Line Construction

6.1.7.4.1 Construction Techniques

RIGHT-OF-WAY CLEARING

All trees, brush, and scrub growth in the ROW will be cleared. Trees beyond the boundary of the ROW may be trimmed or cut with the owners consent if it is determined that the trees present a danger to the transmission line. Equipment used to cut these may include bulldozers, shearing machines, or chainsaws.

ROAD AND PAD CONSTRUCTION

Access roads will be required in areas where the final Vandolah and Lee transmission line ROWs do not follow existing roads. The overall objective of the access roads will be to provide efficient and safe ingress and egress to the transmission line structures while minimizing environmental impact and cost. Access roads will be required for construction and maintenance of the transmission line facilities.

The use of fill will be minimized in the construction of access roads, and where possible, roads will be constructed by blading natural soil from both sides of the intended road. Where fill is required the fill will be trucked in and spread, compacted, and shaped to the desired elevation. Access roads will be constructed to have a maximum surface width of 20 feet. Dump trucks may be used for hauling, and bulldozers and graders may be used for spreading and compacting. A typical cross section for the access road is presented in Figure 6.1.7-4.

LINE CONSTRUCTION

Multiple structure configurations and construction materials will be used throughout the length of the transmission line from the Hardee Power Station to the Vandolah and Lee Substations. The type of structure used in any particular area will be a function of the characteristics of the ROW and surrounding areas.

For the majority of the ROW which crosses open land, the preferred structure will be wooden H-frame construction (see Figure 6.1.3-1). H-frame construction involves directly imbedding the poles into native soil and attaching cross bracing after imbedment. Suspension insulators are then attached to the cross bracing to allow the phase conductors to be pulled. H-frame construction is used for tangent (straight line) construction.

Where the ROW allows, three pole structures will be used for line angle construction. This type of construction involves directly imbedding the structures and guying to meet strength requirements. Once the poles and guy wires are installed, suspension insulators are attached to the structures to allow the conductor to be pulled.

Single pole construction will be used where ROW or other constraints limit the use of H-frame construction. Single pole structures are anticipated to be used in areas where the width of the ROW prohibits the use of H-frame structures, and in areas where visual impacts are significant. Single pole structures may be directly imbedded with native soil, crushed rock or

concrete backfill. Single pole structures can be used for line angles and can be designed to be self supporting.

Structures will be framed and erected using cranes and other support vehicles. Overhead ground wires and conductors will be installed by various wire-pulling equipment. Vehicles used to support line construction may include bulldozers, tractors, and other light vehicles.

Foundations for structures may be either native soil, crushed rock or concrete backfill. In addition, poured concrete foundations may be used where an extra strong foundation is required. With native soil or crushed rock backfill, a hole is augered and the pole is inserted into the hole. The backfill material is then compacted around the pole up to the surrounding ground level. In the case of poured concrete foundations, the required concrete foundation is poured and anchor bolts are installed. Once the foundation has set, the base of the pole is bolted onto the anchor bolts of the foundation.

EROSION

Disturbance to natural vegetation will be kept to a minimum to reduce the potential for erosion. Where necessary, erosion control measures will be utilized to eliminate erosion during construction. Routine maintenance of the ROW will be designed to minimize ground cover disturbance, and therefore reduce the potential for erosion during operation of the transmission line.

6.1.7.4.2 Impacts on Water Bodies and Uses

Exact routing of the ROW within the corridor from the Hardee Power Station to the Vandolah and Lee Substations has not been determined at present. All efforts will be made to avoid waters of the State, including jurisdictional wetlands, during the final routing of the Vandolah and Lee transmission line ROW.

Construction of the Vandolah and Lee transmission lines and associated access road is expected to have minimal impact on waters of the State. During the siting process, corridor segments were identified which contained

relatively few water bodies or wetlands greater than 0.4 km (0.25 mile) in length. This selection criteria was identified to screen out areas with water bodies or wetlands that could not be spanned by the transmission line. Several small creeks and the Peace River will be crossed by the corridor but the line construction is not expected to have an impact on these water bodies. Based on the selected type of construction for the support structures, the transmission line will be able to span a maximum distance of approximately 0.4 km (0.25 mile) and still retain adequate ground clearance. Therefore, few, if any, support structures will be constructed within waters of the State. It is also anticipated that the Vandolah and Lee transmission lines will be able to span or be diverted around most wetlands. However, some filling in wetland areas may be required for the access road. Most of the wetlands crossed by the corridor are relatively small. Therefore, keyhole filling will be utilized where possible in lieu of continuous filling. The total area that will require filling is not known at the present time, but is expected to represent only a small fraction of the overall corridor length. Where road construction or structure placement must occur in wetlands, the following procedures will be followed. To control runoff of project site sediments, appropriate sediment control methods will be used. Methods to be used include staked silt fences with haybales in upland areas and transitional to shallow wetlands, and floating turbidity barriers in water bodies. Silt screens will be placed downstream of construction abutting all open water. In addition, in areas requiring minor excavation for culvert placement, appropriate stabilization of the banks will be provided.

No bridges are expected to be constructed in association with the transmission line or access road. Therefore, no restrictions to navigation will occur on any water body crossed by the corridor. Adequate clearance between the surface of the water and the transmission line will be maintained, and no impedance to boat traffic or other water related activity will result.

6.1.7.4.3 Solid Wastes

Solid waste generated from ROW preparation and line construction generally consists of cleared vegetation and construction related debris. All cleared vegetation and combustible debris will be burned on-site. Applicable state and local regulations regarding on-site burning will be followed. Non-combustible material will be collected and disposal will occur at existing landfills.

Approximately three yards of native soil is expected to be removed for each pole installation. The majority of this soil will be used for backfill in cases where native soil backfill is acceptable for foundation. In cases where crushed rock backfill or concrete foundations are used, the soil will be spread over the ROW in a manner to minimize the impact on the surrounding area.

6.1.7.4.4 Changes to Vegetation, Wildlife, and Aquatic Life

ROW preparation and line construction for the Vandolah and Lee transmission lines will have minimal adverse impact on terrestrial or aquatic systems because the corridor has been chosen to avoid major areas of ecological importance and the ROW will be routed to avoid smaller areas of significant habitat within the corridor. Critical habitats, substantial areas of forest or wetland, concentrations of rare species, breeding locations of sensitive species, and important examples of rare or threatened natural communities were all screened out during the corridor selection process.

SECI plans to avoid construction of raised roads wherever possible, so disruption of hydrological patterns should be minimal. Culverts and similar engineering solutions will be applied to correct any disturbance to drainage caused by essential road improvements.

In xeric communities, opening the tree canopy may have a positive effect on habitat values. Gopher tortoises, burrowing owls, and several of the other sensitive species in the corridor region do best in such relatively sunny open habitats.

Construction activities will inevitably have some direct impact on wildlife. Some animals will be displaced from the ROW by disturbance. Plants will be impacted by essential cutting and clearing activities. Trees must be cut out of the area beneath and immediately adjacent to the lines. The cumulative effect of these impacts will be minimal, however, since care has been and will continue to be taken to avoid important habitats.

6.1.7.4.5 Impact on Human Populations

Transmission line construction to be conducted by SECI will consist of two 230 kV lines from the Hardee Power Station to Vandolah Substation, and one 230 kV line from Vandolah to Lee Substation in North Ft. Myers. Work on these segments will occur simultaneously. Within each segment, specialized crews will work in sequence to clear easement, construct access roads, prepare foundations, assemble and erect support structures, string conductors, and cleanup, with overlap of activities as required. Construction of the entire SECI line is anticipated to take approximately 18 months. It is expected that construction of the Vandolah and Lee lines will not restrict traffic flow on roads adjacent to or crossed by the line. Short-term impacts to area residents from the noise of saws and other equipment which will be required to clear the corridor and construct the support structures will be of short duration.

A construction work crew of approximately 20-30 will be required on each of the two SECI segments with work generally taking place between the hours of 7:00 a.m. and 7:00 p.m. The relatively small number of workers and minimal amount of equipment required for this effort are not expected to cause any significant impact on traffic conditions on area roads either during morning and evening peak traffic periods, or during the day.

6.1.7.4.6 Impact on Regional Scenic, Cultural and Natural Landmarks

As noted in Section 6.1.7.2.4, two state resources areas, the Peace River Canoe Trail and the Cecil M. Webb Wildlife Management Area, are crossed by the Lee transmission line corridor.

The Peace River is a designated canoe trail which traverses 108 km (67 miles) and contains numerous launching/takeout areas. One launch/takeout point is located in the vicinity of the transmission line crossing, near the intersection of SRs 70 and 72. To minimize the potential visual impact of the transmission line as it crosses the Peace River, the line will be located parallel and adjacent to SR 70 where it crosses the river. In addition, the crossing point will be located at a bend in the river so that no long distance views from either upstream or downstream will be possible. Consequently, the one contact will be brief and quickly passed with little possibility of seriously affecting the canoeing experience. Care will be taken by the construction crew to minimize the amount of vegetation cleared on the river banks. Because of its location at a bend in the river and in an area which currently contains major man-made elements (highway, bridge and rail crossings), the transmission line should have minimal impact on the recreational experience of canoeing on the river. With the exception of the point at which the transmission line crosses the river, the line will be a sufficient distance from the Peace River to insure that it is not a focal point in the canoeist's viewscape.

The proposed corridor runs along sections of the north and west boundaries of the Cecil M. Webb Wildlife Management Area to a point approximately 2.4 km (1.5 miles) south of the Tuckers Grade I-75 interchange. Efforts have been and will be made to minimize any adverse impacts to the wildlife management area.

The transmission line will be constructed and maintained without a linear raised road bed, if possible. SECI will maintain locked gates to limit trespass problems.

A general concern FGFWFC has with transmission lines involves the potential for bird collisions. The proposed route has been selected to avoid the vicinities of wading bird rookeries, and minimize corridor length in areas of heavy sandhill crane activity.

Presuming arrangements can be made to maintain native ground cover and use prescribed fire brush control techniques beneath the lines, local FGFWFC officials have four specific concerns about transmission lines in the northwest corner of the Webb area: 1) proximity to red-cockaded woodpecker colonies; 2) potential interference with drainage to Alligator Creek; and 3) potential interference with drainage to Myrtle Slough.

The transmission line corridor route across the wildlife management area has been chosen to avoid relatively undisturbed habitats, large areas of wetland or forest, and concentrations of rare species, as well as areas identified as particularly heavily used by birds. The preferred corridor crosses only a corner of the area, rather than running through the center. This corner has improved pastures of exotic bahia grass and relatively less native vegetation than the Webb area as a whole.

The corridor was rerouted after field surveys revealed red-cockaded woodpecker colonies and extensive foraging habitat in the area originally chosen. It now goes around the edge of the Webb area, crossing mostly improved pastures and open prairies and running close to I-75 where the prescribed burning program necessary for red-cockaded woodpecker habitat management is problematic. Careful ROW selection and construction should avoid impacts on this species.

Drainage into Myrtle Slough and Alligator Creek should not be affected, since a continuous raised road should not be needed.

6.1.7.4.7 Impact on Archaeological and Historical Sites

Upon selection of a final ROW, a professional archaeological survey will be conducted for any areas within the ROW previously identified by DHR as having potentially significant archaeological sites (see Appendix 11.3) and which will be disturbed by land boring and construction activities.

The Applicant will comply with the request made by the DHR (see letter of April 4, 1989 in Appendix 11.3) that if the archaeological survey of the ROW alignment discovers any sites considered to be significant, these sites will

be avoided during construction of the transmission line and subsequently during the maintenance of those properties to assure in-place site preservation. If avoidance is not feasible, impacts will be mitigated through archaeological salvage excavation conducted by a professional archaeologist. The DHR will be consulted regarding appropriate procedures for either preservation or excavation of any significant site(s).

If unforeseen artifacts or archaeological sites are discovered during construction, the DHR will be notified. Following a determination of the importance of these artifacts or sites, the Applicant will work with the DHR to assess mitigation measures necessary to minimize adverse impacts.

6.1.7.5 Post-Construction Impacts and Effects of Maintenance

6.1.7.5.1 Maintenance Techniques

TRANSMISSION LINE MAINTENANCE

The Vandolah and Lee transmission line ROWs will be patrolled and inspected regularly to identify structures in need of repair. Occasional maintenance will be required on the transmission structures. Insulators will be replaced when damaged as will supporting clamps and braces. Wood transmission poles are expected to be replaced on the average of every 15 years. Where steel or concrete poles are used, there will be minimum pole maintenance needed. The expected life of these poles is in excess of 30 years. The maintenance of the transmission line is expected to have a minimum impact on the surrounding area.

RIGHT-OF-WAY MAINTENANCE

Mechanical mowing and herbicides will be used to keep the ROW clear of unwanted vegetation. These chemicals will be used as needed. All herbicide application will be conducted in a manner consistent with all state and local regulations and will be carried out by trained personnel.

No burning is anticipated to be needed for the maintenance of the ROW.

6.1.7.5.2 Multiple Uses

Various activities including citrus farming, grazing, and agriculture are typically allowed within the ROW as long as these activities do not interfere with full use of the ROW. An easement will be obtained for the construction and operating of the Vandolah and Lee transmission lines, including ingress and egress to the transmission line. Specific uses within the ROW will be addressed individually with affected parties. Multiple use of the ROW may be restricted in certain areas, but in general, compatible multiple uses will be allowed.

6.1.7.5.3 Changes in Species Populations

WILDLIFE AND AQUATIC LIFE

Potential post-construction impacts along the Vandolah and Lee transmission lines fall into four major categories: 1) impacts related to the actual transmission lines and supporting poles; 2) impacts of ROW maintenance procedures; 3) disturbances associated with access roads; and 4) effects of electromagnetic fields.

The primary concern associated with the actual transmission line is the potential increase in bird mortality due to collisions with the wires. The impacts of collisions with power lines on avian mortality are difficult to quantify. It is generally agreed, however, that collisions are a potentially significant cause of mortality among birds. It is also agreed that a large percentage of avian mortality from collisions with power lines can be avoided through careful planning (Anderson, 1978; Lee, 1978; Faanes, 1987). For this reason, the corridor was routed to minimize the potential for collisions by avoiding areas of known bird concentrations and areas used for roosting or nesting by sensitive species.

Special attention has been given to habitats used by wood storks and other wading birds, sandhill cranes, and red-cockaded woodpeckers. Prior to ROW selection, additional field surveys will be undertaken to identify undocumented sites used by sensitive species and smaller areas of significant habitat. The ROW will be routed to minimize impact on these areas.

The ROW must be maintained so that trees cannot grow into the overhead wires. This implies maintenance of a permanent gap in the canopy through any forested areas. In hydric or mesic habitats this may have a slight deleterious effect in drying and heating the microclimate of the adjacent forest. However, creation of desirable edge habitat and maintenance of openings will probably have a positive effect on such sensitive species as gopher tortoises and burrowing owls.

Herbicide use will be implemented in a manner that will minimize impacts to wildlife or aquatic organisms.

Access roads can act as barriers to animals reluctant to cross openings, and can displace (or subject to routine trampling) a certain amount of vegetation. These impacts should be minimal, however, because SECI intends to use existing roads wherever feasible and minimize the lengths of any essential new roads.

6.1.7.5.4 Effects of Public Access

It is SECI's policy to install locked gates at all points where the transmission line access road intersects previously fenced property. Therefore, with the exception of SECI personnel performing routine maintenance, no increased vehicle access is anticipated. Since no significant increase in human traffic into formerly inaccessible habitats will result, there will be no subsequent increased disturbance to wildlife.

6.1.7.5.5 Other Post Construction Effects

The transmission line will meet EMF limits set forth in Chapter 17-274, F.A.C. Maximum electric and magnetic field strengths at the edge of the ROW for the transmission line were calculated using the Bonneville Power Administration Corona and Fields Effects program. Input data used in the program were based on the generating capacity of the Hardee Power Station and included the following parameters:

1. A maximum current rating of 2,040 amperes;
2. A minimum conductor clearance of 27 ft from the earth;
3. Currents were assumed to be balanced in phase and in magnitude with no zero sequence current;
4. A maximum operating voltage of 242 kV; and
5. Voltages were assumed to be balanced in phase and in magnitude.

Electromagnetic fields strengths will vary depending on the ROW width and structure type. The maximum field strengths at the edge of the transmission line ROW will be below the field strength standards listed in Chapter 17-274.450, F.A.C. (i.e., 2.00 kV/m for electric field, and 150 milliGauss for magnetic field). The entire transmission line facility will meet the applicable sections of the National Electrical Safety Code. Due to the design and routing of the proposed transmission line and its location relative to residential areas, EMF and acoustic and electric noise will not be a problem.

6.2 ASSOCIATED NATURAL GAS PIPELINE

6.2.1 Project Description

The proposed primary fuel for the Hardee Power Station is natural gas. It will be brought to the site by a new 48-cm (18-inch) natural gas pipeline, the Hardee Power Station Lateral, connecting with an existing gas pipeline near Polk City, Florida. The Federal Energy Regulatory Commission (FERC) issued an environmental assessment on January 31, 1989 for a series of proposed Florida Gas Transmission System (FGT) gas pipelines, which included a portion of the proposed Hardee Power Station Lateral, referred to as the Sarasota Lateral Loop. FERC determined that the construction of the proposed facilities including the Sarasota Lateral Loop would not constitute a major federal action significantly affecting the human environment (FERC, 1989).

The Hardee Power Station Lateral incorporates the proposed Sarasota Lateral Loop and continues to the plant site. The Hardee Power Station Lateral begins about 1.6 km (1 mile) north of Polk City where it interconnects with the existing FGT 18-inch St. Petersburg lateral and continues south to the Hardee Power Station (Figure 6.2.1-1).

The gas pipeline will consist of an underground pipeline along a ROW up to 22 m (75 ft) wide. There are no proposed compressor stations along the preferred pipeline corridor.

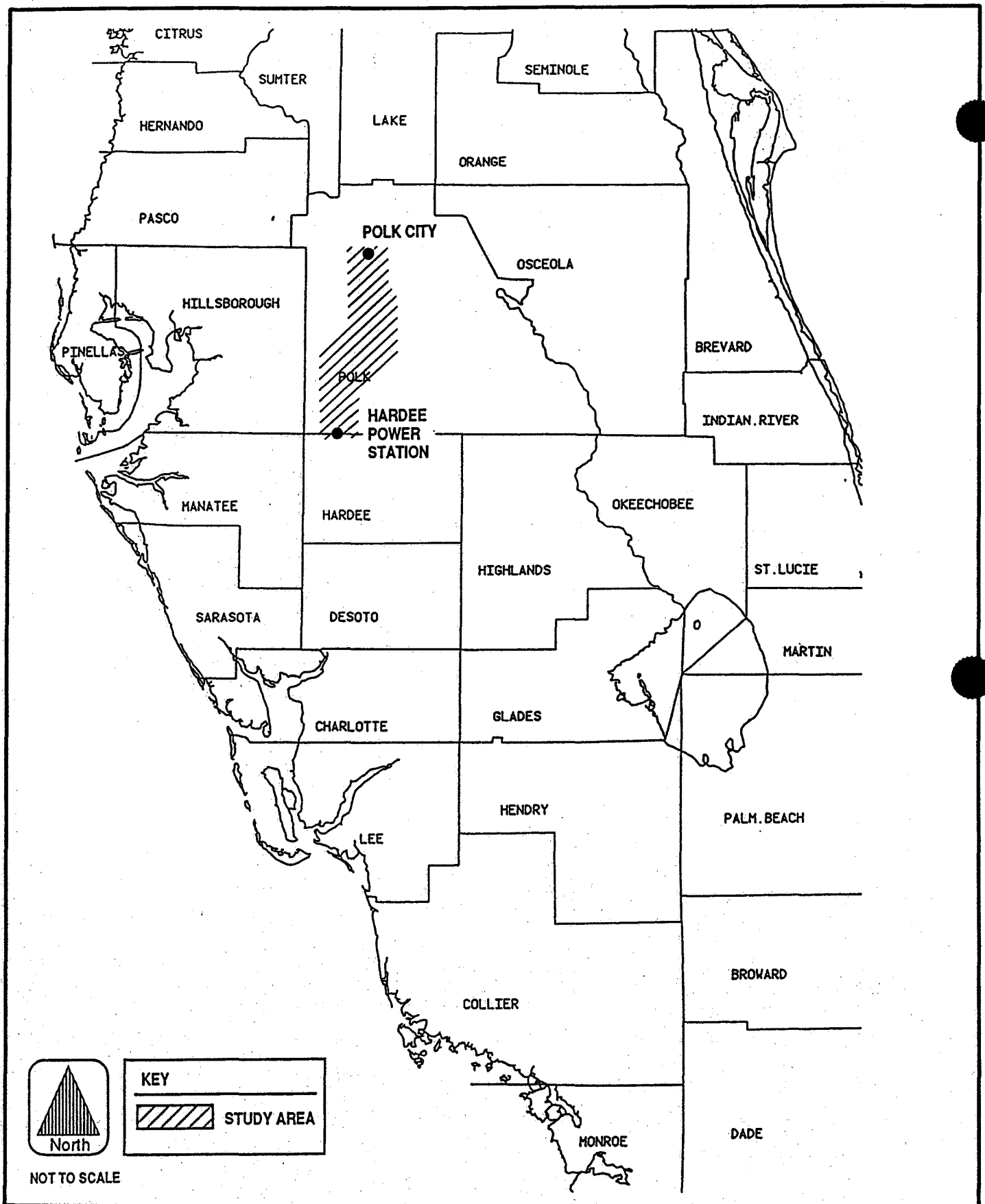


Figure 6.2.1-1 NATURAL GAS PIPELINE STUDY AREA AND INTERCONNECT POINTS

Hardee Power Station

6.2.2 Corridor Location and Layout

Figures 6.2.1-2 through 6.2.1-5 identify the full length of the proposed corridor relative to major geographic features. Existing gas pipeline are shown on these figures. Approximately 91% of the proposed gas pipeline is along existing ROWs.

Beginning at the north end of the pipeline corridor and moving south, the corridor is generally 200 ft wide where it follows the abandoned CSX Railroad. Where the corridor leaves the railroad, it narrows to 100 to 125 ft as it follows a local street. The corridor turns west, then turns south, occupying an area approximately 2,000 ft wide. At the crossing of U.S. 92, the corridor widens to a maximum of 600 ft, then, further south, narrows to 200 to 250 ft, following local streets. Where the corridor follows the existing transmission lines and gas pipeline south of Auburndale, the corridor width is generally 400 ft but varies from approximately 300 ft to 900 ft.

West of Bartow Airport, the corridor encompasses transmission line rights-of-way and is approximately 500 to 600 ft wide. Along Old Bartow/Eagle Lake Road, the corridor incorporates existing transmission line, road, and gas pipeline rights-of-way and is approximately 400 ft wide. Near Bartow, the corridor narrows to between 150 ft and 200 ft.

Along SR 60, the corridor incorporates the road right-of-way plus an existing pipeline right-of-way and is approximately 350 to 400 ft wide. Along Bonnie Mine Road, the corridor encompasses an existing pipeline right-of-way and the road right-of-way and is 300 ft wide. The corridor widens slightly next to CF Industries offices near Pierce and narrows slightly along SR 37 through Bradley. Thereafter, the corridor remains 300 ft wide until it begins following Fort Green Road south of CR 630. At that point, the corridor widens to 600 ft, encompassing the road and railroad rights-of-way down to the Hardee Power Station site.

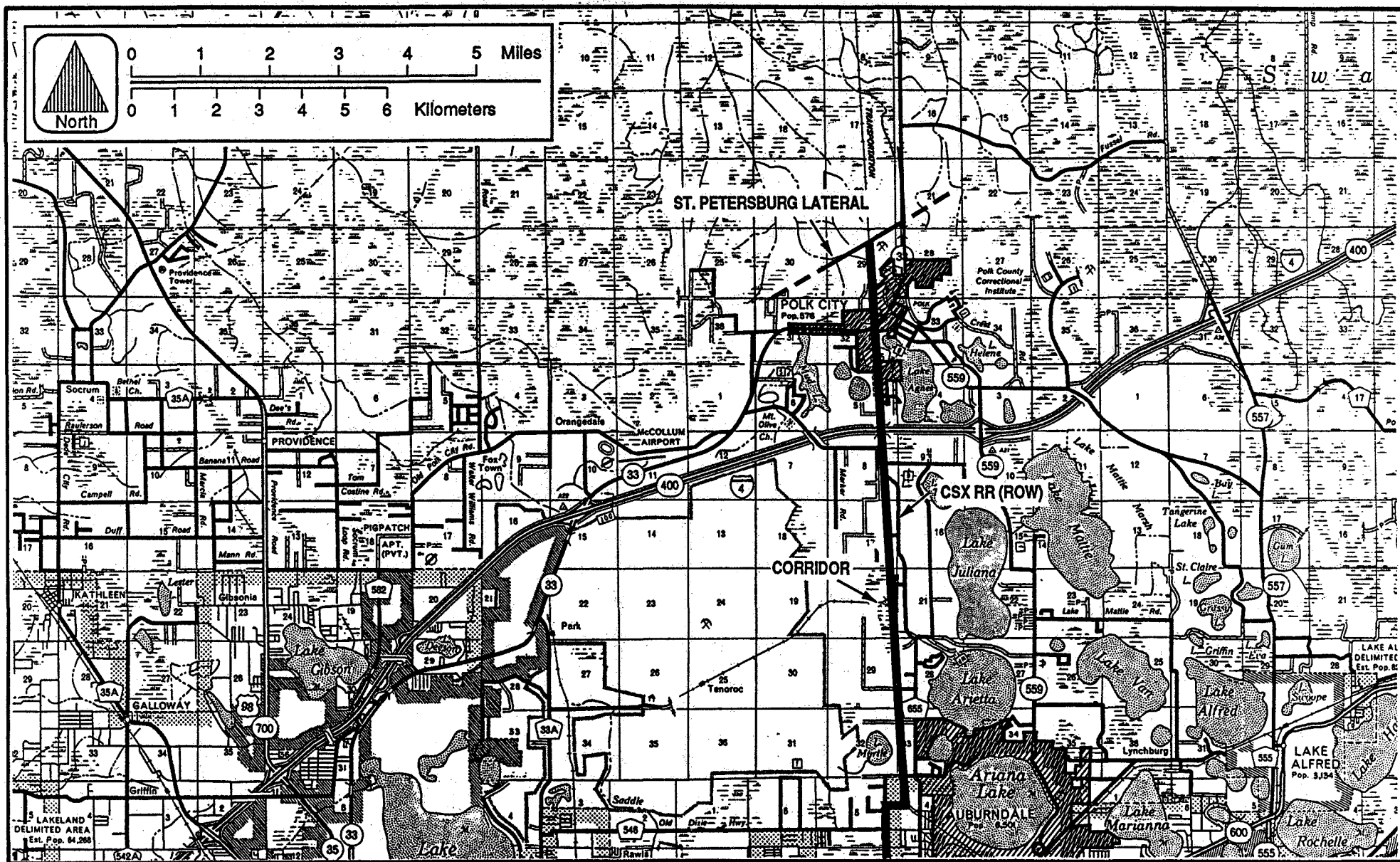


Figure 6.2.1-2 PROPOSED GAS PIPELINE CORRIDOR:
HARDEE POWER STATION LATERAL BEGINNING AT THE ST. PETERSBURG
LATERAL AND CONTINUING SOUTH TO PLANT SITE

**Hardee
Power Station**

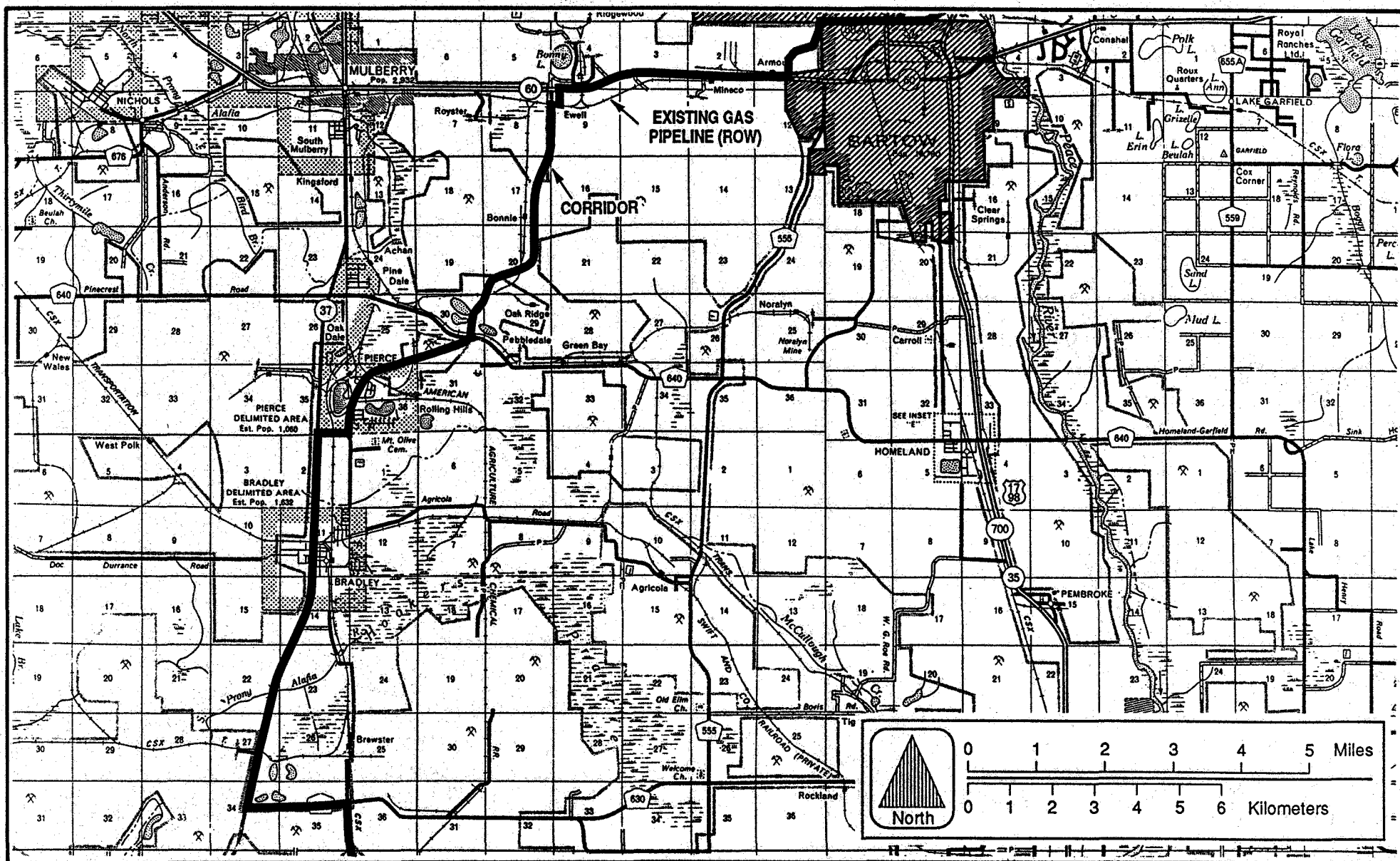


Figure 6.2.1-4 PROPOSED GAS PIPELINE CORRIDOR:
HARDEE POWER STATION LATERAL SOUTH TO PLANT SITE

**Hardee
Power Station**

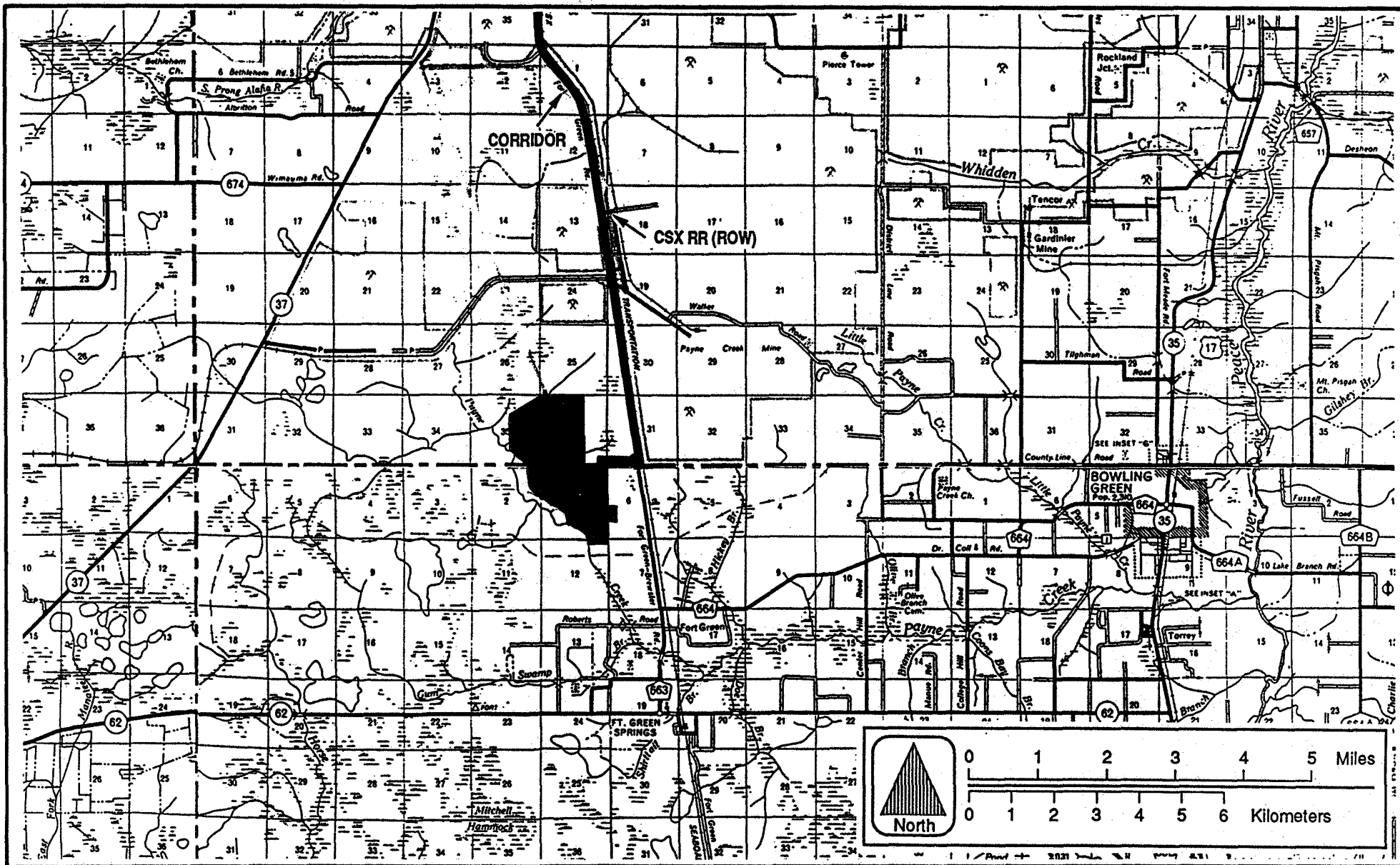


Figure 6.2.1-5 PROPOSED GAS PIPELINE CORRIDOR:
HARDEE POWER STATION LATERAL SOUTH TO PLANT SITE

**Hardee
Power Station**

Figures 6.2.1-6 and 2.6.1-7 present 1:24,000 maps showing the proposed corridor in areas requiring a new ROW.

6.2.3 Gas Pipeline Design Characteristics

The proposed gas pipeline will consist of an underground pipeline 48 cm (18 inches) in diameter. It will be approximately 79 km (49 miles) in length. Figure 6.2.3-1 presents a typical ROW design along new ROWs, and other existing ROWs.

6.2.4 Cost Projections

The estimated costs per mile are approximately \$420,000 per mile. The total cost of the pipeline will vary depending on the ultimate location of the pipe, cost of ROW acquisition and other site specific conditions.

6.2.5 Corridor Selection

FGT conducted the initial gas pipeline ROW selection study and identified preferred and alternative ROWs for the proposed Sarasota Lateral and an extension of this line to the Hardee Power Station Plant Site. These ROWs were reevaluated based on the following environmental considerations:

1. Using the most direct routes between the new power plant and the Polk City interconnect point;
2. Paralleling existing ROWs;
3. Minimizing crossing of rivers and highways;
4. Minimizing impact on residential and commercial development; and
5. Minimizing impact to wetlands and other forested areas.

Environmental conditions within and adjacent to the corridor along the proposed gas pipeline route were examined. By applying the above set of criteria, preferred and alternative corridors were identified and are presented in Figures 6.2.1-2 through 6.2.1-5.

Appropriate maps, aerial photography, ground inspection, local and regional planning documents, and other data sources were used to evaluate these

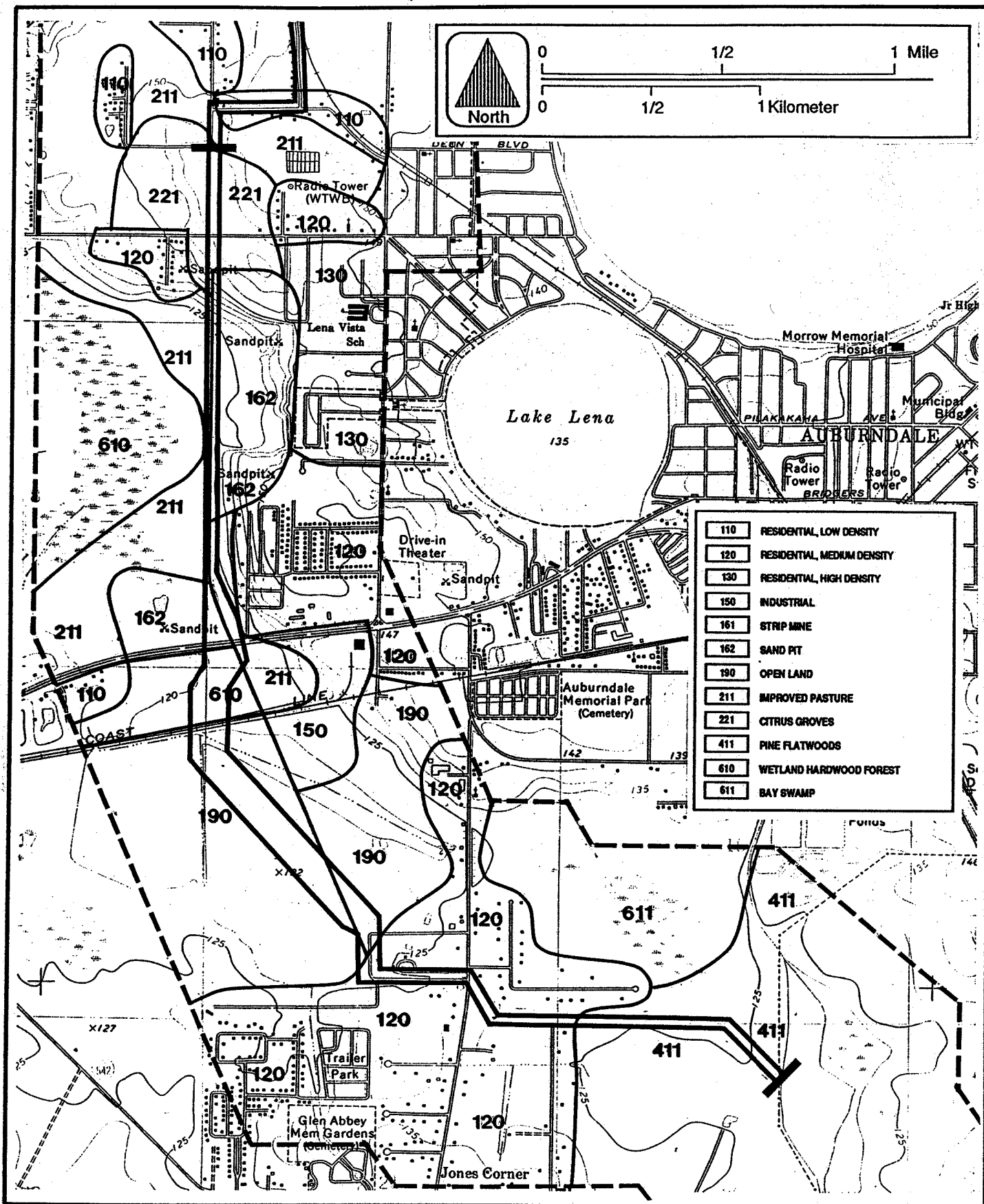


Figure 6.2.1-6 LAND USE/VEGETATION IN POTENTIAL NEW ACCESS AREAS ALONG THE PROPOSED NATURAL GAS PIPELINE CORRIDOR (BRADDOCK ROAD TO HIGHWAY 92)

**Hardee
Power Station**

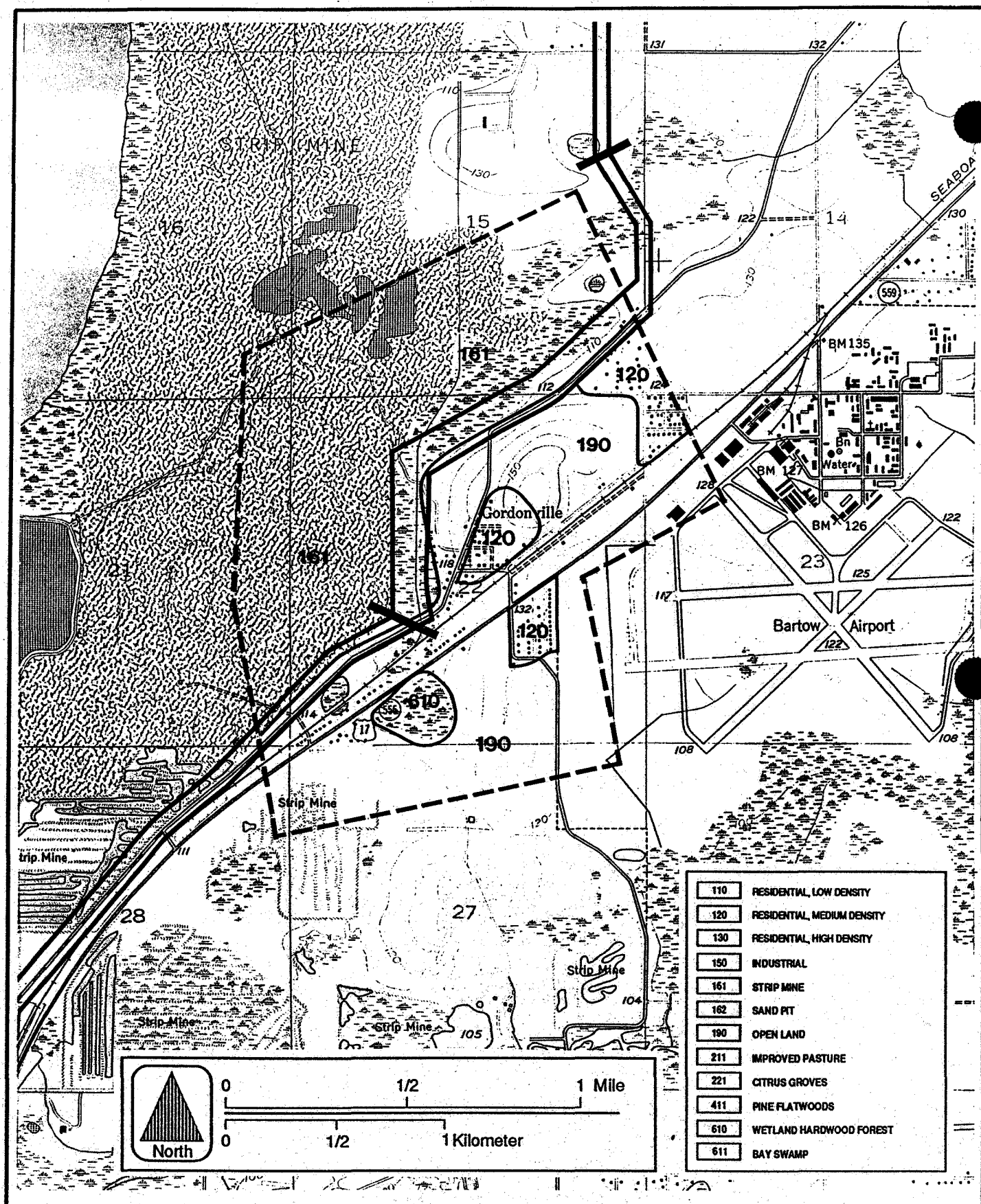
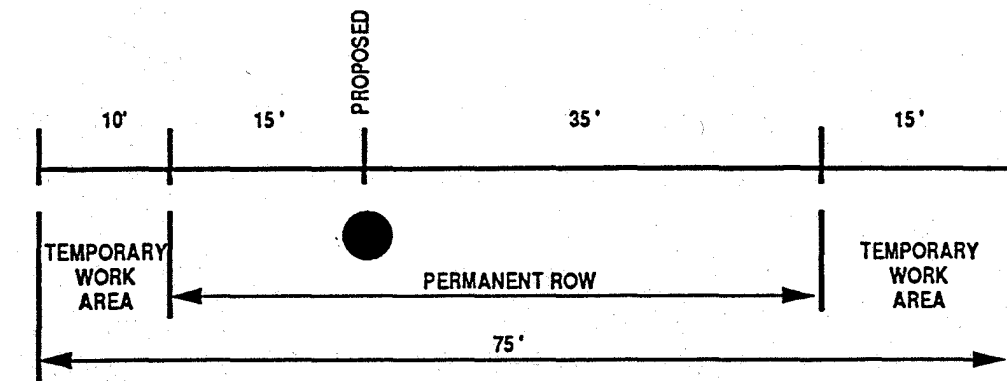
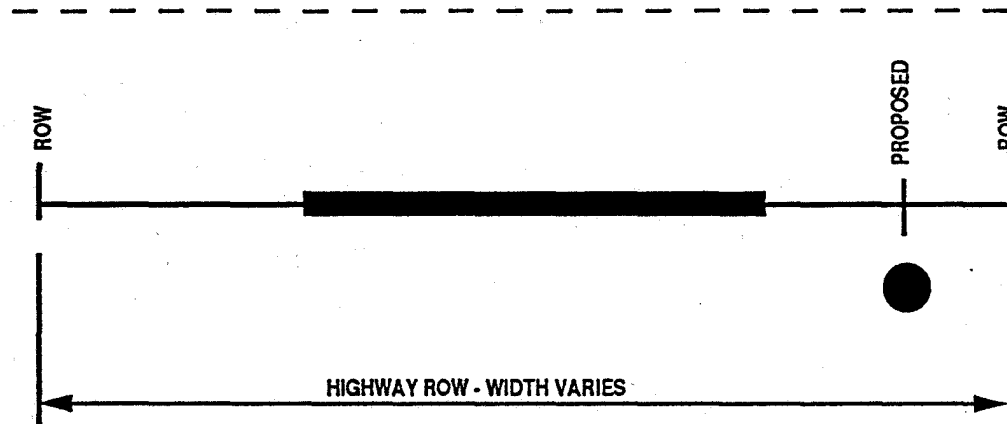


Figure 6.2.1-7 LAND USE/VEGETATION IN POTENTIAL NEW ACCESS AREAS ALONG THE PROPOSED NATURAL GAS PIPELINE CORRIDOR (OLD EAGLE LAKE TO GORDONVILLE)

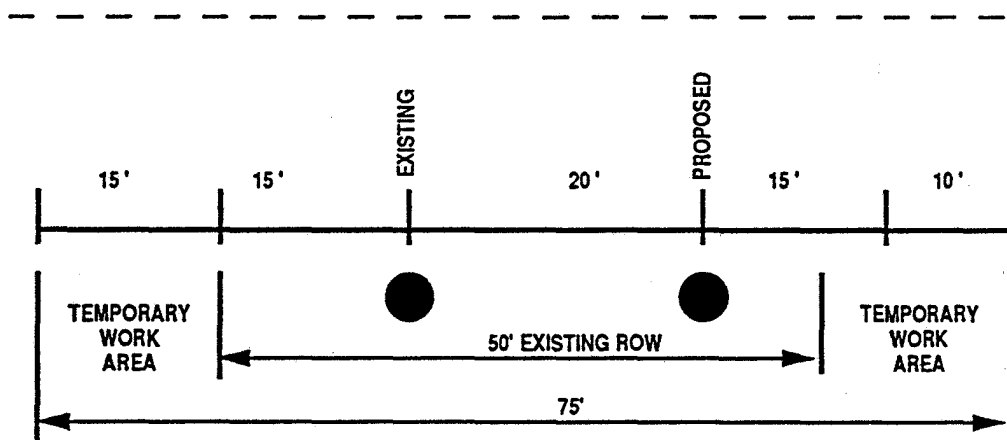
**Hardee
Power Station**



NEW RIGHT-OF-WAY



NEW RIGHT-OF-WAY
ALONG OTHER ROW (HIGHWAY)



NEW RIGHT-OF-WAY
ALONG EXISTING GAS PIPELINE ROW

NOT TO SCALE

Figure 6.2.3-1 PROPOSED RIGHT-OF-WAY (ROW)
SCHEMATIC DESIGNS

**Hardee
Power Station**

corridors. A qualitative assessment of resources contained within the preferred and alternative corridors was made through this process.

Preferred corridors were identified which minimized potential impacts to local land use and environmental features. The alternative corridors were discarded due to environmental considerations, e.g., potential wetland impacts.

6.2.6 Socio-Political Environment of the Corridor Area

6.2.6.1 Governmental Jurisdiction

The proposed natural gas pipeline corridor runs generally southward from just north of Polk City to the Polk/Hardee County line where it enters the plant just inside Hardee County. The pipeline is approximately 79 km (49 miles) long and passes through unincorporated portions of Polk County and Polk City, Auburndale and Bartow. It is also within 0.8 km (0.5 mile) of several smaller unincorporated communities including Bradley Junction and Gordonville. Figures 6.2.1-2 through 6.2.1-5 show the proposed pipeline corridor in relation to the towns and cities within 0.8 km (0.5 mile) of the corridor.

6.2.6.2 Zoning and Land Use Plans

The corridor crosses unincorporated parts of Polk County plus Polk City, the City of Auburndale, and the City of Bartow. Each of the four local government jurisdictions crossed by the corridor has adopted a comprehensive plan pursuant to Chapter 163, FS. Except for the City of Auburndale and the City of Polk City, none of these local governments has an adopted land use plan map. The location of the corridor in relation to the City of Auburndale's future land use plan map is depicted in Figure 6.2.6-1. The location of the corridor in relation to the City of Polk City's future land use plan map is presented in Figure 6.2.6-2.

The City of Auburndale's future land use map covers a planning area that includes the city limits and fringe areas outside the city limits. The future land use plan covering only the city limits does not include the area crossed by the pipeline corridor. As shown on Figure 6.2.6-1, land

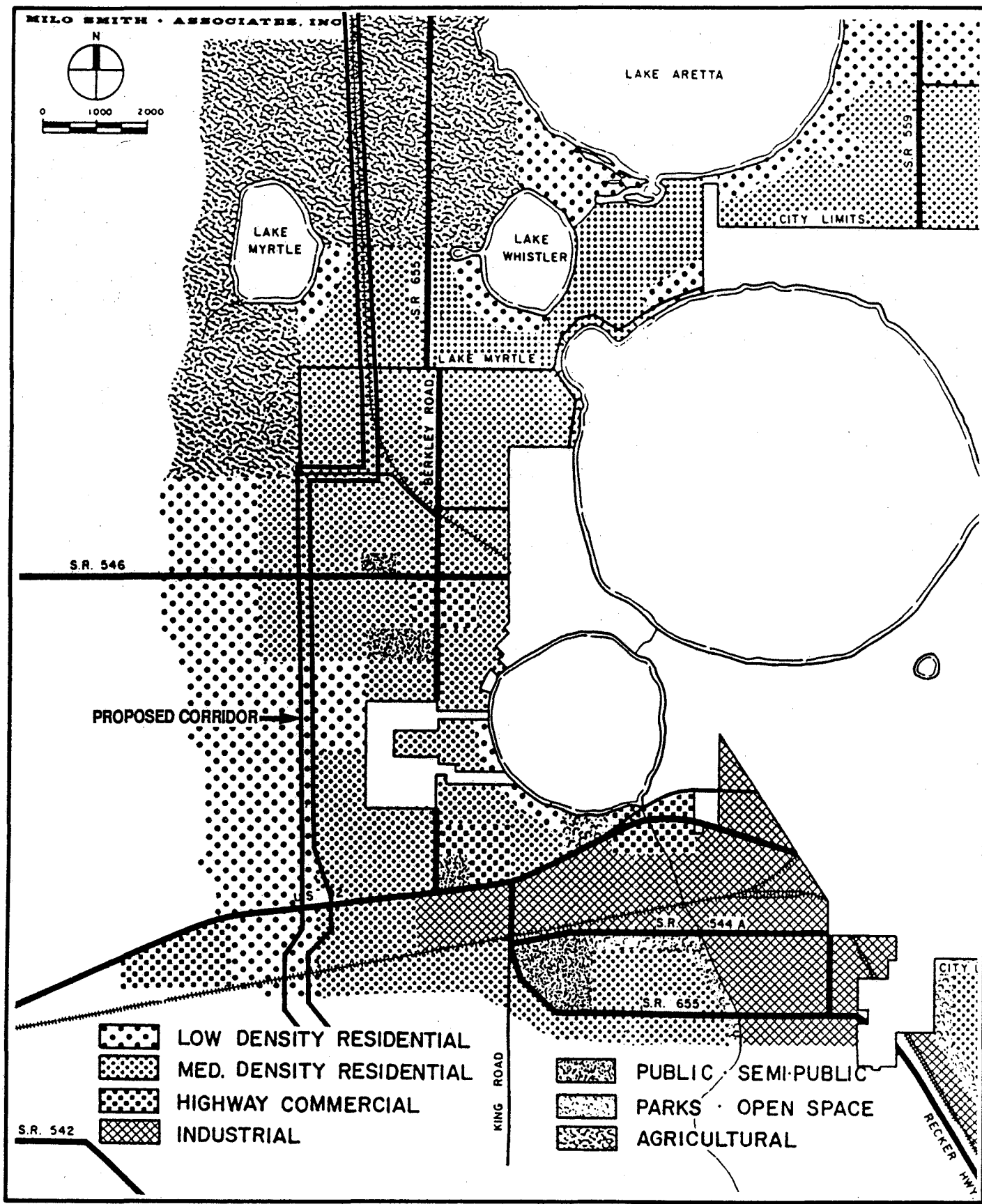


Figure 6.2.6-1 FUTURE LAND USE MAP — AUBURNDALE

**Hardee
Power Station**

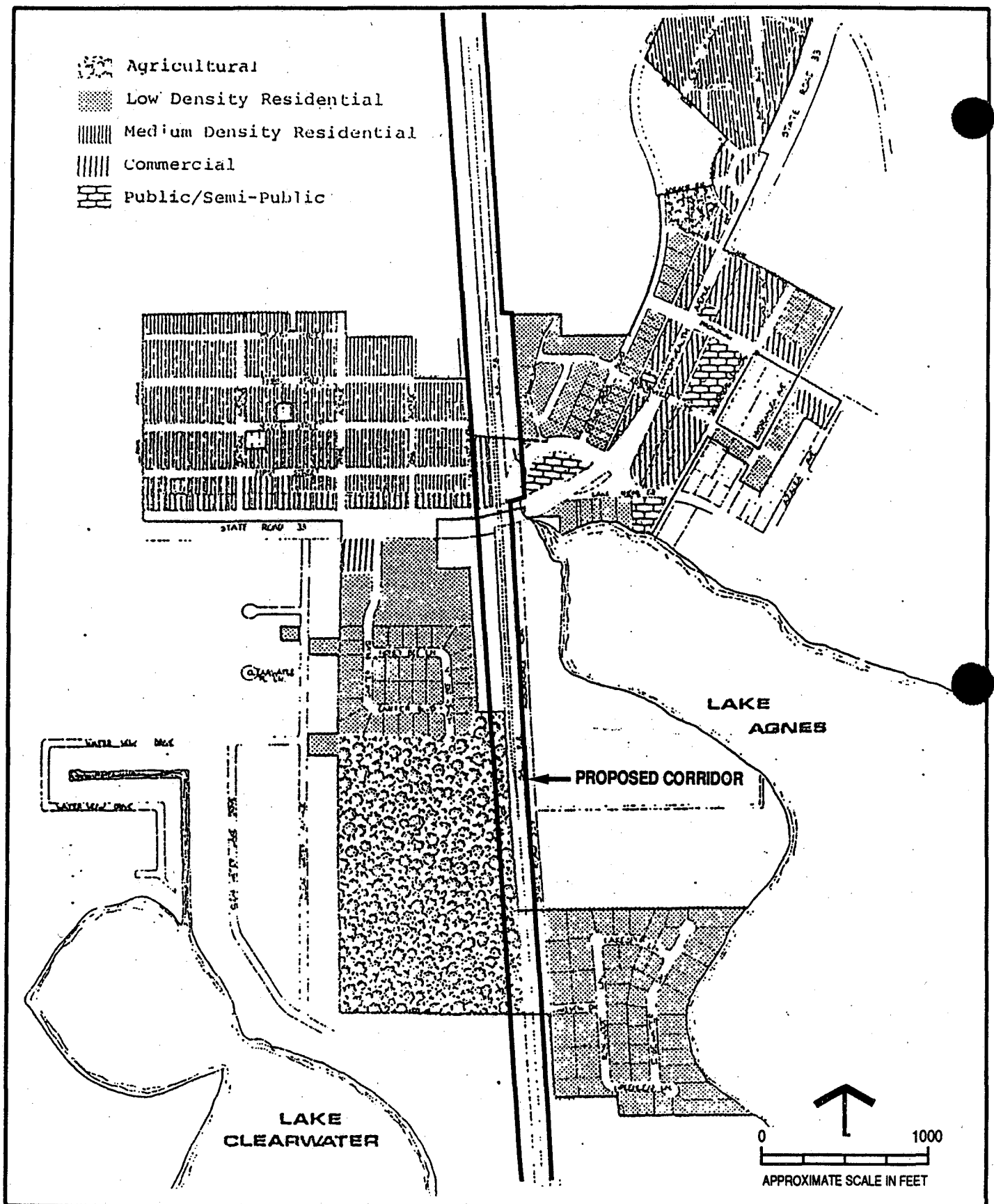


Figure 6.2.6-2 FUTURE LAND USE MAP — POLK CITY

**Hardee
Power Station**

use plan categories crossed by the pipeline corridor are Agricultural, Medium Density Residential, and Low Density Residential.

As shown in Figure 6.2.6-2, land use plan categories in Polk City's future land use plan crossed by the pipeline corridor are Agricultural and Commercial.

The following zoning districts are crossed by the pipeline corridor:

Polk City

C-1--Commercial Restricted District

City of Auburndale

CH--Commercial Highway District

City of Bartow

R-1--Residential District

R-1A--Residential District

C-3--Highway Commercial District

P-1--Professional Office District

I-1--Industrial District

I-2--Industrial District

Polk County

R-1--Residence District

R-2--Residence District

R-3--Residence District

RE-1--Rural Estates District

RE-2--Rural Estates District

SF-1--Single Family District

SF-1M--Single Family District

RC--Rural Conservation District

RC-2--Rural Conservation District

C-2--Commercial District - Multi Neighborhood Commercial

C-3--Commercial District - Regional Commercial

C-4--Commercial District - Heavy Commercial

GI--General Industrial District

PUD--Planned Unit Development District

Applicable provisions of each local government's zoning code are discussed in the following paragraphs.

Polk County--The Polk County Land Use Element of the Polk County Comprehensive Plan and the Polk County Zoning Ordinance were reviewed, and County Officials were consulted to determine the compatibility of the

proposed pipeline with existing Polk County rules and plans. In response to a request from the Applicants, a letter was received from the Polk County Administrator indicating that the Zoning Ordinance and the Comprehensive Plan consider gas pipelines to be essential services. These facilities are, therefore, permitted in the existing zoning districts of Polk County.

Hardee County--The pipeline enters Hardee County on the Hardee Power Station property. The plant and associated gas pipeline are authorized uses under present zoning (see Section 2.2.2).

Polk City--The Zoning Ordinance (Ordinance Number 89-11) does not include any reference to a gas pipeline as either a permitted or prohibited use. The location of the pipeline corridor through Polk City was approved by the City Commission on April 2, 1990.

Auburndale--Auburndale's zoning code (Chapter 25) defines essential services as clearly including "gas facilities" and provides that they "may be located within any zoning district after review and approval by the City Commission" (Section 25-20, Page 1462). That approval was granted by the City Commission on April 2, 1990.

Bartow--The City of Bartow's zoning code defines public service structures as clearly including gas pipelines (Section 15, Page 337). Section 33, general regulations for structures and uses, identifies public service structures as permitted in all zoning districts only after review by the zoning commission (Pages 358-360). Approval was granted by the Zoning Commission on March 26, 1990.

6.2.6.3 Easements, Title, Agency Works

Easements will be required for the gas pipeline corridor to cross lands under the jurisdiction of the Board of Trustees of the Internal Improvement Trust Fund. This jurisdictional determination has been requested for the proposed corridor and will be provided subsequent to ROW selection. A list of roads, railroads and transmission lines within the preferred corridor

for which crossing approvals would ordinarily be required is presented in Table 6.2.6-1.

6.2.6.4 Vicinity Scenic, Cultural and Natural Landmarks

There are no areas of the type identified in Section 2.2.5 of the Instruction Guide for Site Certification Applications within 0.8 km (0.5 mile) of the proposed pipeline.

6.2.6.5 Archaeological and Historic Sites

DHR was contacted to determine whether any archaeological or historic sites listed or eligible for listing in the National Register of Historic Places, or otherwise of national, state, or local significance might be affected by the proposed gas pipeline corridor. A set of USGS quadrangle maps (1:24,000) showing the locations of the corridor were reviewed by the DHR personnel. Both known sites and potential historical and archaeological site locations within the corridor were identified by the DHR staff. Based on DHR review it has been determined that no recorded archaeological and historic sites would be impacted by the proposed corridor (see DHR letter, Appendix 11.3). Several potentially sensitive areas were identified.

6.2.7 Bio-Physical Environment of the Corridor Areas

6.2.7.1 Land Use/Vegetation

Land use (see Section 6.2.7.3) along the corridor ranges from residential (FLUCCS 110-120) to strip mined (FLUCCS 161). The major land use along the corridor is improved pasture (FLUCCS 211). Ninety-one percent of the corridor is along existing gas pipeline, railroad, and highway ROWs. Figures 6.2.1-6 and 6.2.1-7 show land use/vegetation within 0.8 km (0.5 mile) of the proposed pipeline corridor along sections of the corridor requiring new access. Land use and vegetation were determined using USGS 1:24,000 topographic quadrangle maps, recent aerial photos and ground inspection.

6.2.7.2 Affected Waters and Wetlands

Table 6.2.7-1 lists the water bodies that will be crossed by the proposed pipeline. All water bodies are presently crossed by existing ROWs. These

Table 6.2.6-1. Easements, Title, Crossing Approvals Normally Required for Gas Pipeline Construction from Interconnect Point to Hardee Power Station (Page 1 of 2)

Facility	Location	Affected Party	Type of Previous Approvals
SR 33	Polk City	FDOT	Utility Permit
I-4/SR 400	2.3 km (1.4 miles) South of CR 33	FDOT	Utility Permit
CSX RR	4.0 km (2.5 miles) South of I-4	CSX	Use Approval
Mount Olive Road	Polk City	Polk County	Use Permit
Pace Road	4.8 km (3.0 miles) South of Polk City	Polk County	Use Permit
Bryan Lane	4.8 km (3.0 miles) South of Polk City	Polk County	Use Permit
Spring Road	4.0 km (2.5 miles) North of Auburndale	Polk County	Use Permit
Braddock Road	4.0 km (2.5 miles) North of Auburndale	Polk County	Use Permit
Lake Myrtle Road	Auburndale	Polk County	Use Permit
Jones Road	Auburndale	Polk County	Use Permit
Plymouth Road	Auburndale	Polk County	Use Permit
Moss Road East	Auburndale	Polk County	Use Permit
CR 546	Auburndale	Polk County	Use Permit
US 92	Auburndale	FDOT	Utility Permit
CSX RR	Auburndale	CSX	Use Approval
CR 542	Jones Corner	Polk County	Use Permit
CR 540 (Winter Lake Rd)	West of Winter Haven	Polk County	Use Permit
Thornhill Road	West of Eagle Lake	Polk County	Use Permit
Hurst Road	West of Eagle Lake	Polk County	Use Permit
Wilson Road	West of Eagle Lake	Polk County	Use Permit
Mays Road	West of Eagle Lake	Polk County	Use Permit
Sheffield Road	West of Eagle Lake	Polk County	Use Permit
CSX RR	Southwest of Gordonville/West of Bartow Municipal Airport	CSX	Use Approval
Old Bartow/ Eagle Lake Road	Southwest of Gordonville/ West of Bartow Municipal Airport	Polk County	Use Permit
Gertier Road	Northeast of Bartow	Polk County	Use Permit
Church Street	Northeast of Bartow	Polk County	Use Permit
Perch Street	Northeast of Bartow	Polk County	Use Permit
Griffen Street	Northeast of Bartow	Polk County	Use Permit
Thomas Street	Northeast of Bartow	Polk County	Use Permit
Alma Court	North of Bartow	Polk County	Use Permit
Rosa Court	North of Bartow	Polk County	Use Permit
Gate Road	North of Bartow	Polk County	Use Permit
Wall Street	North of Bartow	Polk County	Use Permit
Radford Road	North of Bartow	Polk County	Use Permit

Table 6.2.6-1. Easements, Title, Crossing Approvals Normally Required for Gas Pipeline Construction from Interconnect Point to Hardee Power Station (Page 2 of 2)

Facility	Location	Affected Party	Type of Previous Approvals
CSX RR/U.S. 98/ SR 700/SR 35	Bartow	CSX/FDOT	Use Approval/ Utility Permit
SR 60	West of Bartow	FDOT	Utility Permit
CSX RR	East of Mulberry	CSX	Use Approval
Bonnie Mine Road	Southwest of Bartow	Polk County	Use Permit
Pebbledale Road	Southwest of Bartow	Polk County	Use Permit
Old Hwy 37	Pierce	Polk County	Use Permit
Jamison Road	Pierce	Polk County	Use Permit
CSX RR	South of Bonnie	CSX	Use Approval
CR 630/CSX RR	Pebbledale	Polk County	Use Permit
CSX RR	Pierce	CSX	Use Approval
CSX RR	Rolling Hills	CSX	Use Approval
SR 37	Rolling Hills	FDOT	Utility Permit
Patterson Road	Rolling Hills	Polk County	Use Permit
Williams Road	Rolling Hills	Polk County	Use Permit
Brewton Street	Rolling Hills	Polk County	Use Permit
Doc Durrance Road	Bradley Junction	Polk County	Use Permit
Pine Street	Bradley Junction	Polk County	Use Permit
Forbes Road	Bradley Junction	Polk County	Use Permit
Main Avenue	Bradley Junction	Polk County	Use Permit
CSX RR	Bradley Junction	CSX	Use Approval
SR 37	Bradley Junction	FDOT	Utility Permit
SR 37	Brewster	FDOT	Utility Permit
Fort Green Road	Brewster	Polk County	Use Permit
Mills Road	4.8 km (3.0 miles) South of CR 630	Polk County	Use Permit
Walker Road	6.4 km (4.0 miles) South of CR 630	Polk County	Use Permit

Note: No changes resulting from the gas pipeline are expected to occur within the facilities listed.

Table 6.2.7-1 Water Bodies Crossed by Proposed Gas Pipeline Corridor for the Hardee Power Station

Water Body	Water Classification*	County/Location	Crossings
Unnamed Tributary	Class III	Polk, South of Auburndale	Existing
Saddle Creek	Class III	Polk, North of Bartow	Existing
Bear Branch	Class III	Polk, Bartow	Existing
Skinned Sappling Creek	Class III	Polk, Southwest of Bartow	Existing
South Prong Alafia River	Class III	Polk, South of Bradley Junction	Existing

* Chapter 17.3.161 F.A.C.

water bodies are Class III water bodies. A number of wetlands are crossed by the proposed corridor. The majority of these wetlands are forested wetlands (see Section 6.2.7.3). All are already crossed by existing ROWs.

6.2.7.3 Ecology

Table 6.2.7-2 lists important fauna potentially occurring along the corridor. Except for the gopher tortoise whose burrows was observed along a railroad ROW within the corridor, the probability of occurrence of the other species within the corridor is low because of the lack of good habitat.

The short-tailed snake (Stilosoma extenuatum) whose range includes the corridor could potentially occur along the corridor. This snake, endemic to Florida, is restricted chiefly to longleaf pine/turkey oak plant associations. The ecology of this species is poorly known. It is a burrower and is seldom seen above ground except in spring and fall. The short-tailed snake is threatened primarily due to timber management practices and the conversion of its habitat to citrus groves and building sites. Because of the lack of good habitat within the corridor the probability of occurrence is low.

Detailed discussion of the other species whose ranges include the corridor is presented in the previous Section 6.1.7.3.

The following is a description of the ecological (and land use conditions) observed within sections of the gas pipeline corridor starting at the interconnect point near Polk City and proceeding south to the plant site. Except for 6.9 km (4.3 miles) the corridor contains existing ROWs, i.e., gas pipeline, highways, and railroad ROWs which are ruderal in nature.

Vegetation along the corridor is a mixture of improved pastures, citrus, ruderal areas and occasional wetlands. The southern portion of the corridor passes through mined and reclaimed lands. Wildlife along most portions of the corridor consists primarily of common species that tolerate human proximity, which include songbirds, rodents, small mammals, etc. The

Table 6.2.7-2. Threatened and Endangered Animal Species that Could Potentially Occur along the Gas Pipeline Corridor for the Hardee Power Station

Common Name	Scientific Name	Status	Habitat	Source
BIRDS				
Burrowing owl	<u>Athene cunicularia</u>	SSC	Open pine-pasture	FGFWFC
Southeastern American kestrel	<u>Falco sparverius paulus</u>	T	Open pine-pasture	FGFWFC
Bald eagle	<u>Haliaeetus leucocephalus</u>	T, E	Open pine-pasture with tall trees	FGFWFC USFWS
Audubon's crested caracara	<u>Polyboros plancus audobonii</u>	T T	Prairie, open pasture	FGFWFC USFWS
Wood stork	<u>Mycteria americana</u>	E E	Wetlands	FGFWFC USFWS
REPTILES				
American Alligator	<u>Alligator mississippiensis</u>	SSC T(S/A)	Wetlands	FGFWFC USFWS
Gopher tortoise	<u>Gopherus polyphemus</u>	SSC UR2	Upland areas with abundant herbaceous ground cover	FGFWFC USFWS
Eastern indigo snake	<u>Drymarchon corais couperi</u>	T T	Wooded areas	USFWS FGFWFC
Florida pine snake	<u>Pituophis melanoleucus mugitus</u>	SSC UR2	Upland oak-palmetto open pine-pasture	FGFWFC USFWS
Short-tailed snake	<u>Stilosoma extenuatum</u>	T UR2	Upland oak-palmetto	FGFWFC USFWS

Note: E = Endangered
 SSC = Species of Special Concern
 T = Threatened
 T(S/A) = Threatened Due to Similarity of Appearance
 UR2 = Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking
 USFWS = U.S. Fish and Wildlife Service
 FGFWFC = Florida Game and Fresh Water Fish Commission

wetlands described above, especially in the southern sections, provide habitat for aquatic dependent species such as wading birds.

Interconnect Point North of Polk City to I-4

The preferred pipeline corridor is along an abandoned CSX railroad ROW. On the east side of the pipeline corridor north of Polk City is a north-south narrow bayhead of sweet bay (Magnolia virginiana), swamp bay (Persea palustris), slash pine (Pinus elliottii), pond pine (Pinus serotina), and red maple (Acer rubrum). Cover elsewhere along the remaining corridor section consists of improved pasture and citrus.

An active gopher tortoise (Gopherus polyphemus) burrow was located along the railroad ROW north of Polk City. Most of this section provides only marginal habitat for the gopher tortoise.

I-4 to Braddock Road

This section is primarily ruderal in character and continues along the CSX ROW. A number of residences exist within 0.4 km (0.25 miles) of the corridor. Pastures, abandoned fields and citrus groves are present. One and one-half to three km (1 to 2 miles) south of I-4 the corridor crosses a wetland dominated by sweet bay and red maple. One and a half to 3 km (1 to 2 miles) farther south the corridor crosses wetlands dominated by bays and slash pine.

Braddock Road to US 92

Land use in this section of the corridor is predominantly citrus grove, pasture and a sandpit operation and includes the CSX ROW for approximately half the distance. The corridor leaves the CSX ROW and continues south through pasture and citrus groves. The corridor is bordered on the west by a large bay/slash pine wetland for approximately 1.5 km (1 mile) north of US 92. The corridor itself is an upland ruderal area.

US 92 to CR 542

The corridor crosses a willow swamp, goes across an active CSX railroad, then turns southeast across a willow swamp with scattered stands of red

maple and sweet bay, and then turns east into an area with scattered mobile homes and pastures. Across Thornhill Road, the corridor passes through a ranchette neighborhood and joins an electrical transmission line ROW. The surrounding vegetation in this area is longleaf pine flatwoods and pasture. Dominant plant species in the flatwoods are longleaf pine (Pinus palustris), saw palmetto (Serenoa repens), wiregrass (Aristida stricta), staggerbush (Lyonia fruticosa), and scrubby oaks, such as sand live oak (Quercus geminata). South of the flatwoods the ROW crosses a bay swamp that adjoins CR 542.

CR 542 to CR 540

The corridor follows the transmission line ROW and is surrounded by improved pasture. The corridor crosses a stream in two locations within 0.8 km (0.5 mile) south of CR 542. The corridor joins an existing FGT pipeline ROW. The ROW is built higher than the surrounding pasture which has many low spots of marsh or clumps of bay trees. An excavated ditch borders the ROW on the southern half of this segment. There are at least two culverts to convey water across the ROW.

CR 540 to Thornhill Road

The corridor continues along an FGT gas pipeline and a transmission line ROW. It crosses an improved pasture through most of this section. Ruderal areas and residences occur at the eastern edge of the corridor. Upland areas in this section other than improved pasture include some areas of pine plantation and pine flatwoods. Wetlands in the segment consist of a cypress dome/marsh system crossed by the existing FGT pipeline ROW, but mostly to its east, and an isolated marsh north of Thornhill Road. The cypress dome/marsh consists predominantly of cypress (Taxodium sp.), sweetbay, and slash pine on the west and a large marsh that extends past the corridor area on the east. The marsh is dominated by juncus (Juncus sp.), sedges, and lizard tail (Saururus cernuus).

The isolated marsh is dominated by juncus. There are several small [less than 0.1 ha (0.25 acre)] areas on the corridor dominated by juncus and redroot (Lachnanthes caroliniana). In some areas a wetland with juncus and

elderberry (Sambucus canadensis) parallels the east side of the existing corridor that was probably created by the construction of the ROW for the existing pipeline.

Thornhill Road to Old Bartow/Eagle Lake Road

The corridor continuing along existing ROWS crosses through improved pasture. Citrus groves occur to the east of the corridor. Small areas [<0.2 ha (<0.5 acre)] of pine palmetto flatwoods and xeric oak occur along the corridor. Approximately 0.8 km (0.5 mile) south of Thornhill Road, a large wetland crosses the corridor, apparently draining toward a strip mined area 0.8 km (0.5 mile) east of the corridor. About $3/4$ km ($1/2$ mile) north of Old Bartow/Eagle Lake Road, the corridor veers to the southeast to avoid a small lake. In this area it crosses an area of xeric oak and a longleaf pine flatwoods with an understory of saw palmetto, scrub oaks, and gallberry. Just north of Old Bartow/Eagle Lake Road is another wetland, which drains into Millsite Lake, which is approximately 1.6 km (1 mile) east of the corridor. Both wetlands are mixed slash pine/bay swamp.

Old Bartow/Eagle Lake Road to South of Gordonville

The corridor leaves the existing ROWs and borders the edge of an abandoned citrus grove. This area is a planned site for wastewater irrigation. The route borders the rural, largely residential town of Gordonville and follows Old Bartow/Eagle Lake Road. Although the USGS quad shows a wetland occurring on the north and west side of the corridor, no wetland was observed. It may have been destroyed by the extensive strip mining between this area and Lake Hancock which is 3 to 4 km (2 to 3 miles) northwest of the corridor. This section, largely bordering the residential area of Gordonville, provides only marginal wildlife habitat.

South of Gordonville to Levee South of Saddle Creek

The corridor follows existing highway and pipeline ROWs. The upland area in this section is predominantly ruderal or formerly mined land. There is an area of overgrown longleaf pine-saw palmetto flatwoods occupying the narrow strip of land between Old Bartow/Eagle Lake Road and U.S. 17. The corridor crosses Saddle Creek in this section and its associated mixed

swamp hardwood floodplain. The creek is channelized and its water level is influenced by a dam to the north that controls water flow from Lake Hancock. Cypress trees in the floodplain have been stressed by the channelization as indicated by exposed roots and soil subsidence below the buttresses.

The mixed swamp hardwood floodplain along Saddle Creek provides good wildlife habitat.

South of Saddle Creek and Along SR 60

The corridor parallels existing ROWs for most of the distance. The undeveloped uplands are ruderal, pasture, or citrus orchard in this part of the corridor. The corridor passes through some residential areas. At Bear Branch the route turns southwest leaving existing ROWs until it rejoins the CSX and SR 60. The corridor includes upland hardwoods on the southern edge and part of a strip mine lake on the north in this area. Bear Branch has been channelized and vegetation on its banks is more transitional than wetland: sweetgum (Liquidambar styraciflua), live oak (Quercus virginiana), water oak (Quercus nigra), mulberry (Morus sp.), and black cherry (Prunus serotina). The strip mine lake is bordered by weedy upland vegetation: mulberry, black cherry, persimmon (Diospyros virginiana), and groundsel bush (Baccharis halimifolia).

The proposed route roughly parallels SR 60 for 5 km (3 miles). The corridor consists mostly of pasture, planted pine, and ruderal areas on previously mined lands. At 2 km (3.2 miles) from the location where it meets SR 60, a wetland occurs on the north. Willow (Salix caroliniana) and elderberry dominate the vegetation.

Most of this section is ruderal and/or suburban in character. Wildlife in the area would consist of species that tolerate human proximity and thrive in suburban environments.

South of SR 60 to Rolling Hills

This section consists of previously mined land. The corridor follows existing railroad, gas pipeline and highway ROWs. Uplands are predominantly pasture. It crosses Skinned Sapling Creek with wetland vegetation of elderberry and groundsel bush. A large strip mine lake is west of the corridor between SR 60 and Pebbledale. A small hardwood wetland occurs on the west where the route crosses the railroad at Pebbledale.

Rolling Hills to the Intersection of SR 37 and CR 630

The corridor along Jamison Road consists of unmined lands, predominantly pine/oak flatwoods with a palmetto understory. On SR 37 the corridor consists mostly of pasture on previously mined lands. The corridor following existing ROWs crosses a citrus grove, pine/oak forest and pasture south of Bradley Junction.

The corridor crosses the South Prong Alafia River. The bank of the river is predominantly pasture.

Intersection of SR 37 and CR 630 Along CR 663 to Hardee Power Station Site

This section of corridor follows existing highway, railroad and transmission line ROW. The areas next to the corridor consists mostly of previously mined and actively mined lands. However, along CR 630 there is an area of upland hardwood on the south side of the corridor with black cherry, laurel oak (Quercus laurifolia), and groundsel bush predominating. Upland areas along the corridor that are not actively being mined consist of pasture, ruderal areas and some pineland and citrus. The corridor crosses a willow-dominated hardwood wetland where this route intersects with a proposed Alternate Route. The corridor also crosses the remains of Little Payne Creek. The former creek is represented by a ditch that traverses the road and does not appear to be connected to Little Payne Creek further east. Dominant vegetation is willow.

Most of this segment provides poor wildlife habitat due to the past and present strip mining of the area. There are, however, some small wetlands

adjacent to the corridor that provide habitat for ducks, wading birds, and other wildlife. Additionally, the pastures provide habitat for small mammals and predators such as hawks and owls.

6.2.7.4 Other Environmental Features

All applicable environmental features are described in the above sections.

6.2.8 Effects of Right-of-Way Preparation and Construction

6.2.8.1 Construction Techniques

Construction of the pipeline will involve preparing the construction ROW and trenching. Preparing the construction ROW will involve clearing a path 15 to 23 m (50 to 75 ft) wide, depending on available space, to allow for passage of construction vehicles. Where the pipeline is installed in existing ROWs, less clearing will be required. After preparation of the ROW, a linear trench 30 cm (12 inches) wider and 91 cm (36 inches) deeper than the pipeline diameter will be excavated to install the pipeline. Section 6.2.8.2 discusses erosion potential and proposed mitigation measures.

6.2.8.2 Impact on Water Bodies and Uses

The proposed pipeline will use existing ROW crossings of water bodies. Dredge and fill operations to lay the new pipeline across streams will take place. This type of construction can temporarily increase sedimentation and turbidity levels in the immediate vicinity and downstream of the proposed crossing. In order to reduce these impacts, sediment controls will be used.

Several already altered forested wetlands as well as one new isolated wetland (i.e., red maple swamp) may be affected by construction of the ROW. Potential wetland impacts include soil compaction, sedimentation, alteration of hydrology, and removal of vegetation. These impacts will be minimized by appropriate controls.

No significant adverse effects to wetlands along the proposed corridor are expected since most of the wetlands along the corridor are already impacted

by existing ROWs and the area to be disturbed along the ROW will be small. A new wetland crossing will be required for a small isolated wetland (see US 92 to CR 542 description). This wetland is already modified by a CSX ROW. No significant impacts will occur.

6.2.8.3 Solid Wastes

The major solid wastes generated will be vegetative wastes resulting from clearing activities. These may be used as mulch for the ROW or be transported to a nearby landfill. No hazardous wastes will be generated during construction operations.

6.2.8.4 Changes to Vegetation, Wildlife and Aquatic Life

Most of the corridor follows highway, railroad or transmission line ROWs which are not important vegetative or wildlife habitats. Sections of the proposed corridor that are not located along transmission lines roads or existing pipeline ROWs are on pasture lands. The potential for occurrence of threatened and endangered species in the ROW is extremely low because of the lack of habitat.

Short-term impacts of construction in these or adjoining habitats may include wind erosion and fugitive dust transport due to removal of vegetation and soil disturbance. These impacts will be minimize by appropriate erosion controls. No long-term impacts to these habitats are anticipated.

The effects of the gas pipeline on wildlife will be practically nonexistent except during the construction phase of the project. During construction, some wildlife activities in the vicinity of the pipeline may be temporarily disrupted. These activities (e.g., foraging, nesting, travel, etc.) will resume after construction.

6.2.8.5 Impact on Human Population

Construction of the proposed pipeline will result in short-term impacts to area residents whose property is traversed by the pipeline. For the most

part, the proposed pipeline corridor will be within or adjacent to existing utility ROW thus minimizing the amount of area required for this facility.

During the construction period, trees and brush will be cleared from the construction ROW. Along new ROW sections agricultural uses of the ROW will be temporarily restricted. Since approximately 3 km (1.5 miles) of pipeline can be constructed each day, it is not anticipated that any one specific location will be affected for more than a few days.

Construction through citrus groves or cultivated areas may result in temporary crop or pasture loss for the growing season in which it occurs.

In residential locations, site specific plans will be developed to minimize impacts. Impacts to residential properties could include the temporary disruption of lawns; removal of fences, mailboxes and other structures; removal of ornamental shrubs; the loss of shade trees; the cutting of streets, driveways and sidewalks; and the disruption of household utilities. In residential areas, efforts will be made to minimize dust through watering, and residents will be advised to avoid the immediate construction area.

Construction through streets is likely to have a temporary impact on traffic flow. Area officials will be consulted for each street crossing to insure that there is either adequate clearance or a suitable detour for the passage of emergency vehicles during construction. Other through traffic will be detoured or allowed to pass through the area on a restricted flow basis (one lane or with traffic control personnel). On particularly busy streets, mitigation measures, such as construction during off-peak hours, will be investigated and implemented as practicable.

Upon completion of construction, lawns, sidewalks, parking lots, and roads will be restored. In cleared areas beyond the permanent ROW, ornamental shrubs and fences will be replaced. Trees will be permanently restricted from the permanent ROW.

The impact of noise on the local environment would occur only during construction which progresses fairly rapidly. Although individuals in the immediate vicinity of the work may experience temporary annoyance, the duration of the impact at any specific location would be short-term. No nighttime impacts would occur.

6.2.8.6 Impact on Regional Scenic, Cultural, and Natural Landmarks

There will be no impacts to these resources since there are no regional scenic, cultural or natural landmarks along the proposed corridor.

6.2.8.7 Impact on Archaeological and Historic Sites

There are no recorded archaeological or historic sites along the corridor, therefore, no impacts to these resources are likely. Several potentially sensitive areas occur along the corridor. If the ROW goes through these areas and they have not been previously disturbed then additional surveys will be conducted to determine the significance of these areas and appropriate mitigation measures will be implemented.

6.2.9 Post-Construction Impacts and Effects of Maintenance

6.2.9.1 Maintenance Techniques

When construction is completed, a cleared corridor will be maintained by mechanical means to permit access to the pipeline for inspection and maintenance, and to prevent tree roots from damaging the protective coating on the pipeline. Herbaceous ground cover will be allowed to reestablish in upland and wetland areas. Turf and ornamental shrubs will be restored in residential areas.

Where the pipeline parallels an existing FGT pipeline, up to 4.5 m (15 ft) of additional new permanent ROW may be required, depending on the width of the existing ROW distance to nearby structures, and diameter of the existing pipeline. Up to 15 m (50 ft) of new ROW will be maintained for the pipelines that will not follow existing FGT pipelines. Where the pipeline follows road ROWs, the Applicant will seek permission from the highway authorities to use the existing ROW for maintenance, thereby minimizing the need to acquire additional ROWs from private landowners.

6.2.9.2 Multiple Uses

Upon completion of pipeline construction, land uses within the pipeline ROW will be allowed to revert to preconstruction conditions and most land uses previously active in the area will be allowed to return. Restrictions to land use include the planting of trees and the placement of structures (including swimming pools) within the permanent ROW.

6.2.9.3 Changes In Species Population

Most of the proposed gas pipeline ROW is located along roads, suburban areas, existing ROWs, or mined land. These areas are rarely utilized by threatened or endangered species. Thus, the maintenance of the gas pipeline ROW is not expected to affect any threatened or endangered species. The maintenance of the ROW in wooded areas will preserve edge habitats that are often heavily utilized by white-tailed deer (Odocoileus virginianus). Populations of important wildlife or plant species are not expected to be affected by maintenance of the ROW.

6.2.9.4 Effects of Public Access

The ROW will not expose previously undisturbed natural areas to the public and will not result in any effects to wildlife.

6.2.10 Other Post-Construction Effects

6.2.10.1 Pipeline Safety

The transportation of natural gas by pipeline involves some degree of risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing only a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 538°C (1,000°F) and is flammable at concentrations between 5% and 15% in air. Unconfined mixtures of methane

in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. The specific gravity of methane is 0.55 and, therefore, it is buoyant at atmospheric temperatures.

The proposed pipeline would be designed, constructed, operated, and maintained in accordance with the U.S. Department of Transportation (DOT) Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to insure adequate protection for the public from natural gas pipeline failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, which determine more rigorous safety requirements for populated areas. The class location unit is an area that extends 201 m (220 yards) on either side of the centerline of any continuous 1.6-km (1-mile) length of pipeline. The four area classifications are defined as follows:

Class 1 Location with 10 or fewer buildings intended for human occupancy.

Class 2 Location with more than 10 but less than 46 buildings intended for human occupancy.

Class 3 Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 91 m (100 yards) of any building, or small, well-defined outside area occupied by 20 or more people during normal use.

Class 4 Location where buildings with four or more stories above ground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed in Class 1 locations must be installed with a minimum depth of cover of 76 cm (30 inches) in normal soil, and 46 cm (18 inches) in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require 91 cm (36 inches) in normal soil and 61 cm (24 inches) in consolidated rock. Class locations also specify the maximum distance to a sectionalizing block value--16 km (10 miles) in Class 1, 12 km (7.5 miles) in Class 2, 6.4 km (4 miles) in Class 3, and 4 km (2.5 miles) in Class 4. Pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under Section 192.615, each pipeline operator must also establish an Emergency Plan which provides written procedures to minimize the hazards from a gas pipeline emergency. Key elements of the plan include procedures for:

- (1) receiving, identifying, and classifying emergency events--gas leakage, fires, explosions, and natural disasters;
- (2) establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- (3) making personnel, equipment, tools, and materials available at the scene of an emergency;
- (4) protecting people first and then property, and making safe from actual or potential hazards; and
- (5) emergency shutdown of system and safely restoring service.

Each operator will establish and maintain a liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a gas pipeline emergency, and coordinate mutual assistance in responding to emergencies. The operator will also establish a continuing education program to enable customers, the

public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

The primary casual factor for pipeline accidents is outside forces, which constitute 53.5% of all service incidents. This is followed by corrosion, material and construction defects. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; from earth movements due to soil settlement, washouts, or geological hazards; from weather effects such as winds, storms and thermal strains; and from willful damage. Operators are required to participate in "one call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines (FERC, 1989).

An average annual service incident frequency of 1.30 failures per 1,600 km (1,000 miles) per year has been estimated for all natural gas transmission and gathering lines. The service incident frequency on the FGT system is lower than the industry-wide average. The FGT reported 20 service incidents on its 7,100 km (4,400-mile) system since 1980 -- equivalent to a service incident frequency of 0.57 failures per 1,600 km (1,000 miles) per year (FERC, 1989).

The frequency of service incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time dependent process. Newer pipelines generally have more advanced coatings and cathodic protection to reduce corrosion potential. Older pipelines also have a higher frequency of outside forces incidents partly because the location of older pipelines may be less well known and less well marked than newer lines.

6.2.10.2 Impact on Public Safety

Approximately two-thirds of the incidents are classified as a leak, and the remaining one-third classified as a rupture, implying a more serious failure. From 1970 to 1986 fatalities among the public averaged 2.5 per year nationwide. Nevertheless, the average number of fatalities among the

public--2.5 per year--is relatively small considering the more than 483,000 km (300,000 miles) of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude lower than the fatalities from natural hazards--lightening, tornados, floods, earthquakes, etc. (FERC, 1989).

Based on approximately 483,000 km (300,000 miles) of transmission line in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines is 0.008 per 1,600 km (1,000 miles) per year. Applying the industry-wide average to the proposed new pipeline segments totalling 78.6 km (48.8 miles) yields a recurrence interval of approximately one fatality per 2,000 years. FGT's service incident rate is about half of the industry average, which may lead to an even lower fatality rate. The proposed pipeline consisting of a second pipeline adjacent to an existing pipeline, would cause only a slight increase in risk to the nearby public (FERC, 1989).

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6.3 ASSOCIATED LIQUID FUEL PIPELINE

6.3.1 Project Description

A liquid fuel pipeline will be constructed extending from Port Manatee on Tampa Bay to the proposed Hardee Power Station. This proposed pipeline corridor will be approximately 69 kilometers (43.0 miles) long and would traverse portions of Manatee, Hardee, and Polk Counties.

The pipeline will transport distillate fuel oil through a 20-centimeter (8-inch) diameter steel pipe. The pipeline will be constructed so as not to preclude the transport of butane, propane, or liquified natural gas should those fuels prove more economical. This pipeline will be buried to a minimum depth of 0.9 meters (3 feet) within a ROW 22.5 meters (75 feet) wide. It is anticipated that there will be no pumping stations along the length of the corridor.

6.3.2 Corridor Location and Layout

Figure 6.3.2-1 identifies the full length of both the preferred and alternative liquid fuel pipeline corridors relative to major geographic features. Aerial photographs depicting the preferred and alternative corridors are provided in Figure 6.3.2-2 located in Appendix 11.10. Approximately 95 percent of the preferred pipeline corridor will be located within, or adjacent to, existing ROWs.

6.3.2.1 Preferred Corridor

The preferred corridor was chosen after review and evaluation of both quantitative and qualitative data. The final selection was based upon the preferred corridor's comparatively fewer effects on ecology and wetlands, existing or planned development, and overall disruption.

The preferred pipeline corridor is shown on Figure 6.3.2-1. The western terminus will be located at Port Manatee on Tampa Bay. From that point to U.S. 41, the corridor will be in excess of 750 meters (2,500 feet) to allow for the most efficient alignment from the port's unloading facilities. At U.S. 41, the corridor will be reduced to approximately 480 meters

(1,600 feet) and will run southward adjacent to and within the CSX railroad and U.S. 41 ROWs to Buckeye Road. The corridor then narrows to approximately 240 meters (800 feet) and turns east. It will proceed along or adjacent to an existing Florida Power and Light (FPL) pipeline corridor south of Buckeye Road passing under I-75 to the intersection of the existing FPL north-south transmission line ROW. At that point, the preferred corridor will turn 90° south with a width of 219 meters (730 feet) [60 meters (200 feet) wider on either side of the transmission line ROW]. The corridor follows the existing FPL pipeline ROW, making another 90° turn, proceeding east for approximately 11.1 kilometers (6.9 miles) to the FPL/Manatee power plant site. It makes another 90° turn to the south, and extends to State Road (SR) 62. In that section, the preferred corridor will be 0.9 kilometers (2,900 feet) wide.

At that point, the preferred corridor turns eastward and parallels SR 62 with a 120-meter (400-foot) width centered on the highway center line. The corridor's alignment along SR 62 proceeds east beyond Safford Road, SR 39, and SR 37 for approximately 31.2 kilometers (19.5 miles), entering into Hardee County.

At John Gill Road, just west of the community of Ft. Green Springs, the preferred corridor turns 90° north and parallels that road for approximately 2.0 kilometers (6,500 feet). The corridor then turns 90° east, paralleling Roberts Road running 2.4 kilometers (8,000 feet) and crosses Payne's Creek until it intersects CR 663. In that section, the preferred corridor will be approximately 120 meters (400 feet wide) expanding to 330 meters (1,100 feet) wide where the corridor crosses Payne Creek to provide flexibility in ROW location to reduce wetland impacts.

The preferred corridor makes a turn to the north at CR 663 and proceeds [150 meters (500 feet) wide] northwesterly for 2.1 kilometers (7,000 feet) where it turns west with a width of 1.4 kilometers (4,700 feet) to allow the best, most feasible access to the proposed plant site. This will be the eastern terminus of the proposed pipeline.

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

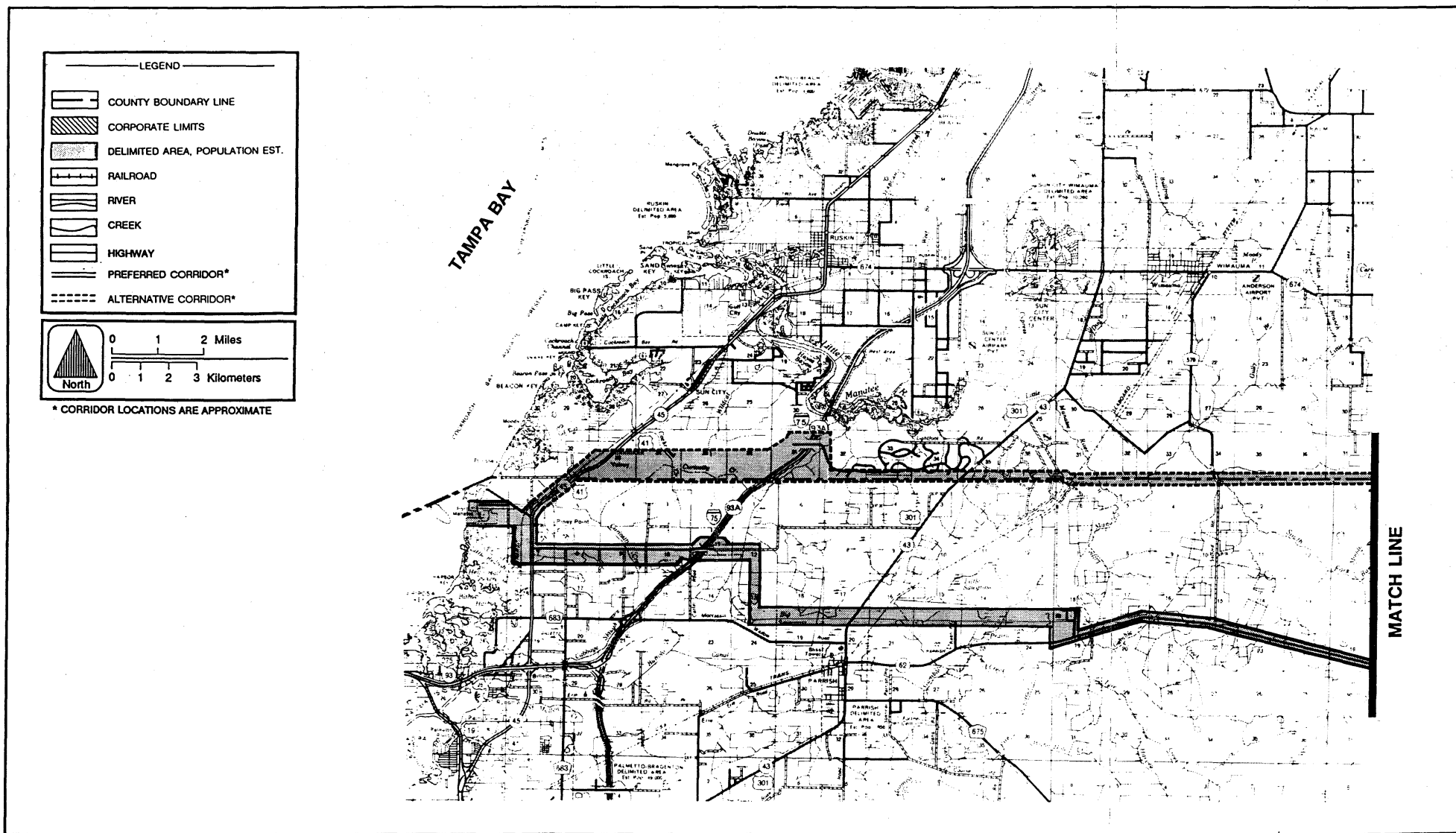


Figure 6.3.2-1 PROPOSED LIQUID FUEL PIPELINE CORRIDOR
(PAGE 1 OF 2)

**Hardee
Power Station**

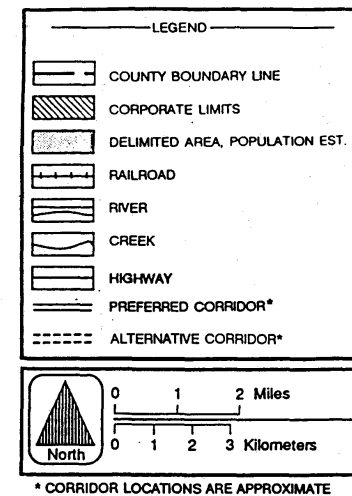
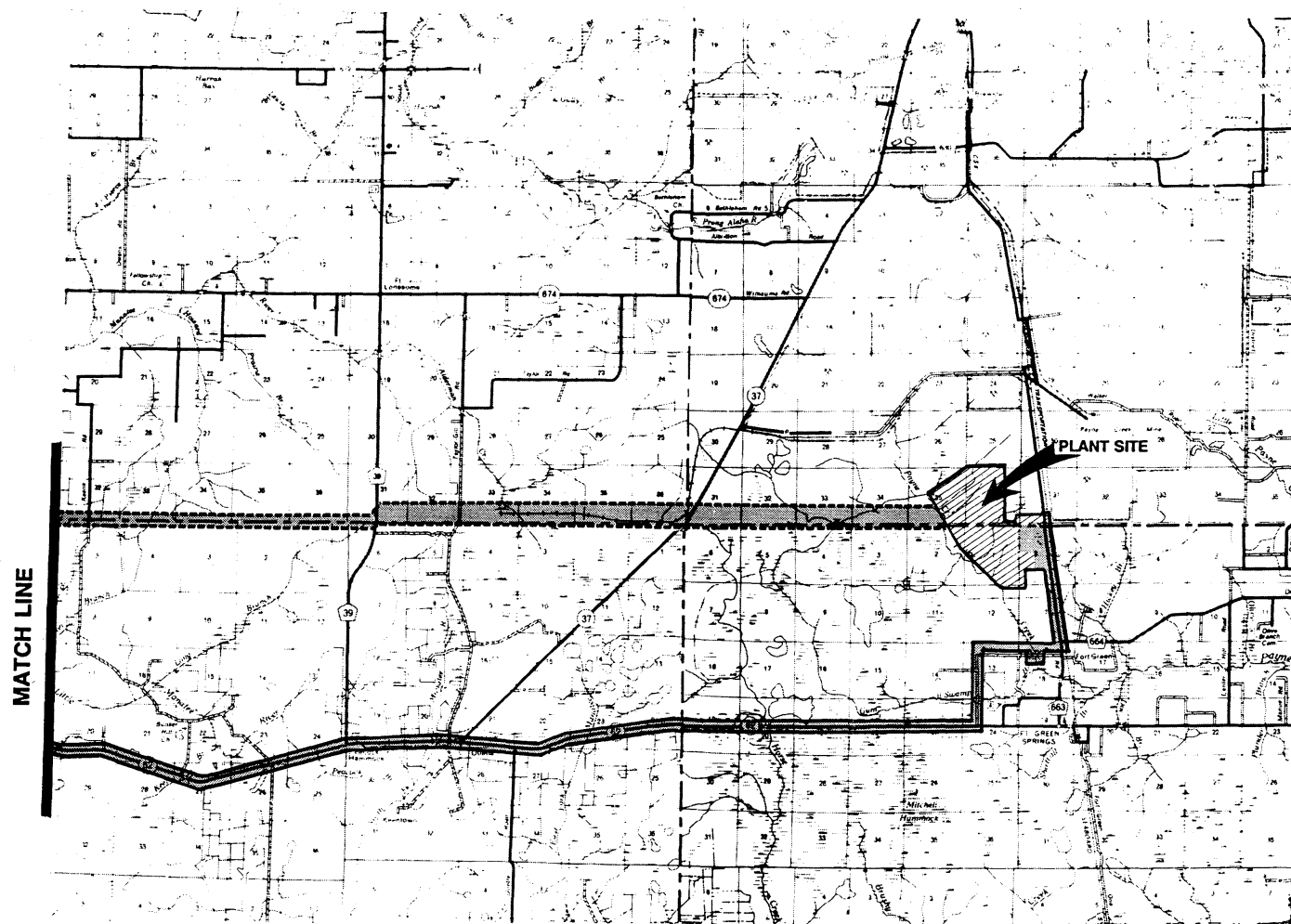


Figure 6.3.2-1 PROPOSED LIQUID FUEL PIPELINE CORRIDOR
(PAGE 2 OF 2)

**Hardee
Power Station**

The preferred corridor will lie adjacent to, or within, existing ROWs for highways and/or a transmission line/pipeline for virtually its entire length, minimizing the disturbance of isolated, relatively ecologically sensitive acreage. In addition, the preferred corridor is located in areas containing limited development, minimizing the disruption of residents as well as commercial enterprises. Finally, the location of the preferred corridor makes it less subject to the effects of future phosphate mining activity.

6.3.2.2 Alternative Corridor

An alternative corridor was identified but was not selected as preferred primarily because of the relatively greater amount of previously undeveloped land that would be subject to impact. In addition, there is uncertainty of the effects of future phosphate mining and reclamation schedules on the proposed pipeline and its required construction schedule. Virtually the entire alternative corridor length traverses open land, crossing only seven roads from U.S. 41 to the proposed plant site (eastern pipeline terminus).

The alternative corridor (Figure 6.3.2-1) begins at the Port Manatee docks (western terminus) and proceeds east to U.S. 41, having a width of 750 meters (2,500 feet) to allow the most efficient exit from the port area. At U.S. 41, the alternative corridor, with a width of 180 meters (600 feet), turns northeasterly and parallels U.S. 41 to the Hillsborough County line. At that point, the alternative corridor turns east, its width increasing to approximately 1.0 kilometer (3,200 feet) from the Hillsborough County line to north of the Valroy Road ROW.

The alternative corridor runs eastward, with the county line serving as the southern limit. This corridor, however, narrows to 96 meters (320 feet), adjoining the Hillsborough County line, to avoid the Sundance Subdivision. At the recently abandoned seaboard coastline railroad ROW, the alternative corridor expands to 120 meters (400 feet) and straddles the Hillsborough/Manatee County line as it continues east. At CR 39, the alternative corridor again widens to 300 meters (1,000 feet) immediately

north of the county line, and continues across Payne Creek where it enters the proposed plant site.

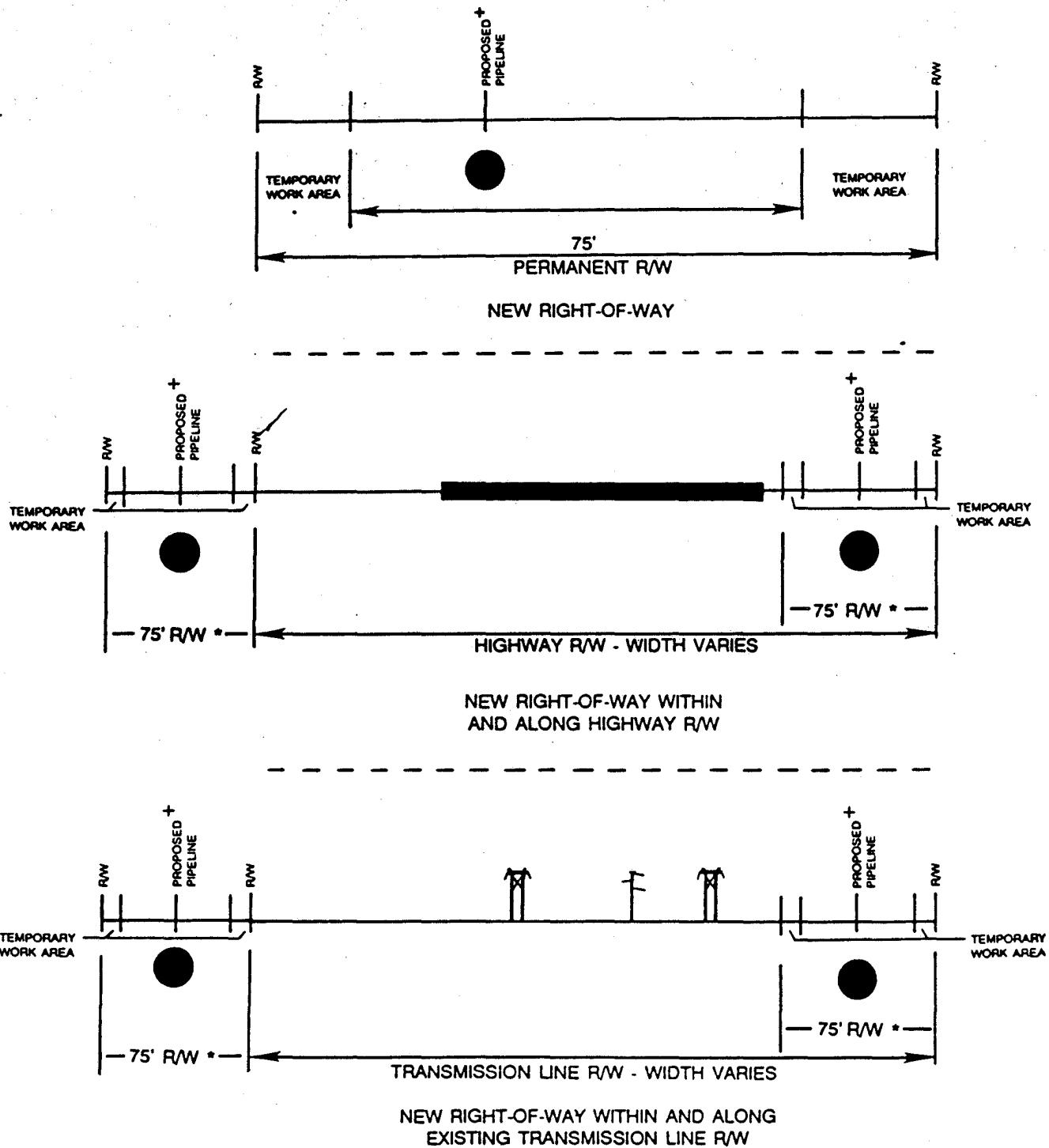
6.3.3 Liquid Fuel Pipeline Design Characteristics

The proposed pipeline will consist of 12-meter (40-foot) sections of 20-centimeters (8-inch) diameter steel pipe (Grade X-42, X-52, X-60, depending on yield strength) with a protective cover. Joints will be welded, and the top of the pipe will be buried to a minimum depth of 0.9 meters (3 feet). Under major highways, railroads and streambeds, the pipeline would be buried at least 1.2 meters (4 feet) deep. The pipeline will be contained within a 22.5-meter (75-foot) ROW. Circumstances may require a ROW width reduction; however, the minimum ROW would be no less than 9 meters (30 feet) in congested areas (for construction, operation, and maintenance).

No part of the pipeline may be located within 15 meters (50 feet) of any private dwelling, industrial building, or place of public assembly without special precautions, such as providing at least 0.3 meters (12 inches) of cover in addition to being below the level of cultivation. The proposed pipeline would be buried at least 0.9 meters (3 feet) deep, exceeding these federal requirements. Figure 6.3.3-1 presents a typical ROW design along new ROW and other existing ROWs.

6.3.4 Cost Projections

Preliminary cost projections for the preferred liquid fuel pipeline are shown in Table 6.3.4-1. The approximate cost is estimated to be \$10,000,000. The total cost of the pipeline will vary due to the final location of the ROW, which will affect the various cost components. Costs for ROW acquisition and other site-specific conditions are highly dependent upon final ROW approval.



NOT TO SCALE

* MINIMUM 30' R/W IN CONGESTED AREAS

+ PROPOSED LIQUID FUEL PIPELINE LOCATION MAY VARY WITHIN R/W

Figure 6.3.3-1 PROPOSED RIGHT-OF-WAY SCHEMATIC DESIGNS

**Hardee
Power Station**

Table 6.3.4-1. Preliminary Cost Analysis for the Hardee Power Station
Liquid Fuel Pipeline

Item	Cost
Land	\$ 725,000
Pipeline	8,740,000
Road Crossings	35,000
Rail Crossing	5,000
Water Crossings	55,000
Wetland Crossings	<u>272,000</u>
TOTAL	\$9,832,000

6.3.5 Corridor Selection

The pipeline corridor selection was based on a 3-stage process:

- Stage I: Regional screening of the Port Manatee/Hardee Power Station study area, followed by preliminary pipeline segment and corridor identification,
- Stage II: Selection of most feasible alternative corridor pathways, and
- Stage III: Selection of preferred and alternative pipeline corridors.

During Stage I, the study area (depicted in Figure 6.3.5-1) was screened to eliminate potential corridor pathways which would contain significant environmental, social, or regulatory constraints. In addition, preliminary corridor pathways and segments were selected.

During Stage II, analytical criteria were identified; incidence and acreages were quantified for each criteria; corridor segments were subjected to a computer model for segment analysis; and leading candidate alternatives were selected. Based on the preliminary screening and corridor/segment identification, the following criteria (constraints) were selected for use in the analysis of each segment and corridor:

- o Existing development;
- o Parks and recreation sites/areas;
- o Historic and archaeological sites/areas;
- o Wetland areas;
- o Water crossings (i.e., bridges, culverts); and
- o Pipeline length.

Various data and sources were used to quantify the selection criteria during this stage:

- o Latest available aerial photography (1"=400', 1"=600', 1"=900', 1"=1,800');
- o U.S. Geological Survey quadrangle sheets (1:24,000);

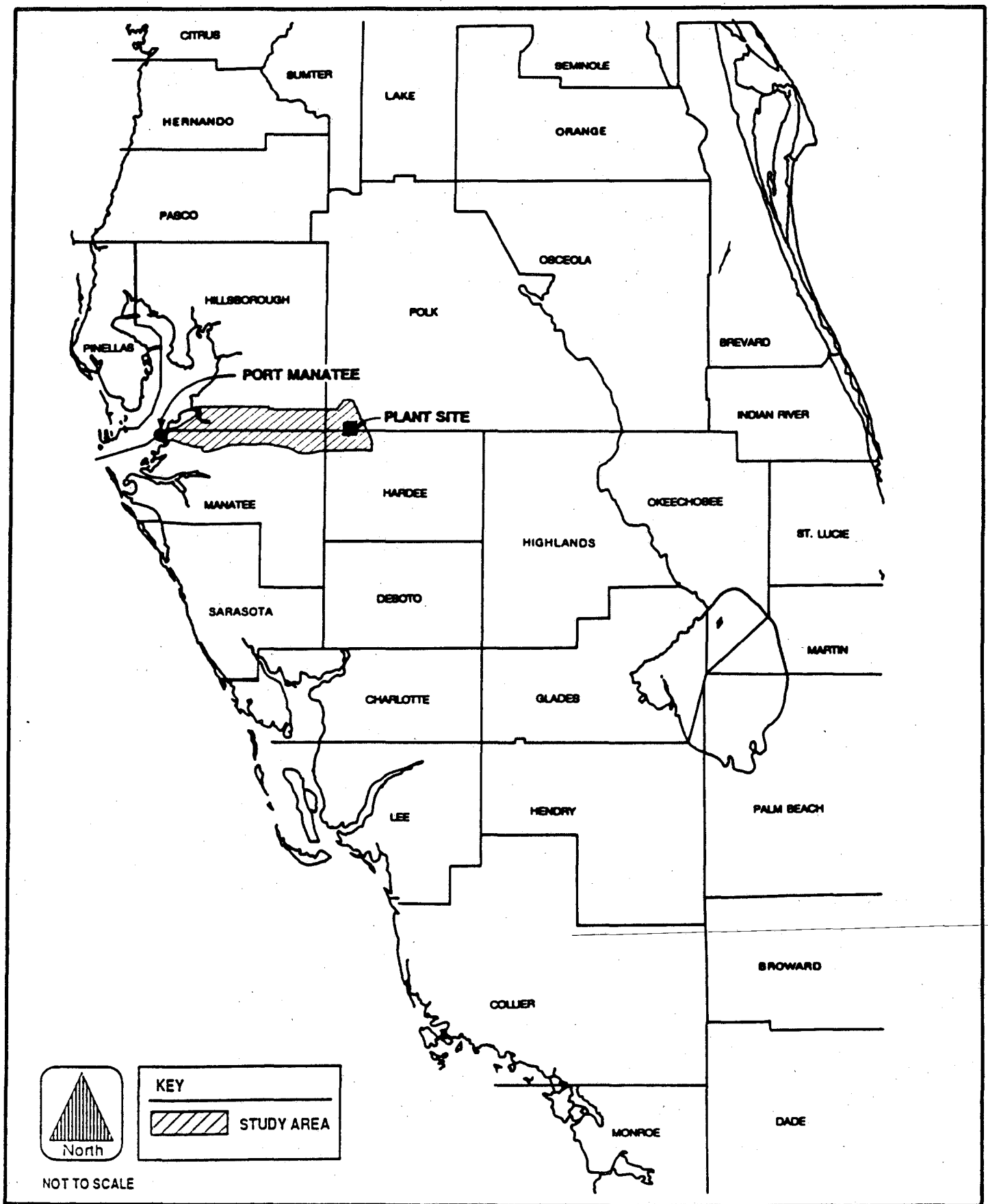


Figure 6.3.5-1 LIQUID FUEL PIPELINE CORRIDOR
SELECTION STUDY AREA

**Hardee
Power Station**

- o Florida Department of State, Division of Historical Resource's identification of known historic and archaeological sites and archaeologically sensitive areas;
- o Contacts with county parks and recreation offices;
- o National Wetlands Inventory maps (1:24,000);
- o Review of available phosphate mine plans in approved DRI Applications and Environmental Impact Statements;
- o Three helicopter flights over the study area or corridors by multidisciplinary technical teams; and
- o Project description information supplied by Tampa Electric.

Each criterion was evaluated on a segment-by-segment basis.

The resulting data were evaluated in a computer modeling program to identify potential corridors that balanced the least incidence and/or acreage of environmentally constraining features with the least number of water crossings and shortest construction length. Relative importance weights were assigned to each criteria to ensure a meaningful analysis. Pairwise comparison evaluations were made within each technical discipline and compiled for a ranking of potential corridor pathways.

Certain broad assumptions were used in the analysis:

- o Location within, or adjacent to, an existing ROW was preferable in terms of both environmental considerations and cost;
- o Alignment would be permissible through unmined areas containing known phosphate reserves; and
- o Areas containing significant development were to be avoided wherever possible.

During Stage III, qualitative and quantitative data such as environmentally sensitive features and costs were refined and evaluated. The preferred and alternative corridors were identified.

6.3.6 Socio-Political Environment of the Corridor Area

6.3.6.1 Governmental Jurisdiction

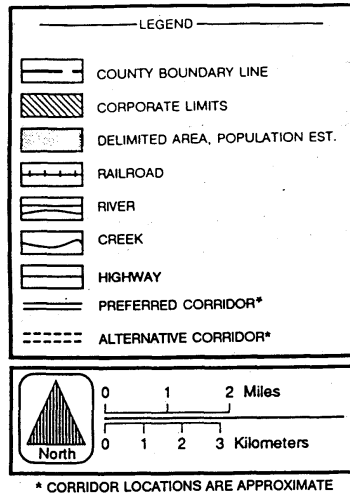
Figure 6.3.6-1 identifies the governmental jurisdictions within and adjacent to the preferred and alternative liquid fuel pipeline corridors. The preferred liquid fuel pipeline corridor will originate at Port Manatee which is located in unincorporated portions of Manatee County. The preferred corridor will extend eastward along various ROW to east of SR 37, where it will enter unincorporated Hardee County. In the vicinity of the unincorporated community of Ft. Green Springs, the preferred corridor is situated adjacent to the periphery of the community. The preferred corridor then continues to the plant site. If the plant entrance road ROW is used for the liquid fuel pipeline, an approximately 0.8-kilometer (0.5-mile) segment of the pipeline will be located in unincorporated Polk County.

The alternative liquid fuel pipeline corridor originates where the preferred corridor intersects U.S. 41 in unincorporated Manatee County. The alternative corridor extends from the Port Manatee vicinity into unincorporated Hillsborough County until it bisects an abandoned Seaboard Coastline Railroad line. From this location, the alternative corridor staddles the Manatee/Hillsborough County line until its intersection with CR 39. From CR 39 to SR 37, the alternative corridor is located in unincorporated Hillsborough County. East of SR 37, the alternative corridor enters unincorporated Polk County where it extends until the corridor terminates at the plant site boundary.

The Little Manatee River is an Outstanding Florida Water. The alternative corridor crosses the river at two locations (see Figure 6.3.6-1). No other local, regional, state, or federal areas identified in Section 2.2.1 of the Instruction Guide for Certification Applications are present within 0.8 kilometer (0.5 miles) of the preferred or alternative corridors.

6.3.6.2 Zoning and Land Use Plans

The preferred and alternative corridors are located in the unincorporated portions of Hillsborough, Polk, Manatee, and Hardee Counties. Each county



① OUTSTANDING FLORIDA WATERS

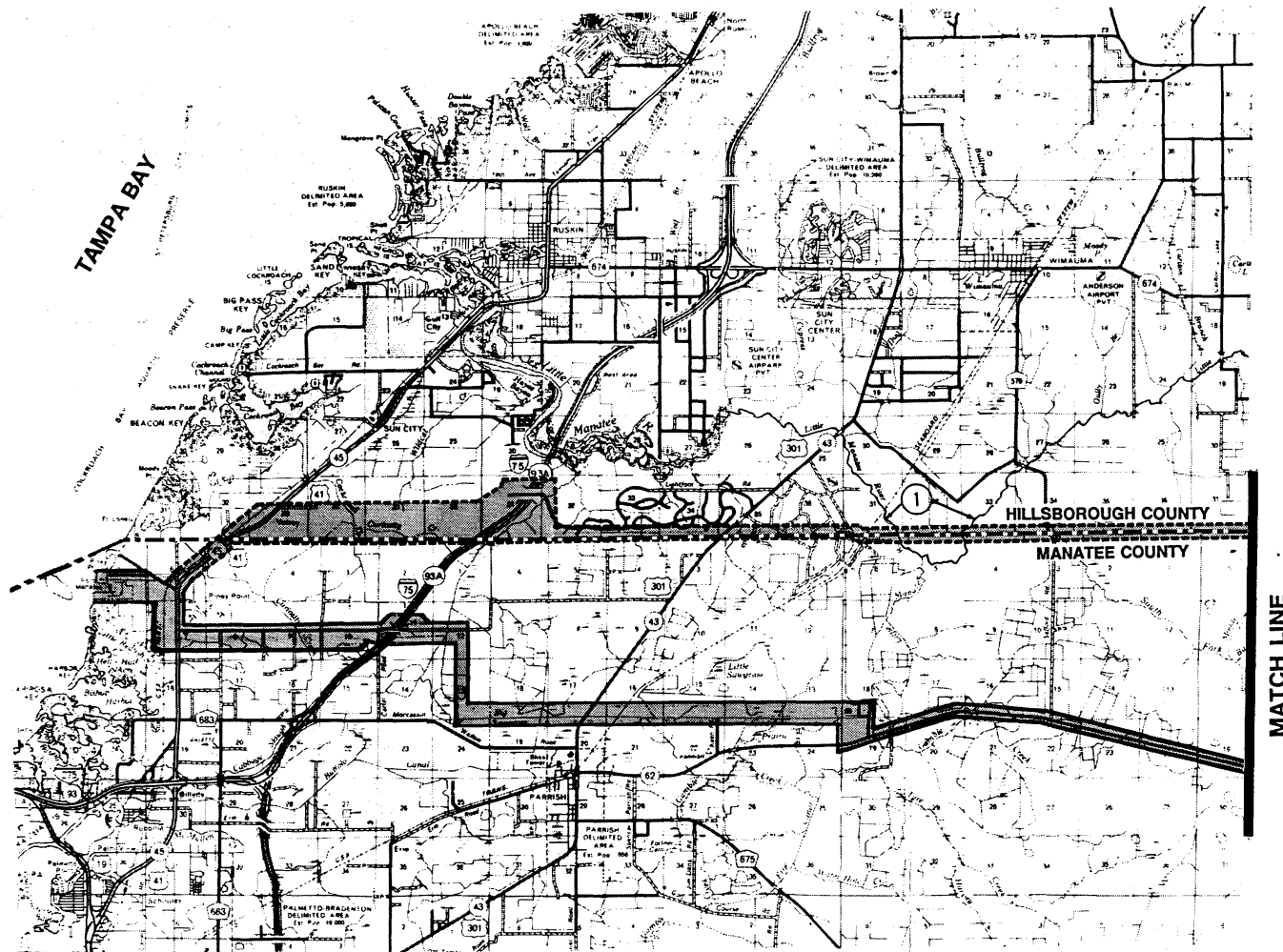


Figure 6.3.6-1 GOVERNMENTAL JURISDICTIONS - LIQUID FUEL PIPELINE CORRIDOR
(PAGE 1 OF 2)

**Hardee
Power Station**

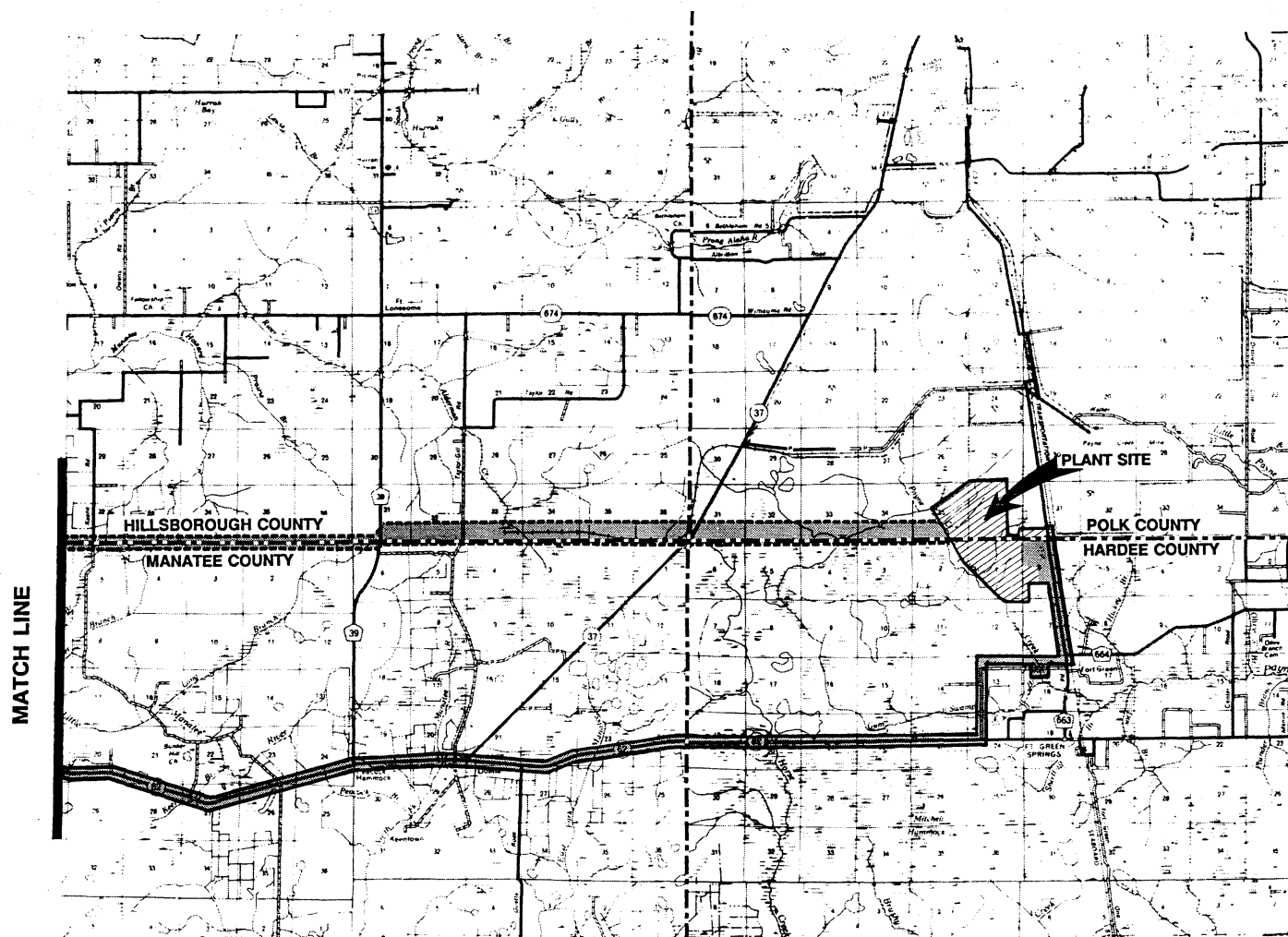


Figure 6.3.6-1 GOVERNMENTAL JURISDICTIONS - LIQUID FUEL PIPELINE CORRIDOR
(PAGE 2 OF 2)

**Hardee
Power Station**

has a Comprehensive Plan as mandated by Chapter 163, Florida Statutes. The current status of each plan is described below:

HILLSBOROUGH COUNTY

The Comprehensive Plan was prepared in accordance with the Comprehensive Planning and Land Development Regulations Act and adopted by the Board of County Commissioners in February 1989 for transmittal to the Department of Community Affairs (DCA) for approval.

POLK COUNTY

The Comprehensive Plan was adopted in July 1979.

MANATEE COUNTY

The Comprehensive Plan was prepared in accordance with the Comprehensive Planning and Land Development Regulation Act, adopted by the Board of County Commissioners and approved by DCA in 1989.

HARDEE COUNTY

The Comprehensive Plan was adopted in 1979.

Figure 6.3.6-2, located in Appendix 11.10, depicts the future land use designations identified in Hillsborough and Manatee County's Comprehensive plan. Polk and Hardee County's Comprehensive Plans do not contain future land use plan maps.

None of the comprehensive plans specifically address liquid fuel pipelines. The concept of locating a pipeline in industrial areas and areas of relatively low residential density (including Hillsborough County's R and RR designations and Manatee's IH, IL, and AG-R designations) is consistent with basic land use compatibility principles.

Each county also regulates land use and development by zoning code. Hillsborough County's zoning maps depict three zoning districts along the alternative corridor, A--Agricultural, AA--Agricultural, Single-Family

Residential, and CU--Community Unit. Hillsborough County permits public service facilities as a Class A special use.

Polk County's zoning maps depict those portions of the preferred and alternative corridor in Polk County as RC--Rural Conservation. The RC district addresses subterranean utility lines and Classes I and II Essential Services and is a permitted use.

The preferred corridor in Manatee County located in the following zoning districts:

A	General Agriculture
A-1	Suburban Agriculture
A1/AF	Suburban Agriculture/Agricultural Fringe
AF/A1	Agricultural Fringe/Suburban Agriculture
AF/R 1B	Agricultural Fringe/Residential
R-10	Residential
R-4B	Residential/Mobile Home Park
R-5	Residential/Recreational Vehicle Park
PDR	Planned Development Residential
C	Neighborhood Commercial
C-1	General Commercial
C-1A/AF	Resort Commercial/Agricultural Fringe
M-1	Light Industrial
M-2	Heavy Industrial

Heavy and light utility uses are permitted in A, A-1, M-1, and M-2 districts as a special permit use. Light utility uses are permitted in the remaining districts as a special permit use.

The Hardee County portion of the preferred corridor is located in the following districts:

A-1	Agricultural
M-1	Mining District (Overlay A-1)
I-1	Light Industrial

C-2 General Commercial
F-R Farm Residential

The Hardee County Zoning Ordinance does not specifically address subterranean pipelines or utility uses. The corridor should qualify as an accessory use incidental and subordinate to permitted principal uses.

6.3.6.3 Easements, Title, Agency Works

Approvals for crossings of federal highways such as I-75 are typically obtained from FDOT and the Federal Highway Administration (FHWA). Approvals for crossings of state roads would normally be required from FDOT, and each county grants approval for crossings of county-maintained roads. All crossings of state roads will conform to specifications contained in FDOT's Utility Accommodation Guide (July 1979). Permits are also normally required to cross waterways or other facilities under the jurisdiction of a designated water control district and "works of the district," defined as projects or works such as structures, impoundments, wells, streams, and other watercourses officially adopted by the Southwest Florida Water Management District (SWFWMD) governing board.

Easements will also be required for the liquid fuel pipeline corridor to cross lands under the jurisdiction of the Board of Trustees of the Internal Improvement Trust Fund. A jurisdictional determination has been requested for the proposed preferred and alternative corridors. This jurisdictional determination is part of the permitting activities for the pipeline ROW. Table 6.3.6-1 lists roadways, waterways, and railroads within the preferred and alternative pipeline corridors for which crossing approvals would normally be required. Notification is usually sufficient when crossing facilities owned by another utility.

6.3.6.4 Vicinity Scenic, Cultural, and Natural Landmarks

There are no scenic, cultural, or natural areas of the type identified in Section 2.2.5 of the Instruction Guide for Site Certification Applications within 0.8 kilometers (0.5 miles) of the proposed liquid fuel pipeline corridors.

Table 6.3.6-1. Easements, Title, Crossing Approvals Normally Required for Liquid Fuel Pipeline Construction in the Preferred (P) and Alternative (A) Corridors

Facility	Corridor	Affected Agency	Type of Approval	Potential Changes
<u>Roadways</u>				
U.S. 41	P,A	FDOT & FHWA*	Utility Permit	None
I-75	P,A	FDOT & FHWA*	Utility Permit	None
U.S. 301	P,A	FDOT & FHWA*	Utility Permit	None
SR 62	P	FDOT	Utility Permit	None
SR 37	P,A	FDOT	Utility Permit	None
Valroy Rd.	P	Hillsborough Co.	Utility Permit	None
Safford Rd/CR 579	P,A	Hillsborough/Manatee Co.	Utility Permit	None
CR 39	P,A	Hillsborough/Manatee Co.	Utility Permit	None
Buckeye Rd.	P	Manatee Co.	Utility Permit	None
Carter Rd.	P	Manatee Co.	Utility Permit	None
Keen Rd.	P	Manatee Co.	Utility Permit	None
Keene Rd.	P	Manatee Co.	Utility Permit	None
Taylor-Gill Rd.	P	Manatee Co.	Utility Permit	None
Duette Rd.	P	Manatee Co.	Utility Permit	None
John Gill Rd.	P	Hardee Co.	Utility Permit	None
Roberts Rd.	P	Hardee Co.	Utility Permit	None
CR 663	P	Hardee Co.	Utility Permit	None
CR 664	P	Hardee Co.	Utility Permit	None

Table 6.3.6-1. Easements, Title, Crossing Approvals Normally Required for Liquid Fuel Pipeline Construction in the Preferred (P) and Alternative (A) Corridors (Continued, Page 2 of 2)

Facility	Corridor	Affected Agency	Type of Approval	Potential Changes
<u>Railroads</u>				
Seaboard Coastline	P,A	FDOT	Encroachment Permit	None
<u>Waterways**</u>				
Gamble Creek	P	SWFWMD	Utility Permit	None
Keen Branch	P	SWFWMD	Utility Permit	None
Graveyard Creek	P	SWFWMD	Utility Permit	None
Peacock Branch	P	SWFWMD	Utility Permit	None
Horse Creek	P	SWFWMD	Utility Permit	None
Curiosity Creek	P,A	SWFWMD	Utility Permit	None
Little Manatee River	P,A	SWFWMD	Utility Permit	None
Gum Swamp Branch	P,A	SWFWMD	Utility Permit	None
Payne Creek	P,A	SWFWMD	Utility Permit	None
Cockroach Creek	A	SWFWMD	Utility Permit	None
Moody Branch	A	SWFWMD	Utility Permit	None
Little Long Branch	A	SWFWMD	Utility Permit	None
Alderman Creek	A	SWFWMD	Utility Permit	None

* FHWA approval for crossings of federal highways is obtained indirectly as part of the utility permit obtained from FDOT.

** DNR may also be an affected agency for waterways due to submerged sovereign lands under the jurisdiction of the Board of Trustees of the Internal Improvement Trust Fund.

6.3.6.5 Archaeological and Historic Sites

The Florida Master Site File at the DHR was reviewed to determine whether any known archaeological or historical sites were recorded within the preferred and alternative corridors. One site (Hr 13) was found to be located approximately 3.2 kilometers (2.0 miles) north of the SR 62/CR 663 intersection, and it is the only known site located within the preferred corridor. An additional site (Hi 414) is located on the west bank of Curiosity Creek and is the only known site located in the alternative corridor.

In addition to reviewing the Florida Master Site File for known sites, the DHR reviewed the proposed corridors to determine any areas that appear to be archaeologically sensitive. Although the agency indicated that the majority of both corridors have a low likelihood of containing significant archaeological or historical sites, DHR did identify the portions of the corridors that appear to be archaeologically sensitive by marking aerial photographs.

DHR recommends that those portions of the corridors designated archaeologically sensitive be subjected to a professional archaeological and historic survey (see Appendix 11.3). The methodology used for the survey, as well as the survey results, will be provided to DHR during permitting activities before construction for review and acceptance.

6.3.7 Bio-Physical Environment of the Corridor Area

6.3.7.1 Land Use/Vegetation

Figure 6.3.7-1, located in Appendix 11.10, depicts a series of maps identifying the preferred and alternative corridors and the area extending 0.4 kilometers (0.25 mile) from each edge of these corridors in relation to existing land use and land cover. These maps depict land uses and land covers at 1:24,000 scale. Land uses and land cover is depicted at Levels II and III of the Florida Land Use and Cover Classification System (FLUCCS), respectively. Existing land use for both the preferred and alternative corridors and their vicinities are predominantly open land and agricultural areas. Land cover or vegetation types in the undeveloped and

agricultural areas of the preferred and alternative corridors include agricultural land, forested uplands, and wetlands.

Concentrations of industrial activity occur at Port Manatee and in the vicinity of the plant site. The industrial activity in the vicinity of the port is related to shipping and rail activities and manufacturing. The industrial activity in the vicinity of the plant site is associated with phosphate mining and processing.

Various utilities and transportation uses also parallel or bisect the preferred and alternative corridors. Utilities include electrical transmission and distribution lines and associated substations, water, and natural gas transmission distribution lines, telephone, and cable. Transportation uses include state and county highways, local road, I-75, and railroads.

VEGETATION

The preferred corridor follows existing roads and/or linear utilities throughout the majority of its length. Agricultural lands predominate along the preferred corridor and include cropland, citrus groves, improved pasture, palmetto prairie, and planted pine. Small tracts of pine flatwoods occur along the preferred corridor, with smaller areas of oak hammock and oak scrub. Small areas of isolated and contiguous wetlands occasionally occur along the preferred corridor, including freshwater marsh and hardwood swamp. Unlike the preferred corridor, the majority of the alternative corridor traverses the Manatee/Hillsborough County line which is not paralleled by roads and highways or other linear facilities. Although the majority of the alternative corridor consists of agriculture, such as improved pasture, row crops, palmetto prairie, and citrus groves, there is a greater amount of undeveloped land along the alternative corridor than the preferred corridor. This undeveloped land consists of forested uplands, including pine flatwoods, oak scrub, and oak hammock. Small areas of sand pine scrub occur near the junction of Safford Road and the county line and near the county line and the abandoned railroad alignment west of the Little Manatee River.

Seven major land cover types and five major agricultural land uses were identified within the corridors as vegetation communities. The agricultural land use types were included because these lands are dominated by vegetation. The community types within the preferred and alternative corridors are described below in terms of vegetation, physical structure, and ecology. The community abbreviations given reflect the corresponding FLUCCS mapping codes.

UPLANDS

Agricultural Lands--The majority of the preferred and alternative corridors support agricultural lands used for cattle or citrus/crop production. The major agricultural land use types within the corridors are row crops (211), improved pasture (213), citrus groves (230), palmetto prairie (321), and planted pine (441). Row crops, mostly tomatoes, improved pasture, and citrus groves are an intensive form of agriculture, which results in the complete alteration of the original vegetation. A non-intensive agricultural use, palmetto rangeland or prairie, typically consists of pine flatwoods which have been altered slightly by the removal of the pine overstory and the enhancement of forage grasses through fire management for cattle grazing. Palmetto prairie can be characterized as an open, treeless rangeland dominated by saw palmetto (Serenoa repens) in the shrub layer and a mixture of grasses and forbs in the herbaceous stratum. Another non-intensive agricultural use is planted pines. Planted pine areas along the corridor consist of strips of slash pines (Pinus elliottii) planted in rows along highways within the preferred corridor.

Pine Flatwoods (411)--Pine flatwoods are characterized by a nearly flat topography with relatively poorly-drained soils. Generally, an organic or clay hardpan is situated a few feet beneath the soil layer. During the rainy season, pine flatwoods may have water on or near the soil surface. Pine flatwoods are open forest associations dominated by an overstory of pines. Longleaf pines (Pinus palustris) occur on well drained soils; slash pine is more commonly found along poorly drained, wetter areas. The shrub layer is typically dominated by saw palmetto with gallberry (Ilex glabra),

wax myrtle (Myrica cerifera), sand live oak (Quercus geminata), fetterbush (Lyonia lucida), and tarflower (Befaria racemosa). The herbaceous cover contains a variety of fire-tolerant species, including blazing star (Liatris spp.), paw paw (Asimina reticulata), and a predominance of wiregrass (Aristida spp.).

Pine flatwoods depend upon periodic fires to restrict the encroachment of hardwood trees and perpetuate fire-adapted flatwoods vegetation, which maintains the pine/saw palmetto character. Since pine flatwoods lose this structural and functional integrity when periodic burning is excluded, pine flatwoods are referred to as a fire or subclimax community. With the exclusion of fire, oaks typically become established and ultimately form a hardwood forest or oak hammock (422). Small tracts of pine flatwoods are present along the corridors; however, the majority of this historically dominant community type has been logged and impacted by agricultural activities such as cattle production and farming.

Sand Pine Scrub (413)--Sand pine scrub is a xeric, endemic association characterized by an overstory of sand pines (Pinus clausa) and an open evergreen understory, with sandy areas devoid of vegetation. Sand pine scrub occurs on excessively drained white sandy soils at higher elevations than surrounding plant communities. The understory typically contains aggregations of scrub oaks (Quercus geminata, Q. myrtifolia, and Q. chapmanii) and saw palmetto. The herbaceous complement of the sand pine scrub community is very depauperate.

Oak Scrub (421)--Oak scrub is a xeric community type that possesses an evergreen shrubby understory situated upon well-drained, deep white sandy soils on high ground. Scrubby flatwoods typically contain widely scattered slash or longleaf pine in the overstory. However, when characterized by an association of scrub oaks interspersed with areas of barren white sand without a pine canopy, the community is considered to be an oak scrub. Understory shrubs include sand live oak, dwarf live oak (Quercus minima), gopher apple (Licania michauxii) and saw palmetto. Herbaceous plants and vines within this xeric association include wiregrass, black root

(Pterocaulon virgatum), deer moss (Cladonia spp.), greenbriar (Smilax spp.), and pinweeds (Lechea spp.)

Oak Hammock (422)--In the State of Florida, the term "hammock" refers to any hardwood or broad-leaved evergreen forest which is not regularly inundated and occurs on well-drained to wet, highly organic soils. Vegetation composition within hammocks varies depending upon the type of soils, hydroperiod, and location. The primary hammock association found along the preferred and alternate corridors is mesic oak hammock.

These mesic hammocks are typically dominated by live oaks (Q. virginiana) or laurel oaks (Q. laurifolia) within the canopy layer. Generally, the wetter the system, the greater the occurrence of laurel oaks. Oak hammocks have well developed canopy layers and, therefore, rather depauperate understory layers. Since these hammocks mostly occur in pasture, this condition is further maintained through the influence of cattle trampling and foraging. Common herbaceous, vining, and shrubby plants found in the oak hammocks include wax myrtle, saw palmetto, beauty berry (Callicarpa americana), greenbriar, poison ivy (Toxicodendron radicans), Virginia creeper (Parthenocissus quinquefolia), pepper vine (Ampelopsis arborea), and grape (Vitis munsoniana). Epiphytes, such as spanish moss (Tillandsia usneoides), ball moss (T. recurvata), and wild pine (T. utriculata) are common on the limbs of the oak trees.

WETLANDS

Cypress Swamp (611)--Cypress swamp is a forested freshwater wetland dominated by pond cypress (Taxodium ascendens), bald cypress (Taxodium distichum), or a combination of both species. Within the corridors, only cypress strands and riverine cypress swamp were observed. Riverine cypress swamp consists of bald cypress that are situated along river or creek floodplains. Associated species present in the canopy and understory include red maple (Acer rubrum), wax myrtle, willow (Salix caroliniana), buttonbush (Cephalanthus occidentalis), cinnamon fern (Osmunda cinnamomea), and various bromeliads (Tillandsia spp.). Cypress strands are dominated by an overstory of bald and/or pond cypress. Cypress strands are generally

elongated or irregularly shaped systems located at the headwaters of inland tributaries. Water levels in cypress strands are influenced by precipitation and runoff from surrounding areas. Plant diversity in cypress strands is similar to that of riverine cypress systems.

Hardwood Swamp (621)--Hardwood swamps are seasonally inundated, freshwater, forested wetlands, which are dominated by water-tolerant hardwoods. The arboreal species composition varies according to swamp origin, hydroperiod, and soil structure. Hardwood associations typically support a dominance of one or a mixture of the following trees: laurel oak, red maple, sweet bay (Magnolia virginiana), swamp red bay (Persea palustris), and pop ash (Fraxinus carolinianus). The degree of canopy closure and seasonal water levels typically dictate the species cover and density at the understory and ground levels. Hardwood swamps which support a moderate to low percentage of cypress trees within the overstory are considered mixed cypress hardwood swamps. Such mixed cypress hardwoods usually occur along drainage corridors or along streams within the corridors. The specific species composition within respective strata varies according to swamp origin and hydroperiod. Typically this community may be characterized as a red maple-cypress or a laurel oak-cabbage palm-cypress association.

Another category of hardwood swamp is the swamp thicket also known as heads or shrub swamp. Swamp thickets are dense stands of aquatic shrubs or small trees that occupy standing water or periodically flooded sites. Swamp thickets that may be found along the corridors are dominated by almost pure monocultures of willow. These associations typically become established within freshwater marshes or wet prairies that have not been burned or experienced a significant reduction in water levels.

Freshwater Marsh (641)--A marsh is a treeless association dominated by emergent herbaceous and shrub aquatic vegetation which is seasonally wet, or flooded, for most of the year. The vegetative association appears as an open expanse of grasses, sedges, rushes, and other herbaceous plants. Freshwater marsh can be characterized as seasonally inundated, shallow, round, or elliptical depressions within terrestrial habitats (typically

pine flatwoods, palmetto prairie, and improved pasture in the corridors). These inland marshes are further characterized by concentric zones of emergent vegetation with floating-leaved and/or free floating plants at the center. The center may contain permanent to semipermanent standing water and, depending upon the size of the system, may be devoid of vegetation and resemble a pond. The variation in species composition among marshes is a function of water fluctuations and soil conditions. Dominant emergents associated with freshwater marsh include maidencane (Panicum hemitomon), arrowhead (Sagittaria spp.), pickerelweed (Pontedaria cordata), soft rush (Juncus effusus), and club rush (Eleocharis spp.). Common shrub species which occur sporadically throughout include willow, wax myrtle, and buttonbush.

Although not considered a true marsh, another herbaceous wetland type under the FLUCCS category of 641 is wet prairie. Large to small shallow water areas primarily within pine flatwoods and palmetto prairies that are dominated by St. Johns wort (Hypericum fasciculatum) or inland cordgrass (Spartina bakeri) are called wet prairie. Wet prairie differs from freshwater marsh by the occurrence of sandy soils with thin organic layers rather than the deep mucks/peats and the diversity of aquatic plants associated with true marshes.

6.3.7.2 Affected Waters and Wetlands

The physiography of the area where the proposed liquid fuel pipeline will be located is such that any corridor of similar dimensions to the preferred and alternative corridors will contain some wetlands and waterbodies.

From west to east, both the preferred and the alternative corridors traverse the physiographic regions called the Gulf Coastal Lowlands in the west and the Central Highlands in the east, which are broad marine terraces. The Gulf Coastal Lowlands are sharply delineated to the east by a prominent scarp with an elevation of approximately 12 meters (40-feet) MSL. They are characterized by a gently sloping topography, and are typically poorly drained. Most of the surface water in this area is tidal in nature. East of the scarp, the preferred and alternative corridors

traverse a small portion of the DeSoto Plain, which is a unit of the Central Highlands. The DeSoto Plain is gently sloping, and as a result of this feature and the areal lithology, it is poorly drained. The Plain rises to elevations of about 27 meters (90 feet) MSL in the corridor area. The Polk Upland, another unit of the Central Highlands, is located at the eastern edge of the DeSoto Plain. The Polk Upland rises to approximately 39 meters (130 feet) MSL at the terminus of the corridor area and is characterized by areas of relatively flat, poorly drained topography.

The waterbodies crossed by the preferred and alternative corridors are shown in Table 6.3.7-1. The major receiving waters for the waterbodies crossed by the preferred corridor are (from west to east): Tampa Bay, Gamble Creek, the North Fork Manatee River, the East Fork Manatee River, the Manatee River, Payne Creek, and the Peace River. The major receiving waters for the waterbodies crossed by the alternative corridor are (from west to east): Tampa Bay, Cockroach Bay, the Little Manatee River, the South Fork Little Manatee River, and Alderman Creek. All waterbodies crossed by the preferred corridor are designated as Class III (for recreation and for the propagation and maintenance of a healthy, well-balanced population of fish and wildlife) by Chapter 17-3, Florida Administrative Code (FAC), except for the following: 1) the North Fork Manatee River, which is designated as Class I (potable water supplies), and 2) the East Fork Manatee River, which is also designated as Class I. In the alternative corridor, all waterbodies crossed are designated as Class III except for the Little Manatee River, which is designated as an Outstanding Florida Water.

Both of the corridors contain marshy depressions which drain to numerous intermittent streams. In some places, the streams have been channelized and canals have been dug to augment poor natural drainage. A large cooling pond [approximately 16.9 square kilometers (6.5 square miles)] for the FPL/Manatee power plant is located just south of the Hillsborough/Manatee County line at a point where the Little Manatee River dips into Manatee County. This pond has reduced the natural drainage area to creeks in this area. East of SR 39, and adjacent to SR 37, extensive mining activities

Table 6.3.7-1. Waterbodies Within the Preferred (P) and Alternative (A) Liquid Fuel Pipeline Corridors

Waterbody	Receiving Water	Corridor(s)	Comments
Unnamed Canal	Tampa Bay	P,A	Adjacent to Port Manatee
Unnamed Pond	Isolated	P,A	Adjacent to Port Manatee
Unnamed Ponds	Isolated	A	Adjacent to U.S. 41
Mine Pit	Isolated	P	Adjacent to U.S. 41
Unnamed Creek	Piney Point Creek	A	Perpendicular to corridor
Unnamed Creek	Little Redfish Creek	P	Intermittent; adjacent to U.S. 41
Unnamed Ponds	Isolated	P	At edges of corridor
Curiosity Creek	Little Manatee River	P	Perpendicular to corridor
Cockroach Creek	Cockroach Bay	A	Intermittent
Curiosity Creek	Little Manatee River	A	Channelized
Wildcat Creek	Little Manatee River	A	Headwater at north edge of corridor
Unnamed Ponds	Isolated	A	Adjacent to I-75
Curiosity Creek	Little Manatee River	A	East of I-75
Unnamed Creek	Curiosity Creek	A	Intermittent
Unnamed Creek	Curiosity Creek	A	Intermittent
2 Unnamed Creeks	Unnamed tributary of Little Manatee River	A	East of I-75
Unnamed Creek	Unnamed tributary of Little Manatee River	A	Adjacent to U.S. 301

Table 6.3.7-1. Waterbodies Within the Preferred (P) and Alternative (A) Liquied Fuel Pipeline Corridors (Continued, Page 2 of 3)

Waterbody	Receiving Water	Corridor(s)	Comments
Unnamed Canal	Unnamed tributary of Little Manatee River	A	East of U.S. 301
Unnamed Canal	Curiosity Creek	P	At Buckeye Road
Unnamed Ponds	Isolated	P	Crossed by FPL transmission lines
Unnamed Creek	Gamble Creek	P	Intermittent
Little Manatee River	Tampa Bay	A	2 Crossings; Outstanding Florida Water
South Fork Little Manatee River	Little Manatee River	A	Crosses at confluence of unnamed tributary and South Fork, Little Manatee River
6 Unnamed Creeks	Gamble Creek	P	Intermittent
Unnamed Creek	South Fork Little Manatee River	P	Intermittent
Unnamed Creek	Gamble Creek	P	Intermittent
7 Unnamed Creeks	Howard Prairie Branch	A	Intermittent
Unnamed Creek	South Fork Little Manatee River	P	Intermittent
Keen Branch	South Fork Little Manatee River	P	About 3 miles west of SR 39
Graveyard Creek	South Fork Little Manatee River	P	About 2 miles west of SR 39

Table 6.3.7-1. Waterbodies Within the Preferred (P) and Alternative (A) Liquefied Fuel Pipeline Corridors (Continued, Page 3 of 3)

Waterbody	Receiving Water	Corridor(s)	Comments
Unnamed Creek	North Fork Manatee River	P	Intermittent
North Fork Manatee River	Manatee River	P	Class I Water
Mine Pit	Isolated	A	West of SR 37
Unnamed Creek	Alderman Creek	A	Intermittent; drainage area decreased by mining
Unnamed Tributaries	Payne Creek	A	3 miles east of Hillsborough County line
East Fork Manatee River	Manatee River	P	Class I Water; about 3 miles East of SR 37
Unnamed Creek	Horse Creek	P	Intermittent
Horse Creek	Peace River	P	1.5 miles east of Manatee County line
Mine Pit	Isolated	A	South side of corridor
Gum Swamp Branch	Payne Creek	P	Culverted at road crossing
Payne Creek	Peace River	P	Corridor widens at Roberts Road Crossing
Mine Pit	Isolated	P	West of CR 663
Payne Creek	Peace River	A	Crosses at proposed plant site boundary

Source: USGS Quadrangle Maps, 1972-1987
REDI Maps, 1979-1989
Hardee County, 1988,

are underway. This mining activity has generally resulted in a reduction in the size of natural drainage areas.

The preferred corridor proceeds east out of Port Manatee and turns due south parallel to U.S. 41. It then turns due east along Buckeye Road. It crosses several intermittent, unnamed creeks and an unnamed, isolated pond (at its southern edge). It then crosses Curiosity Creek. It crosses an unnamed stream at I-75 and then crosses a culverted canal.

The preferred corridor then turns south, paralleling an existing FPL transmission line. It crosses three unnamed intermittent creeks, and then turns east, paralleling another existing transmission line corridor. It crosses two intermittent creeks, two isolated ponds, and then crosses U.S. 301. It then crosses an abandoned Seaboard Railroad ROW, and three intermittent unnamed creeks. It turns south, and then turns east to parallel SR 62. To the north of this area is the FPL/Manatee plant cooling pond.

The preferred corridor then crosses three intermittent tributaries of Gamble Creek, passes the junction of SR 62 and Safford Road, and crosses three unnamed intermittent streams which flow to South Fork Little Manatee River. It then crosses Keen Branch and Graveyard Creek, both of which flow to South Fork Little Manatee River.

East of SR 39, the preferred corridor crosses the North Fork Little Manatee River, which is designated as Class I by Chapter 17-3, FAC. It passes SR 37, and then crosses the headwaters of the East Fork Manatee River, also designated as Class I by Chapter 17-3, FAC. As the corridor continues east, it crosses Horse Creek.

It turns north and crosses Gum Swamp Branch. It then turns east near Roberts Road, crosses Payne Creek, and turns north along CR 663. Here it is bordered on the west by a settling pond and on the east by phosphate mining activity. As it turns west, it is widened to about 1,350 meters (4,500 feet) to provide flexibility in routing around mining activities.

The alternative corridor heads east from Port Manatee. It then proceeds northwest, parallel to U.S. 41. It turns due east immediately north of the Hillsborough-Manatee County line. It crosses Cockroach Creek, the headwaters of Wildcat Creek, and a channelized portion of Curiosity Creek. It crosses a few small, isolated ponds, and then it crosses I-75.

The alternative corridor then crosses another branch of Curiosity Creek and several intermittent streams that flow into the Little Manatee River, which is designated as an Outstanding Florida Water by Chapter 17-3, FAC. It crosses the Little Manatee River twice east of the recently abandoned Seaboard Railroad ROW. It then crosses the South Fork Little Manatee River at SR 579.

The alternative corridor then crosses several intermittent streams which flow to the Little Manatee River. At SR 39, the corridor widens to 300 meters (1,000 feet) and passes through extensive mining activity to SR 37. It also crosses Alderman Creek in this area.

Past SR 37 and the Hillsborough-Polk County line, the alternative corridor crosses a wetland and associated streams, which all drain into Payne Creek. More phosphate mining activity also exists in this area. The corridor then crosses Payne Creek at the proposed plant site.

6.3.7.3 Ecology

Based on a literature survey, field inspections, and consultations with federal and state agencies, certain species officially designated as endangered, threatened, or species of special or regional concern by the USFWS or FGFWFC may reasonably be expected to occur in the liquid fuel pipeline project study area. For purposes of this discussion, this area includes sections of Hillsborough, Manatee, Polk, and Hardee Counties bounded by Tampa Bay (Port Manatee) on the west, SR 674 on the north, CR 663 on the east, and SR 62 on the south. Also considered were certain species (fish, wading birds) which are not federally- or state-listed but which are of recreational or ecological importance. The criteria which

determined the specific species to be addressed in this application included their known or expected occurrence in the project area as residents, migrants, or transients; potential for impact due to ROW preparation and construction and maintenance of the liquid fuel pipeline; or other agency concerns such as the presence of preferred or suitable habitat. The list of animal species potentially occurring within 450 meters (1,500 feet) of the proposed pipeline corridor and listed by FGFWFC or USFWS is given in Table 6.3.7-2. Non-listed, but recreationally important species occurring within waters of the proposed pipeline project area are listed in Table 6.3.7-3.

The following sections include discussions for endangered, threatened, and species of special concern which occur or may occur in the pipeline project study area. Discussions are also provided for other important species which share specific habitats (fish, wading birds). The probability of occurrence for threatened and endangered species within the proposed pipeline project area was based on known locations for such species (e.g., eagle nests, wading bird rookeries, gopher tortoise colonies), on direct observations of species or their signs of occurrence, on recent and historical reports of occurrence in scientific literature, and on the presence of suitable habitat as determined by helicopter flyovers and follow-up ground truthing.

WILDLIFE SPECIES

The occurrence of wildlife species within a given area is mainly related to the presence of suitable habitat for nesting, foraging, and reproduction. Wildlife habitat type and quality vary with vegetation type and structure, surrounding land uses and hydrologic factors. For these reasons, wildlife habitat types can frequently be categorized and equated with the land use/land cover types which are present in a region. Vegetation communities present within the pipeline project area were determined by helicopter flyovers and ground truthing and mapped on aerial photography. The land use/land cover identified in the preferred and alternative corridors which provide the principle wildlife habitat types include agricultural lands (row and field crops, citrus groves, palmetto rangeland, improved pasture)

Table 6.3.7-2. Listed Animal Species Potentially Occuring Within 1,500 Feet of the Proposed Pipeline Corridor

Common Name	Scientific Name	Designated Status ¹		Probability of Occurrence ⁴
		FGFWFC ²	USFWS ³	
<u>Fish</u>				
Common snook	<u>Centropomus undecimalis</u>	SSC	--	VL
Rivulus	<u>Rivulus marmoratus</u>	SSC	--	VL
<u>Amphibians and Reptiles</u>				
American alligator	<u>Alligator mississippiensis</u>	SSC	T(S/A)	L
Eastern indigo snake	<u>Drymarchon corais couperi</u>	T	T	M
Gopher tortoise	<u>Gopherus polyphemus</u>	SSC	UR2	P
Florida pine snake	<u>Pituophis melanoleucus mugitus</u>	SSC	UR2	L
Florida gopher frog	<u>Rana areolata aesopus</u>	SSC	UR2	L
Short-tailed snake	<u>Stilosoma extenuatum</u>	T	UR2	VL
<u>Mammals</u>				
Florida panther	<u>Felis concolor coryi</u>	E	E	VL
Florida mouse	<u>Peromyscus floridanus</u>	SSC	UR2	L
West Indian manatee	<u>Trichechus manatus latirostris</u>	E	E	VL
Sherman's fox squirrel	<u>Sciurus niger shermani</u>	SSC	UR2	VL
<u>Birds</u>				
Roseate spoonbill	<u>Aiaia ajaja</u>	SSC	---	VL
Florida scrub jay	<u>Aphelocoma coerulescens coerulescens</u>	T	T	VL
Limpkin	<u>Aramus guarauna</u>	SSC	---	M
Florida burrowing owl	<u>Athene cunicularia floridana</u>	SSC	---	L
Kirtland's warbler	<u>Dendroica kirtlandii</u>	E	E	VL

Table 6.3.7-2. Listed Animal Species Potentially Occurring Within 1,500 Feet of the Proposed Pipeline Corridor
(Continued, Page 2 of 2)

Common Name	Scientific Name	Designated Status ¹		Probability of Occurrence ⁴
		FGFWFC ²	USFWS ³	
Little blue heron	<u>Egretta caerulea</u>	SSC	---	P
Snowy egret	<u>Egretta thula</u>	SSC	---	P
Tricolored heron	<u>Egretta tricolor</u>	SSC	---	P
Arctic peregrine falcon	<u>Falco peregrinus tundrius</u>	E	T	L
Southeastern American kestrel	<u>Falco sparverius paulus</u>	T	UR2	H
Florida sandhill crane	<u>Grus canadensis pratensis</u>	T	---	P
Southern bald eagle	<u>Haliaeetus leucocephalus</u> <u>leucocephalus</u>	T	E	P
Wood stork	<u>Mycteria americana</u>	E	E	M
Red-cockaded woodpecker	<u>Picoides borealis</u>	T	E	VL
Audubon's crested caracara	<u>Polyborus plancus audubonii</u>	T	T	L

NOTES:

- 1: E - Endangered
T - Threatened
T(S/A) - Threatened Due to Similarity of Appearance
SSC - Species of Special Concern
UR2 - Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking

- 2: Florida Game and Fresh Water Fish Commission (list published in Section 39-27.003-005, FAC)
3: United States Fish and Wildlife Service (list published in List of Endangered and Threatened Wildlife and Plants, 50 CFR 17.11-12)
4: Probability of Occurrence
VL - very low; L - low; M - moderate
H - high; P - present

Sources: FGFWFC, 1988.

Table 6.3.7-3. Common (Nonlisted) Fish* Expected to Occur in the Waters of the Corridor Study Area

Common Name	Scientific Name
Black crappie	<u>Pomoxis nigromaculatus</u>
Bluegill	<u>Lepomis macrochirus</u>
Bowfin	<u>Amia calva</u>
Brown bullhead	<u>Ictalurus nebulosus</u>
Channel catfish	<u>Ictalurus punctatus</u>
Florida gar	<u>Lepistosteus platyrhinchus</u>
Largemouth bass	<u>Micropterus salmoides</u>
Mosquitofish	<u>Gambusia affinis</u>
Redbreast sunfish	<u>Lepomis auritus</u>
Redear sunfish	<u>Lepomis microlophus</u>
Spotted sunfish	<u>Lepomis punctatus</u>
Tilapia	<u>Tilapia sp.</u>
White catfish	<u>Ictalurus catus</u>

* Species not rare, threatened, or endangered but included due to recreational (game fish) or ecological importance.

Source: FGFWFC, 1989.

pine flatwoods, oak hammocks, freshwater marsh, cypress swamp, hardwood swamp, disturbed lands (e.g., grasslands, cleared areas along ROWs, areas dominated by Australian pines or Brazilian pepper, mined lands), and, to a small extent, xeric scrub areas dominated by scrub oak or sand pine.

The majority of the pipeline project area has been disturbed, primarily by agricultural uses such as citrus culture and cattle production. Grasslands, rangeland, improved pasture and other agricultural lands, such as truck crop land and citrus groves, and transportation ROWs are generally of lower value to wildlife than are more natural, less disturbed, vegetative community types. Marshes, swamps, and to a lesser extent pine flatwoods are of greater habitat value, providing larger diversity of ecological niches. They can be expected to support a greater variety of wildlife species. The xeric scrub communities, although not ordinarily of high species diversity, are relatively rare and as such can support rare, threatened or endangered species which are often restricted to these habitat types.

Habitat quality was assessed during helicopter flyovers and during ground truthing. Both the type and quality of surface waters were also examined to determine their potential habitat suitability for the aquatic- and wetland-dependent species under consideration. The status and potential for occurrence of species included for review were determined by habitat inventory, literature surveys, agency contacts and aerial surveys. Agencies or organizations contacted included the USFWS, FGFWFC, and FNAI. Twenty-seven listed vertebrate species, including 2 fish, 6 reptiles and amphibians, 15 birds, and 4 mammals were identified as species occurring or potentially occurring in the pipeline project area. The status and potential occurrence of these species in and along the preferred and alternative corridors are discussed in the following paragraphs.

AMPHIBIANS

Florida gopher frog (Rana areolata aesopus)--The gopher frog is designated as a species of special concern by FGFWFC and is currently under review by USFWS. Suitable gopher frog habitat consists of xeric uplands such as

sandhill and sand pine scrub communities. The gopher frog is often associated with gopher tortoise burrows. The occurrence of gopher frogs within the study area is limited to suitable xeric habitat. The preferred and alternative corridors traverse primarily mesic and hydric communities with relatively high water table conditions and do not contain large areas of xeric habitat preferred by this species. At three separate localities along the alternative corridor, areas of sand pine scrub with limited populations of gopher tortoise were identified. Gopher tortoise populations were sparse, and the number of burrows within the corridor is estimated to be extremely small. Therefore, no substantial or significant populations of gopher frogs are expected to occur within or adjacent to either the preferred or alternative corridors.

REPTILES

American alligator (Alligator mississippiensis)--The American alligator is listed as a species of special concern by the FGFWFC and FCREPA and as threatened (due to similarity of appearance) by the USFWS. The latter classification (threatened due to similarity of appearance) is not due to the alligator's biological vulnerability, but is due to its close similarity of appearance with other listed species such as the American crocodile (i.e., it is classified as threatened to protect these other species). This species inhabits most wetland communities where sufficient permanent open water, and aquatic prey, are present. Currently, the State of Florida permits regulated harvest of alligators to control population levels, especially where alligators are incompatible with current land uses. Within the pipeline project area, alligators can be expected to occur within isolated open water bodies, within freshwater marshes with permanent open water, and within natural and manmade drainages which are sufficiently large and otherwise suitable for alligators. This species was not observed in such areas within the preferred and alternative corridors. Because the water bodies and creeks within and adjacent to the corridors are not large, only low levels of occurrence and habitat utilization by alligators are expected.

Eastern indigo snake (Drymarchon corais couperi)--Eastern indigo snakes are listed as threatened by FGFWFC and USFWS. Indigo snakes occur in a variety of habitat types, including xeric habitats, pine flatwoods, hardwood hammocks and hardwood swamps. The Eastern Indigo snake is only expected to occur in the more rural areas of the corridors, especially in certain areas of the alternative corridor where relatively larger tracts of natural lands, with limited disturbance, occur.

Gopher tortoise (Gopherus polyphemus)--Florida gopher tortoises are listed as a species of special concern by FGFWFC and under review by the USFWS. Gopher tortoises generally occur on well-drained uplands. Gopher tortoises prefer xeric habitat such as sand pine scrub and oak scrub as well as relatively well-drained pine flatwoods and old field associations. The preferred and alternative corridors do not traverse significant portions of such habitats. However, three small areas of sand pine scrub are crossed by the alternative corridor. Gopher tortoise burrows were observed in these areas, but the population levels were assessed to be at low densities. Along the preferred corridor, several small areas of oak scrub were observed and investigated. No gopher tortoises occur in these xeric habitats.

Florida pine snake (Pituophis melanoleucus mugitus)--The Florida pine snake is listed as a species of special concern by the FGFWFC and is under review for listing by the USFWS. This species occupies habitat similar to that of the gopher tortoise. It is found in xeric upland habitats including oak scrub and sand pine scrub. This upland species is known to inhabit gopher tortoise burrows and may occur along the alternative corridor where sandhill and oak scrub areas are traversed.

Short-tailed snake (Stilosoma extenuatum)--The short-tailed snake, endemic to Florida, is largely restricted to the longleaf pine/turkey oak association, which is absent from the study region. It is occasionally found in upland hammock and sand pine scrub, but usually where such scrub is adjacent to longleaf pine/turkey oak. This species is threatened according to FGFWFC. Owing to the scarcity of suitable habitat along the

alternative corridor and a virtual absence of habitat along the preferred corridor, the species has only very low probability of occurrence in the area.

MAMMALS

Florida panther (Felis concolor coryi)--The Florida panther is classified as an endangered species, and it is likely that fewer than 50 individuals remain, mostly in the southern one-third of the state. It is not restricted to any particular habitat type but requires larger, natural areas in which to range, forage, and locate mates. Due to the high level of agricultural and moderate residential development in the pipeline project area, as well as the absence of recent occurrence records, this species has a very low probability of occurring within the project area.

Florida mouse (Podomys floridanus)--The Florida mouse, a state species of special concern, occurs primarily in scrub habitats with xeric conditions, open tree stands, clumped shrubs, and patches of open areas with well-drained sandy soils. It is known to utilize gopher tortoise burrows. Habitat suitable for this species rarely occurs along either the preferred or alternative corridor. Three relatively small areas of xeric scrub occur along the alternative corridor where gopher tortoise burrows were observed. These areas are probably too small to support any persistent, substantial populations of this species. This species probably does not occur elsewhere in the study area.

West Indian manatee (Trichechus manatus latirostris)--This endangered massive aquatic mammal inhabits sluggish rivers, shallow estuaries and salt-water bays. Critical habitat for this species includes reaches of the Little Manatee River upstream to its crossing of Highway U.S. 301 in Section 25, T32S, R19E, Hillsborough County, approximately 1.6 to 2.4 kilometers (1 to 1.5 miles) north of the alternative corridor. Manatee habitat is not traversed by either the preferred or alternative corridor, although small tributary creeks draining into the Little Manatee and Peace Rivers are crossed.

Sherman's fox squirrel (Sciurus niger shermani)--This large tree squirrel, a state species of special concern, primarily inhabits longleaf pine/turkey oak associations of the sandhills, where logging and development have reduced habitat quality. Fox squirrels can occur at low densities in some ecotonal situations involving pine flatwoods and margins of bayheads or cypress ponds. The study area is at or outside the southwest limits of this species' geographic range, and the ecotonal habitats present are rare, suboptimal and would be unlikely to support substantial numbers of fox squirrels. No records or signs of fox squirrels were discovered during field investigations. It is doubtful that this species occurs along either corridor.

WADING BIRDS

Twelve species of wading birds probably occur in the vicinity of the preferred and alternative corridors. The wood stork is listed by USFWS as endangered and by FGFWFC as threatened. The limpkin is listed as a species of special concern by FGFWFC. The roseate spoonbill, little blue heron, snowy egret and tricolored heron are considered species of special concern by FGFWFC. The great blue heron, great egret, black- and yellow-crowned night herons, eastern least bittern, glossy ibis and white ibis are not listed by either USFWS or FGFWFC, but they are protected species. All of these species require marshes or shallow open water for feeding and swamp forest habitats for nesting and roosting. Wading bird habitat is present along both the preferred and alternative corridors, but crossings were minimized during the regional screening phase of the pipeline corridor selection process.

With the exception of the roseate spoonbill, all of these species may utilize wetlands within the proposed pipeline corridors. The roseate spoonbill prefers coastal wetlands and occurs at inland freshwater wetlands only infrequently. The wading birds observed repeatedly in the study area were the great egret, little blue heron, tricolored heron, and great blue heron.

A review of agency records of wading birds rookeries for the region identified four previously recorded rookeries, all of which are at least one-mile distant from either the proposed preferred corridor or the alternative corridor. Three possible, unconfirmed rookery sites were also suggested by FGFWFC, all of which were outside the corridors. These sites were inspected during helicopter flyovers, but no evidence of rookery use was detected. No additional, new rookery sites were identified during the corridor selection process. Thus, although wading birds are likely to utilize some of the wetlands along both corridors, no involvement with nesting sites is expected.

OTHER BIRDS

Wood stork (Mycteria americana)--Wood storks are listed as endangered by USFWS and FGFWFC due to their population decline. Their populations, colony locations, and reproductive success are monitored by USFWS and FGFWFC. Wood storks typically nest in cypress swamps, will often fly long distances to forage, and require shallow water in which fish become concentrated to feed and reproduce successfully. Shallow marshes, ditches, and small ponds or flooded depressions in swamp forests are all used for foraging. A wood stork colony site was reported by FGFWFC to occur in Section 35, T32S, R23E, north of the Polk County line. This colony site was not observed during the aerial flyovers, despite a deliberate search. The colony site probably has been abandoned. No new, previously unreported colony sites were encountered, and no wood storks were observed along either corridor.

Limpkin (Aramus guarana)--This medium-sized water bird inhabits riparian habitats, feeding on snails and a variety of small invertebrate and vertebrate food items. It is likely to occur along the larger creeks and slow-flowing drainages of the study area, but not in substantial numbers.

Florida scrub jay (Aphelocoma coerulescens coerulescens)--The Florida scrub jay is a highly social jay which occupies xeric scrub habitats along the central Florida and coastal ridges. Florida scrub jays have specific habitat requirements and are largely restricted to open oak scrub with an

open scattered canopy (usually sand pine), and a low (usually < 2 meter high) discontinuous shrub layer dominated by scrub oak species, rosemary, and other ericaceous species. They avoid wetlands, flatwoods (xeric, scrubby flatwoods are suboptimal habitat and occasionally used) and other forested habitats. The closest substantial populations are located in Highlands County. According to the scientific literature and FNAI records, scrub jays reportedly occur in Hillsborough County north of the Little Manatee River near I-75 at two localities and at the Little Manatee River State Recreation Area. All of these sites are approximately two or more miles from the alternative corridor. No scrub jays were detected during field inspections. The xeric sand pine and oak scrub habitat which does occur along the alternative corridor (described previously for several species) is of unsuitable quality and too small in size to support any permanent scrub jay population. Thus, scrub jays are unlikely to occur along either corridor.

Florida burrowing owl (Athene cunicularia floridana)--This owl, a ground dwelling species which inhabits sandy ground with sparse growth including sandhill communities, pastures, and maintained grasslands, is a state species of special concern. As has been noted previously, the study corridors traverse limited areas of xeric habitat. Consequently, the probability of occurrence of burrowing owls is low, and substantial populations are unlikely to occur in the study area. No records of burrowing owls were reported by FGFWFC or FNAI, and no owls were observed during habitat surveys.

Kirtland's warbler, (Dendrioca kirtlandii)--An endangered warbler, this species migrates through Florida and other states from the northern portion of Michigan to its winter habitat in the Bahamas. It is present in Florida, in a variety of habitats, for only a few days each year. Because this species migrates primarily along the east coast, it is unlikely to travel through the study area during migration.

Arctic peregrine falcon, (Falco peregrinus tundrius)--This species migrates from the arctic to winter in Florida. It is listed as threatened by FGFWFC

and endangered by USFWS. Wintering falcons require an area with an abundant food supply of birds and numerous perches on which to roost, sun, and feed. Coastal areas usually provide optimum conditions for survival, but peregrin falcons will opportunistically exploit concentrations of birds attracted to urban areas, dump sites, and agricultural areas. This species has a moderate probability of occurring as a rare transient along either corridor during winter, but more frequent occurrence of this endangered species is not likely in the suboptimal habitat that is present. Past clearing of large segments along the corridors has probably caused reduced prey abundance, as well as fewer snags and other roosts required for optimal habitat, in contrast with coastal habitats.

Southeastern American kestrel (Falco sparverius paulus)--This species, listed as threatened by FGFWFC, usually occurs in open pine forests and clearings, uses exposed perches, and preys upon insects as well as small vertebrates. This species probably occurs along both corridors where open pine forests occur, but substantial numbers are not likely. No kestrels were observed during field surveys.

Florida sandhill crane (Grus canadensis pratensis)--Listed as threatened by FGFWFC, sandhill cranes feed and nest in shallow freshwater marshes throughout central and south Florida. Feeding also occurs in wet pastures and unimproved rangeland. This species was observed foraging in pastureland in Manatee County and probably occurs occasionally throughout the study area. No known nesting sites are within either of the two corridors.

Southern bald eagle (Haliaeetus leucocephalus lelucocephalus)--Bald eagles occur throughout Florida, becoming more numerous toward south Florida. Second only to Alaska in eagle population size, Florida's populations are considered threatened by FGFWFC. Bald eagles are listed as endangered by USFWS. Eagles require large bodies of open water in which to fish. Nests are typically in large, live pine trees (mangroves in south Florida), often in pine flatwoods at some distance (several miles) from their preferred foraging area. This species, and its nests are thoroughly protected by

federal and state laws and nest use and productivity are closely monitored by FGFWFC and USFWS.

Ten documented eagle nests were reported to occur in the general vicinity of the pipeline project area. Corridor involvement with all but one of these was avoided during the regional screening phase of study. The remaining nest site was discovered in 1988 and is an active nest. The nest is located in slash pine stand between U.S. 41 and the CSX rail line in Section 32, T32S, R18E. No other eagle nests are within 450 meters (1,500 feet) of either corridor.

Red-cockaded woodpecker (Picoides borealis)--This species is designated as endangered by USFWS and as threatened by FGFWFC. It is usually restricted to overmature stands of longleaf (and to a lesser extent slash pine) pine with an open, parkland understory maintained by fire. Large (≥ 12 " dbh), often diseased (red-heart fungal disease) live pine trees are required for cavity nests, which are excavated by this species. A good supply of pine stems within its territory also is required for foraging. Large, relatively undisturbed tracts of pine forests, with suitable colony sites (i.e., very large pines), are required to constitute suitable habitat.

The limited pine flatwoods habitat present along either corridor is unsuitable for either cavity tree nests or foraging, as trees are relatively small and stem densities are quite low due to prior logging and clearing activities. There are no records of this species within the project area, and the nearest published record is in eastern Hardee County. Due to absence of suitable habitat, this species is not expected to occur within or adjacent to either corridor.

Audubon's crested caracara (Polyborus plancus audubonii)--This threatened hawk species occurs mainly in dry prairies and palmetto rangelands. It is very opportunistic in its feeding and will consume carrion as well as live prey. Its geographic range is centered northwest of Lake Okeechobee. Records in central Hardee County and south central Manatee County indicate the western limit of its range. Some apparently suitable habitat occurs

along the preferred corridor. This species may occur, probably as a rare transient, along the preferred corridor.

FISH

Common snook (Centropomus undecimalis)--The common snook is listed by FGFWFC as a species of special concern. The Florida range of the common snook includes warm coastal estuaries of the Atlantic Ocean and Gulf of Mexico, southward from the Indian River and Tampa. Common snook have specific habitat needs and prefer saline and estuarine mangrove shorelines and swamps. However, aquatic communities in the study area do not include mangrove swamp systems or estuarine areas which may serve as important spawning and nursery areas for snook. As such, the occurrence of snook within the preferred and alternative corridor is very unlikely.

Rivulus (Rivulus marmoratus)--The rivulus is a killifish found in Caribbean waters from the Venezuelan coast to the southern third of peninsular Florida. This specific concern species is extremely rare in Florida and has not been collected in the Port Manatee area. Within the vicinity of the project study area, the rivulus could inhabit mosquito ditches and bays with estuarine mangrove or saltmarsh shorelines at Port Manatee. Given the rarity of this species in the region and the fact that the pipeline will not cross suitable rivulus habitat, this species is not expected to occur along either proposed corridor.

Other (Non-Listed) Fish

Potentially suitable habitat in the pipeline study area consists of lakes, rivers, and streams. These may contain all of the common (non-listed) fish included in Table 6.3.7-3. Natural areas considered suitable habitat within the preferred corridor may include the Little Manatee River, Horse Creek, and Payne Creek. According to FGFWFC, the bluegill and redear sunfish occur in almost any waters, and the redbreast sunfish may occur in the Little Manatee River.

Emergent weed-choked areas of any streams within the preferred and alternative corridor are expected to contain channel catfish, white catfish, and brown bullhead.

Ponds within a phosphate reservoir adjacent to the eastern portion of the alternative corridor may support catfish, tilapia, redear sunfish, spotted sunfish, redbreast sunfish, largemouth bass, and bluegill.

6.3.7.4 Other Environmental Features

All relevant environmental features associated with the liquid fuel pipeline corridors from Port Manatee to the Hardee County Power Plant have been considered and discussed in the preceding sections. No additional information is necessary to describe the environs of the corridors.

6.3.8 Effects of Right-of-Way Preparation and Construction

6.3.8.1 Construction Techniques

Construction will essentially involve clearing the construction ROW of brush and timber, trenching, laying the pipe, backfilling, and seeding disturbed areas. In all cases, the pipeline will not be located within 15 meters (50 feet) of any private dwelling, industrial building, or place of assembly without special precautions. During clearing, marketable timber which are to be removed will be sold. In residential areas, ditches will be compacted while being backfilled. Lawns will be seeded or sodded, as required by owner, and compensation will be made for watering costs.

The construction trench will be sufficiently deep so that the top of pipe will be at least 0.9 meters (3 feet) below ground surface level. At major highways and rail crossings, the pipeline pathway will be bored to minimize disruption of service. Local governments will be contacted, when necessary, to avoid traffic interference. At minor crossings, including unpaved roads, the trench will be open cut. Pipe will be placed along the ditch in 12-meter (40-foot) segments, welded, covered with a protective coating, and lowered into the trench. The trench will be filled, with the ground stabilized and seeded.

In flowing streams, excavation will be done by either dragline or clamshell dredge. Standard trenching equipment such as a backhoe will be used to cross dry or intermittent stream beds. Trenches will be sufficiently deep so that the top of the pipe will be 1.2 meters (4 feet) below the stream bed. The pipe will be welded on the upland ROW and push/pulled or floated into place.

Excavated material from flowing streams will be stored temporarily on an upland site. From dry stream beds, excavated material will be placed adjacent to the trench. It will later be returned to the trench. If rain results in a stream flow, the flow will be maintained to avoid upstream ponding.

The pipeline will be hydrostatically tested. Test water will be discharged and filtered so that erosion and turbidity are kept to a minimum.

Stream bottoms and banks, as well as upland areas, will be restored to original contours after construction to minimize drainage impacts. If necessary, banks will be stabilized using acceptable techniques.

In cases of directional drilling, there will be no local or stream disturbance. A drill rig will be set on one shore, and a pilot hole will be drilled that passes below the stream bed and surfaces on the other side. Prewelded pipe, attached to the pilot drill pipe, will be pulled back through the hole with the use of special equipment that expands the hole to the size of the pipe.

A trenching machine (backhoe or dragline/clamshell dredge) will be used in wetlands containing little or no surface water, depending on the water content of the subsoil. However, rainfall during construction could require adjustments to the use of a backhoe and the push/pull method to lay pipe.

Excavated materials will be stored along one side of the trench (within the wetland) and then used as the source material for backfill. Water flow

between wetlands on both sides of the pipeline, as well as in streams crossed within the wetlands, will be maintained during construction, and the area will be returned to preconstruction contours.

Finally, with the exception of trees that will be cleared from the ROW (for the life of the pipeline), wetland areas will be allowed to revegetate naturally or be restored by supplemental planting.

6.3.8.2 Impacts to Water Bodies and Uses

The Applicant will provide detailed information on dredging and filling (locations and volumes) to FDER and SWFWMD after the corridor is certified, when the ROW is determined and the engineering is completed.

The proposed east-west liquid fuel pipeline will pass through some wetlands and waterbodies. When crossing them, it may be necessary to trench using mats and flotation platforms. The pipe could also be floated over the water after it is welded together and then sunk to the bottom of the trench. In most cases, however, the trench will be excavated by a dragline. At least 1.2 meters (4 feet) of cover will be provided for the pipeline under the stream bed. Pipeline segments will be bent to match ground contours, welded together on the upland ROW into 12-meter (40-foot) lengths, coated with a protective coating, and hydrostatically tested. The test water will be discharged so as to not cause erosion. The pipeline will be lowered into the trench. The trench will then be backfilled.

Excavated material will be stored temporarily in an upland area for flowing streams. For dry, intermittent streams, spoil will be stored adjacent to the ditch. Should rain cause water to flow into the intermittent stream, the flow will be maintained to prevent ponding upstream of the construction site. All stream bottoms, streams banks, and uplands will be returned to the original contours.

For streams and rivers that are to be directionally drilled, no disturbance to the shoreline or stream will be necessary. A drill rig will be set up on one side of the stream crossing, and a pilot hole will be drilled at an

angle so that the drill pipe passes under the stream and surfaces on the other side. A pre-welded length of pipeline will be attached to the pilot drill pipe, and pulled back through the hole using special equipment that enlarges the hole to the diameter of the pipeline. The advantage of this method is that there is no disturbance to the stream. The disadvantages are that it costs more than conventional methods and may not be feasible under certain geological conditions.

Along the preferred corridor the major waterbodies to be crossed are the North Fork Manatee River, the East Fork Manatee River, and Payne Creek. The crossing of the forks of the Manatee River will be parallel to SR 62, where impacts have already occurred as a result of clearing for the roadway. The corridor at the crossing of Payne Creek has been widened to provide flexibility to be adjacent to Roberts Road. Along the alternative corridor, the major waterbodies crossed are the Little Manatee River (twice), and Payne Creek at the proposed site boundary. The three crossings of these waterbodies do not parallel any existing linear facility, such as a road.

Additional mitigative measures may include the use of staked silt fences with haybales in upland areas transitional to shallow wetlands, floating turbidity barriers in open waterbodies, silt screens downstream of construction or other acceptable sediment controls. As a result of these measures, only short term impacts to water quantity and quality are expected.

The construction of the pipeline should not require any ground water withdrawals, dewatering, or relocation of any waterbodies. The construction will not create any new connections to waters-of-the-state. Since no bridges are required, and since the pipeline will be constructed beneath stream beds no effects on navigation are expected.

6.3.8.3 Solid Wastes

Solid waste generated from ROW preparation, trench excavation, and pipeline installation will consist of cleared vegetation, dry excavated material,

and construction debris. Cleared brush and debris will be disposed by onsite burning. Applicable state and local regulations regarding onsite burning will be followed. Marketable timber will be cut into saleable lengths and stacked to the side of the ROW.

Excavated material will be returned to the trench. It is anticipated that only minor amounts of fill material will be brought to the site, or be removed.

6.3.8.4 Changes to Vegetation, Wildlife, and Aquatic Life

Impacts on terrestrial and aquatic systems and species resulting from ROW preparation and construction will depend primarily on the location of the selected ROW and, to a lesser degree, on clearing and excavation techniques. The ROW location determines which type of vegetative community will be altered or cleared due to access road construction. The type of vegetative community, in turn, determines which wildlife species are likely to occur in the vicinity of the area impacted by the ROW preparation and construction.

In general, higher diversities of plant and wildlife species are associated with more mature and structurally diverse vegetative communities. As such, the areas along the preferred and alternative corridors exhibiting the highest species diversities are expected to occur at the major stream crossings and within the large tracts of undeveloped land. However, the ROW preparation and construction will minimize or avoid potentially adverse impacts to terrestrial and aquatic systems and species populations for the following reasons. The potential for impacts has already been minimized or avoided through a systematic, environmentally responsive corridor selection study using biological and ecological screening criteria. Biological and ecological siting constraints such as the presence of threatened and endangered species, critical or sensitive habitats, major wetlands or woodlands, and known locations of significant resources such as eagle nests or wading bird rookeries were identified and evaluated. A detailed consideration of potential impacts to vegetation and wildlife is presented in the following sections.

VEGETATION

Impacts to the existing vegetative communities crossed by the preferred and alternative corridors (see Section 6.3.7.1) are associated with ROW preparation and construction excavation practices as addressed in Section 6.3.8.1, Construction Techniques. Such impacts to the vegetative communities will occur principally along the limited sections of ROW that are forested. ROW preparation and construction will require the cutting of trees and the subsequent maintenance of the ROW in a low-growing, early successional system. Adjoining tracts of woodlands will remain intact and provide habitat for forest species. Forested communities such as hardwood swamps, pine flatwoods, oak hammock, and oak scrub occur along short sections of the preferred corridor, and hardwood and cypress swamps, pine flatwoods, sand pine and oak scrub, and oak hammocks, occur primarily along the alternative corridor.

Along most of their lengths, both the preferred and alternative corridors traverse nonforested communities. In such open areas of low-growing vegetation (e.g., improved pasture, cropland, rangeland, wet prairie, freshwater marsh) the ROW preparation and pipeline excavation should not prematurely alter the vegetative communities. Only the construction of access roads will result in a permanent loss of the existing vegetation in these areas. Ground vegetation will also be temporarily destroyed in certain areas by the equipment that will be used in the ROW preparation and construction. Adjacent communities should not be affected by access road construction since erosion control measures and proper culverting will be maintained.

Clearing practices in nonforested wetlands will retain the vegetative root mat in the ROW, thereby minimizing impacts to wetland areas due to siltation and sedimentation. Impacts to wetlands will vary depending on the wetland system through which the pipeline is routed. The resulting shift in wetland vegetation composition will vary with the type of the original overstory and soil and drainage alterations resulting from excavation activities. Outside of areas where filling is necessary for

access road construction, freshwater marsh, shrub swamp, and wet prairie systems crossed by the pipeline will not be significantly affected by excavation and pipeline installation since the pipeline will be deep enough to allow for adequate surface and ground water flows and proper culverting will be maintained.

WILDLIFE

Specific impacts to terrestrial and aquatic vertebrates expected due to ROW clearing and pipeline installation vary by species. Based on a thorough assessment of the status and potential for occurrence of threatened and endangered species in and along the preferred and alternative corridors (see Section 6.3.7.3), no permanent or adverse changes are expected to occur in the populations of relevant species listed in Table 6.3.7-2 as a result of ROW preparation or pipeline installation activities. This conclusion is based on an analysis of each species' probability of occurrence within the preferred and alternative corridors, on each species' tolerance of disturbance and mobility (i.e., ability to avoid active clearing and work areas), and on the degree of alteration or loss of important habitat resources required by each relevant species.

Special consideration was given to the potential for impacts to the continued regional presence of relevant species, particularly eagle, woodstork, gopher tortoise, wading birds, and scrub jay populations from ROW clearing and pipeline installation activities. No bald eagle nests are located within or in the vicinity of the preferred corridor and, therefore, eagles will not be affected or disturbed by the clearing and installation activities. Similarly, no documented scrub jay, wading bird, or woodstork nesting colonies are located within this corridor.

A single eagle nest occurs in the alternative corridor. In view of its use by eagles despite heavy railroad traffic and highway traffic on U.S. 41, the construction and operation of a pipeline within this corridor, provided it does not require clearing of trees or other vegetation immediately surrounding the nest, is not expected to affect its continued use by eagles.

Local displacement of some wildlife species is expected to occur during periods of clearing and construction activities. Such displacement is generally temporary and will not adversely impact or reduce the local or regional population status of relevant species. A review of protected species potentially occurring within the future ROW shows them to be generally adaptable to manmade disturbances, mobile, and frequently able to habituate to the ROW clearing and pipeline construction activities. A review of the relevant species list shows no particularly sensitive species or populations which can be expected to be displaced permanently. Species such as wood stork, herons and egrets, limpkin, sandhill crane, glossy ibis, and alligator, among others, are adaptable and expected to return to the ROW area following habitat disturbances. Florida sandhill cranes, wood storks, herons, and egrets are expected to use recently cleared inundated areas of the ROW for feeding immediately following such activities.

Individual small burrowing mammals or fossorial reptile and amphibian species may be lost during ROW preparation. Such individual losses, however, would be restricted to limited segments of the ROW and should not substantially affect local or regional populations. As shown in the individual species' discussions, most of the listed burrowing and fossorial species, such as Florida mouse, Florida pine snake, and gopher frog, are unlikely to occur in any substantial numbers within the preferred or alternative corridors.

The American alligator is expected to occur occasionally in wetlands throughout the preferred and alternative corridors but is highly mobile, and it is not anticipated that the presence of alligator populations will be in conflict with construction and maintenance of the transmission line. In the event that individual alligators cause nuisance problems for construction or maintenance personnel, FGFWFC will be contacted to deal with the individuals in question. Indigo snakes, gopher tortoises, or similar species encountered during construction will be temporarily displaced from the area of construction. After construction is completed, such species are expected to resume use of the habitat located within the

ROW. No significant habitat or resources will be lost, and the local and regional populations will not be adversely impacted.

No losses of medium-sized or large mammals due to direct impacts or habitat alterations are expected because of the mobility of these species.

Therefore, local populations of game species, species of commercial importance, or threatened or endangered species of mammals potentially occurring within the ROW area will not be adversely impacted. The erosion control measures and the protection of water quality previously described will eliminate the potential of adverse impacts to manatees or gamefish.

No significant impacts to the resident avifauna or migratory species are expected since the preferred and alternative corridors do not include major staging, breeding, or wintering areas for such species.

Impacts on aquatic systems and species are expected to be temporary and insignificant. During construction, disturbances of the vegetative ground cover will be kept to a minimum to reduce the erosion and sedimentation potential. ROW clearing in potentially sensitive habitats such as forested wetlands may be through restrictive clearing. Leaving the root mat of most trees in place in forested wetlands will reduce the overall impacts of clearing due to soil erosion and siltation. Although the ROW preparation will involve minor excavation and placement of fill resulting in temporary increases in turbidity and silt deposition, such impacts will be local, temporary, and are not expected to adversely affect aquatic resources. The need for fill will be minimized by using the existing roads for access where possible. Following ROW preparation and pipeline construction in wetland areas, such disturbed areas will be allowed to revegetate as each section of the pipeline is completed, which will restore its habitat value and minimize changes in species composition or distribution.

6.3.8.5 Impact on Human Populations

Construction workers and equipment will be required to clear portions of the ROW for construction laydown, excavation, pipe assembly, and placement of the pipeline in the excavated trench. Construction of the pipeline is

anticipated to take less than 6 months and will generally be limited to daylight hours.

Road crossings will be made by jack and bore method under paved road crossings. Construction activities will use the proposed ROW as much as practical. Special emphasis will be made to ensure property access where driveways intersect highway ROW. During construction, restrictions to vehicle traffic flow will be minimized by placement of traffic cones, barriers and the use of flagmen as necessary.

Construction will generate noise from construction equipment and construction worker tools. Noise impacts will be minimal due to the short duration of construction at any given point along the ROW. The few residences, along the preferred and alternative corridors, are infrequent and usually set back from the ROW by a distance of several hundred feet.

Impacts will be limited to construction activities since operational activities are generally confined to Port Manatee and the plant site except for pipeline inspections and moving of ROW.

6.3.8.6 Impact on Regional Scenic, Cultural, and Natural Landmarks

The proposed corridor will have no impact on regional scenic, cultural, and natural landmarks either during or after construction as no features of this type lie within or near the corridor.

6.3.8.7 Impact on Archaeological and Historic Sites

A cultural resource survey will be conducted in the undisturbed portions of areas that will be cleared or excavated in the pipeline ROW for those areas identified by DHR as appearing to be archaeologically sensitive, the two recorded sites identified in Section 6.3.6.5 and any other areas determined by a professional archaeologist or DHR. If land clearing and excavation will disturb the recorded sites or any significant sites identified in the cultural resource survey, mitigation may be provided as determined by DHR and the professional archaeologist.

If any site or sites are found during construction, the Applicant will implement a "chance find" procedure. A professional archaeologist will evaluate the site and in consultation with DHR will determine the significance of the find. If the site is considered significant by DHR, measures will be taken to preserve or mitigate the impact to the site.

6.3.9 Post Construction Impacts and Effects of Maintenance

6.3.9.1 Maintenance Techniques

The ROW will be mechanically mowed periodically, and environmentally safe herbicides used to keep the ROW clear of unwanted vegetation. These chemicals will be used as needed. All herbicide applications will be conducted in a manner consistent with all federal, state, and local regulations and will be carried out by trained personnel. No burning is anticipated to be needed for the maintenance of the ROW.

6.3.9.2 Multiple Uses

When construction is completed, the area within the ROW can revert to its original land use. Land uses prior to construction, with the exception of tree planting and construction (structures, swimming pools) will be allowed to resume.

6.3.9.3 Changes in Species Populations

The status and potential for occurrence of relevant species in and along the preferred alternative corridors were discussed in Section 6.3.7.3. Although a large number of species were addressed for the pipeline project study area, only a fraction of that number was determined to have a moderate or higher potential for occurrence within the preferred and alternative corridors. This is not coincidental, as efforts were made during the corridor selection study to avoid potentially sensitive habitats. The avoidance of such habitats eliminated or lowered the probability of occurrence of numerous relevant species in the preferred and alternative corridors. In addition, although it was not possible to avoid all wetland communities, care was taken to avoid or minimize the length of crossings for the most mature or ecologically valuable community types, such as forested wetlands.

The potential impacts affecting the existing vegetation communities and wildlife species occur primarily during ROW preparation and pipeline construction. After pipeline installation, the cleared ROW provides new habitats within forested associations. Together with the existing nonforested systems, the ROW will essentially be maintained as low-growing or early successional vegetation communities.

Herbaceous species and woody vegetation will reestablish within the ROW. Access roads will remain cleared. The amount and location of access roads to be constructed will vary depending on final ROW location and site-specific requirements. The length and width of these access roads (i.e., the extent of vegetation clearing) will be kept at the minimum required for maneuvering equipment during pipeline excavation and installation, and during subsequent pipeline maintenance. Wherever possible, existing roads will be used for access to further minimize the required vegetation clearing. With the exception of canopy clearing, the presence of these roads will not alter adjoining aquatic habitats or wetlands.

The existing hydrological conditions, including sheet flow, will be maintained through culverting. Culverts will be designed at wetland crossings such as freshwater marsh and swamps to maintain flows and equalize water levels from one side of the road to the other. The wetlands located at the crossings should continue to function and develop normally in response to wet and dry season rainfall. Therefore, the integrity of the habitat and the composition and population levels of local wildlife species within the wetlands will be maintained.

Maintenance of the ROW will be consistent with the original ROW preparation. This includes mechanical clearing, manual cutting, and the application of EPA- and state-approved herbicides by a licensed contractor which will be conducted in compliance with all applicable regulations. The use of herbicides will restrict the growth of nuisance trees (e.g., Australian pine, Brazilian pepper, and Melaleuca) throughout the ROW. The selective, site-specific use of agency-approved herbicides is not expected

to adversely impact nontarget vegetation or wildlife species within the ROW or in adjoining terrestrial and aquatic habitats.

The ROW will be allowed to revegetate but will be maintained without trees, whose roots could damage the pipeline. This will, in forested areas, remove a narrow belt of forest habitat and replace it with an open, edge community. At any one locality, this effect will be insignificant to any of the wildlife populations previously discussed. The cumulative impacts to habitats over the length of the corridor will be regionally negligible, and distributed over a large area, so that local effects are minimal. The creation of this edge habitat is not expected to have either an adverse or positive impact on existing wildlife communities.

Because the access roads will be relatively narrow, will not cross large wetland systems, will not be paved, and will not be traveled intensively (as opposed to a regular roadway), no significant mortality or interference with wildlife movements is expected to occur.

6.3.9.4 Effects of Public Access

The pipeline, when completed, will result in no additional public access impacts on undisturbed land. It has no features that would tend to increase public activity.

6.3.10 Other Post-Construction Effects

6.3.10.1 Pipeline Safety

The transportation of liquid fuel by pipeline involves some degree of risk to the public in the event of pipe failure and subsequent release of the liquid fuel. The greatest hazards would be a fire/explosion and/or water contamination following a major pipeline rupture. In order to minimize the possibility of such situations, the proposed pipeline would be designed, constructed, operated, and maintained in accordance with the U.S. Department of Transportation (USDOT) Minimum Federal Safety Standards in 49 CFR, Part 195. The regulations are intended to ensure adequate protection for the public from liquid fuel pipeline failures. Part 195 specifies minimum design requirements for the pipeline (including material

selection and qualification; protection from internal, external, and atmospheric corrosion; design pressures; hydrostatic test pressures; and maximum allowable operating pressures).

Part 195 also prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. This written plan, or manual, will include procedures for normal day-to-day operations as well as procedures for emergencies. These emergency procedures will include the following key elements:

1. Receiving, identifying, and classifying emergency events-- pipeline rupture, fires, explosions, and natural disasters;
2. Establishing and maintaining communications with local fire, police, and public officials and the coordination of emergency response;
3. Making personnel, equipment, tools, and materials available at the scene of the emergency;
4. Minimizing public exposure to injury by assisting with evacuation efforts or other appropriate action; and
5. Directing an emergency shutdown of the system and safely restoring service.

The applicant must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that respond to a liquid fuel pipeline emergency and coordinate mutual assistance in responding to emergencies. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a liquid fuel pipeline emergency and report it to appropriate public officials.

Some historical data are available concerning the failure rate of liquid fuel pipelines similar to that proposed for this project. Over the period of 1979 through 1988, there were an annual average 209 failures for approximately 280,000 kilometers (175,000 miles) of liquid fuel pipeline.

For a 69-kilometer (43-mile) length of pipeline, this translates to an expected failure rate of 1 incident every 19.5 years. It should be noted that, given the advances in pipe materials technology (particularly in protective coatings) in the last ten years, this incidence rate is probably high compared to that which will be realized. The reasons for pipe failure have been corrosion (25 percent), outside damage such as backhoe operation (28 percent), defective pipe (6 percent) and undetermined causes (41 percent). Most failure incidents have proven to be minor, small leaks. Pipeline availability should be 95-98 percent, with most of the down-time for regular maintenance and testing.

6.3.10.2 Impacts on Public Safety

The transportation of liquid fuel by pipeline does involve some risk to the general public in the event of an accident. However, the use of the DOT guidelines in 49 CFR, Part 195 for the design, construction, operation, and maintenance of the proposed pipeline will minimize the chances of a hazardous condition. These guidelines also include regular testing requirements along the pipeline to ensure the immediate detection of a leak or rupture.

The preferred and alternative corridors are proposed to be constructed through areas that are primarily agricultural, with only a few residential dwellings scattered within agricultural areas. As a result, the number of people likely to be affected by an accident is relatively small.

Due to the thoroughness of federal requirements and the potential number of public likely to be affected, the impacts on public safety will be greatly minimized.

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HARDEE
POWER
STATION

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 7

**ECONOMIC AND SOCIAL
EFFECTS OF
PLANT CONSTRUCTION
AND OPERATION**

CHAPTER 7

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7.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

7.1 SOCIO-ECONOMIC BENEFITS

The primary benefit to be derived from Hardee Power Station project is the provision of a new, clean and reliable energy source to the public served by the Applicant. In addition to the provision of energy, the proposed project will provide jobs, tax revenues, and a productive use for a site of limited environmental resource value.

TAX REVENUES

Both direct and indirect tax benefits will accrue as a result of the construction and operation of the Hardee Power Station. The economic benefits of the associated liquid fuel pipeline are discussed separately in Chapter 6.0. Local revenues will be derived from property taxes paid on the facility and its property as well as on the property on which the transmission lines and gas pipelines are sited. State taxes will accrue in the form of taxes levied on the materials and supplies required to construct the facility.

Assuming a 30-year life for operation, it is estimated that approximately \$36,304,800 (nominal dollars) in property taxes will be paid ad valorem over the life of the facility. [This estimate assumes full abatement (economic development ad valorem tax exemption) of county assessment for the first 10 years and also assumes 295 MW of power.] These taxes will be split between the county (about 34% of total) and tax payments to the school district and the SWFWMD.

Direct benefits of plant construction will result from the purchase of materials and equipment, land and construction contracts. Materials, equipment, and contracts for construction of the 295 MW plant will cost about \$144 million, with 9.5%, or about \$13.7 million for goods purchased regionally (Tampa/Orlando area). It is estimated that sales tax to be paid on construction materials and equipment will total about \$8,631,700 during the construction effort (nominal dollars). Table 7.1-1 lists anticipated taxes and associated payments for the Hardee Power Station.

Table 7.1-1. Projected Taxes on Hardee Power Station and Transmission Facilities Over Life of the Plant

Dollars in Millions	
Property Taxes on Plant	
To County*	\$12.3
To School Board and SWFWMD	<u>24.0</u>
Total Property Tax on Plant	\$36.3
Property Tax on Transmission Facilities	
Hardee County	\$ 2.7
Polk County	1.3
DeSoto County	2.2
Charlotte County	1.4
Lee County	<u>.3</u>
Total Property Tax on Transmission Facilities	\$ 7.9
Sales Tax on Construction and Operation of Plant	
On Plant Construction	\$ 8.6
On Transmission Line Construction	1.9
During 30-yr operation (Plant & Transmission Facilities)	<u>3.3</u>
Total Sales Tax	\$13.8
TOTAL PROJECTED TAXES	58.0

* Includes full abatement of county assessment for 10 years.

Assumptions:

1. Assume millage rate held constant for all 30 years.
2. Economic development ad valorem tax exemption applies only to the county taxes and not the school and SWFWMD for first 10 years.
3. No improvements will be made to the plant.
4. Assessed value is based on original cost less accumulated depreciation at 3.3% per year (new).
5. Taxes during the period do not reflect a present value calculation.

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 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. 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.

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 over the next several years (through 1995) than employment opportunities, a larger number of 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 up to 225 workers will be employed over the 26-month construction period required for the first phase of this facility. Employment is expected to peak at 400 workers. The total construction payroll for this facility is estimated at up to \$34 million.

Operation of the 295 MW facility will employ approximately 80 persons who will work in three shifts.

Equal employment opportunities for all persons has been identified as a major priority of the CFRPC Comprehensive Policy Plan (1987). The Applicant

maintains full compliance with all applicable federal, state and local regulations regarding equal employment opportunity and affirmative action.

ENHANCEMENT OF RECREATIONAL OR ENVIRONMENTAL VALUES

Construction and operation of this facility will reclaim land previously mined for phosphate ore and will also create a new cooling reservoir. The use of mined lands for the Hardee Power Station 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

Off-site improvements to local roads, waterways or other transportation facilities are not anticipated at this time. Discussions with county officials indicate that improvements to roads, through the use of Economic Development Funds, may be considered in the future.

7.2 SOCIO-ECONOMIC COSTS

7.2.1 Temporary External Costs

According to the Florida Department of Labor and Employment Security, over 75,000 construction workers reside within 97 km (60 miles) of the proposed site. 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 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 recreational vehicles (RV) 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 over 1,000 full hook-ups for RVs 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 cause a change in usage patterns of normal users of these facilities.

Traffic congestion may occur at certain intersections during the morning and evening hours when construction workers are arriving at or departing from the site (see Section 4.6.2 for discussion of traffic access and impacts). Any congestion will, however, be of short-term duration and will be mitigated, to the extent possible, with the use of traffic control personnel on an as needed basis.

Since workers will be commuting and not relocating 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 2.2.3-2 for existing land use within 8 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 over one mile to the nearest residences, on-site construction activities will not be visible and noises will be unmeasurable 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, the Hardee Power station 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, have any impacts, displace persons from the land, cause loss of income, or result in significant costs to local government.

AESTHETICS

The project site is located 0.6 km (1 mile) west of CR 663 in Hardee County, just south of the Polk County border. The combustion turbines, steam turbine, and heat recovery steam generators will be located outside (see Figure 3.2-2). The tallest project structures at the site, the HRSG exhaust stacks, will be 27 m (90 ft) high. The Control Building will be 11 m (36 ft) tall. The Service and Water Treatment Buildings will be 6 m (20 ft) high. An 18 m (60-ft) high bay will extend from the Service Building to provide a covered laydown area. Support steel will be provided for a gantry crane; the top of the crane trolley will be 17 m (57 ft) above grade. The demineralized water storage tank will be the tallest tank onsite at 15 m (50 ft) above grade. Fuel oil and raw water tanks will be 13 m (43 ft) high. Transmission lines will exit the plant on the east side and will be routed both north and south along CR 663. A cooling reservoir will be constructed and used as the source of cooling water. A plant access road will be constructed off CR 663, but traffic signals at the intersection are not anticipated. Site grade elevation will be approximately 36 m (118 ft) above MSL. The top of the stacks will, therefore, be at elevation 63 m (206 ft) MSL. CR 663 elevation east of the site is 38 m (123 ft) MSL.

The exterior of the main plant buildings will be neutral colored panel siding to absorb, and not reflect, sunlight. The stacks will also be a neutral or dark color.

As discussed in Section 2.2.3 the Hardee Power Station is located in an area which has been in industrial (mining) activity for a considerable amount of time and is located well away from areas of any potential visual sensitivity. 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 Power Station Site, site lines were drawn out to reasonably accessible locations within an approximate 8 km (5 mile) radius.

The visual analysis found that from almost all accessible locations to the south, southwest, southeast and east towards the facility (with the exception of Ft. Green), area topography and vegetation will effectively block or screen views of the Hardee Power Station. 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 one-half mile stretch on the west side of CR 663 east of the site. Mining operations are in progress north and northeast of the site. The project facilities will be visible to persons in vehicles traveling south on CR 663, north of the site, through a southwesterly viewing corridor. Vegetation in this corridor consists only of brush and scattered trees. Mining operations in this area north of the facility may occasionally screen the site, but mining and reclamation efforts will be concluded in the next few years. Persons traveling north on CR 663, 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 Ft. Green a portion of the stacks will 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 in the view will minimize the importance of the stacks and they should appear as just one more industrial structure on the horizon. Once mining is completed the stacks will be a more dominant feature of the viewscape. However, while some views of the tops of the stacks may be possible from Ft. Green, the new structures will be in conformance with the previously established industrial character.

No views of the facility should be possible from the unincorporated community of Ft. 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 Ft. Green Springs is Payne Creek and its associated wooded wetlands. Ft. Green Springs' location on the "back" of a

slope, the location of its 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 contain people 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 man-made (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, the Hardee Power Station 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 the Hardee Power Station will have no visual effect on such properties.

The use of the proposed site for power generation will cause no hardship based on conversion of land use. The site is currently a phosphate mining area with no future plans for public or recreational use. The use of the property for the Hardee Power Station will reclaim a no longer productive parcel of land into a productive use without displacing any persons or loss of value to the region.

Since the site is not in or near any area used for tourism or commercial fishing, the proposed Hardee Power Station will not affect these resources.

As previously noted, the proposed site is about 1.6 km (1 mile) away from the nearest residence with substantial buffers in between. In addition, the site area has been actively used for industrial purposes (mining) for many

years with the mining activities projected to expand to the west and south during the next decade. Given the historic industrial use of the area and the distance between the site and the nearest residences, it is highly unlikely that the proposed project will have any detrimental effect on real estate values within the region.

REFERENCES - Chapter 7

Central Florida Regional Planning Council Comprehensive Policy Plan.
1987.

**HARDEE
POWER
STATION**

**SITE
CERTIFICATION
APPLICATION/
ENVIRONMENTAL
ASSESSMENT**

CHAPTER 8

**SITE AND DESIGN
ALTERNATIVES**

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8.0 SITE AND DESIGN ALTERNATIVES

8.1 ALTERNATIVE SITES

8.1.1 Introduction

As required by Chapter 186 FS and implementing regulations codified in Chapter 22E-2, FAC, SECI identified the need for new electric generating capacity in their 1987-1998 Ten Year Power Plant Site Plan. In April 1987, SECI initiated a site selection study to locate, evaluate, and recommend areas which were suitable for the construction and operation of an electric-generating facility. The study was referred to as the Combined Cycle Plant Site Selection Study (ESE, 1988). This section summarizes the procedures and results of that study.

The geographic area of the study included all or part of 46 counties in Florida, roughly corresponding to the applicant's member service area (Figure 8.1.1-1).

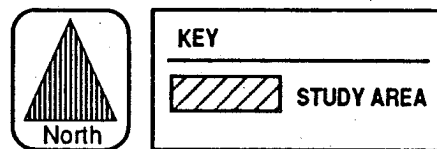
Potential areas were located and evaluated to determine their capability to accommodate a 660 MW combined-cycle (CC) plant utilizing natural gas, No. 2 fuel oil, or treated No. 6 residual fuel oil (no longer under consideration) with the potential for conversion to synthetic gas from a coal gasification plant at an unspecified future date.

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 the FEPPSA.

8.1.2 Siting Study Objectives

The overall objective of the site selection study was to locate, evaluate, and recommend areas within the study area suitable for construction of the proposed facilities.

The site selection study was designed to accomplish this objective through the following five major tasks:



NOT TO SCALE

Figure 8.1.1-1 POWER PLANT SITING STUDY AREA

Hardee Power Station

1. Identify areas within the project study area where it would not be feasible to locate the proposed CC facility because of existing environmental, land use, or other constraining factors.
2. Identify locations within the project study area which could be capable of accommodating the proposed facility based solely on environmental considerations.
3. Identify Candidate Study Areas by evaluating locations identified as favorable based on fuel delivery, transmission, construction, and environmental permitting considerations.
4. Evaluate the Candidate Study Areas based on specific environmental and engineering criteria, and identify Prime Study Areas which are the most suitable for the development of the proposed facility.
5. Develop engineering and cost information on the Prime Study Areas, select a Preferred Study Area and an Alternative Study Area, and initiate a search within the Preferred Study Area to locate a specific site for the proposed CC plant.

8.1.3 Siting Study Approach

The siting study was structured into three major phases (Figure 8.1.3-1). Each phase had specific objectives and outputs, all aimed to fulfill the overall study objective. The three phases and objectives within each phase were:

1. Phase I--Regional Study Area Screening
 - a. Evaluate the entire study area based on multidisciplinary environmental constraints to determine the relative suitability (i.e., potentially favorable or restricted) of areas for the plant development; and

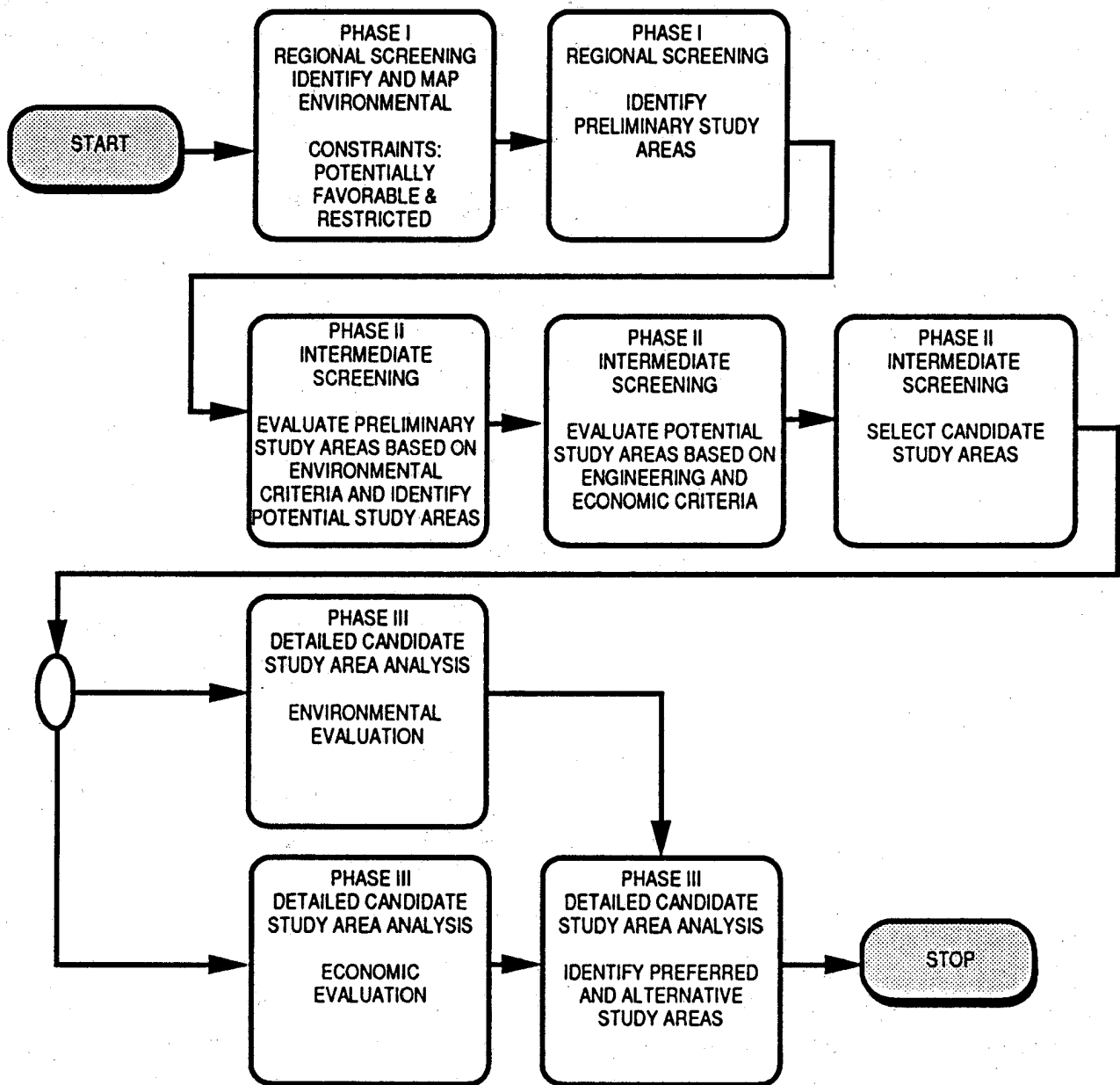


Figure 8.1.3-1 SITING STUDY PHASES

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Power Station**

- b. Identify Preliminary Study Areas within those areas rated potentially favorable based on the overall composite rating of all environmental constraints.
2. Phase II--Intermediate Screening and Ranking
- a. Evaluate and rate the Preliminary Study Areas based on specific environmental criteria to identify Potential Study Areas;
 - b. Evaluate the Potential Study Areas based on proximity or accessibility criteria for existing transportation, fuel delivery, and transmission systems as well as water sources for each plant type; and
 - c. Select Candidate Study Areas which are ranked most suitable for plant development.
3. Phase III--Detailed Study Area Analyses
- a. Rank the Candidate Study Areas based on numerical comparison rating and weighing system using specific environmental and engineering criteria;
 - b. Select Prime Study Areas which ranked most suitable for plant development;
 - c. Develop detailed engineering and cost information on the Prime Study Areas; and
 - d. With the Applicant's staff, recommend a Preferred Study Area and Alternate Study Area for plant development.

Each phase had a specific output or result which was documented, reviewed, and approved prior to initiation of the next phase. This procedure ensured consistency and focused on achieving overall study objectives.

8.1.4 Phase I--Regional Screening

In the Regional Screening phase the general environmental suitability of areas within the study area for siting either the CC or a gasification combined cycle (GCC) plant was determined. Areas favorable to development, and of approximately 13 km² (5 square miles) in size, were identified for further investigation.

The methodology involved screening and mapping the entire project study area according to two ratings--potentially favorable and restricted. The screening methodology involved examination of the study area based on environmental criteria or constraints. These criteria were grouped into major environmental categories and included:

1. Land Use Constraints,
2. Ecological Constraints,
3. Air Quality Constraints, and
4. Water Availability Constraints.

The regional screening process identified 38 Preliminary Study Areas for further investigation (Figure 8.1.4-1). These Preliminary Study Areas varied in size and shape, depending on both the configuration of the potentially favorable areas and the location of the infrastructure (existing systems and facilities) and transportation corridors. The configuration of these Preliminary Study Areas observed, wherever possible, the political, regulatory, and management boundaries that existed within the local area. The configuration process avoided crossing natural or manmade physical barriers. These Preliminary Study Areas were at least 13 km² (5 square miles) in size.

8.1.5 Phase II--Intermediate Screening

Intermediate screening evaluated the Preliminary Study Areas based on environmental and engineering/economic criteria and selected Potential Study Areas for detailed, site-specific analysis. This objective was accomplished in two steps. In the first step, the 38 Preliminary Study Areas from the regional screening results were evaluated based on specific environmental

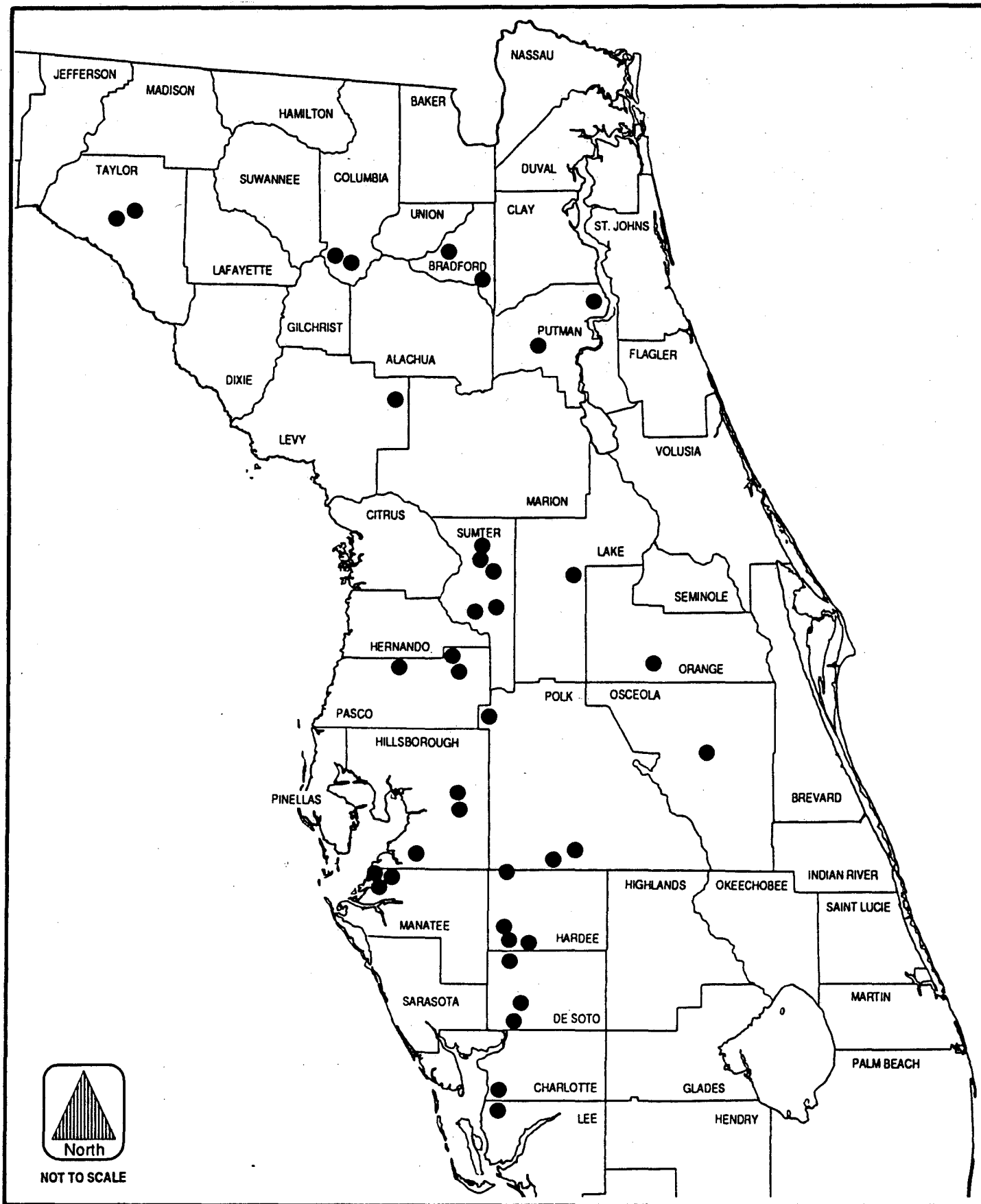


Figure 8.1.4-1 GENERAL LOCATION MAP OF PRELIMINARY STUDY AREAS - PHASE I REGIONAL SCREENING

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criteria. The criteria considered the specific differences in site and facility requirements for power plant development. The Preliminary Study Areas were screened and ranked in the following environmental categories:

1. Land use,
2. Water availability,
3. Geotechnical suitability,
4. Ecological considerations, and
5. Air quality.

The discipline rankings were composited into an overall environmental ranking of the Preliminary Study Areas, and the resulting 27 Potential Study Areas were then considered for further engineering/economic evaluation (Figure 8.1.5-1).

The second step of the intermediate screening process involved evaluation of engineering economic criteria which reflect generic cost factors for proximity or access to existing fuel delivery pipelines, rail, barge, or highway systems, transmission systems (230 kV and above), and cooling-water sources for the power supply option. The 27 Potential Study Areas were rated and ranked according to these criteria, and nine Candidate Study Areas were selected for more detailed analysis (Figure 8.1.5-2).

8.1.6 Phase III--Detailed Candidate Study Area Analysis

The Detailed Candidate Study Area Analysis involved three tasks:

1. Evaluate and rank the nine Candidate Study Areas based on environmental criteria to select and rank Prime Study Areas for further evaluation,
2. Evaluate these Prime Study Areas based on detailed engineering and economic criteria, and
3. Determine the Prime Study Areas for applicant review.

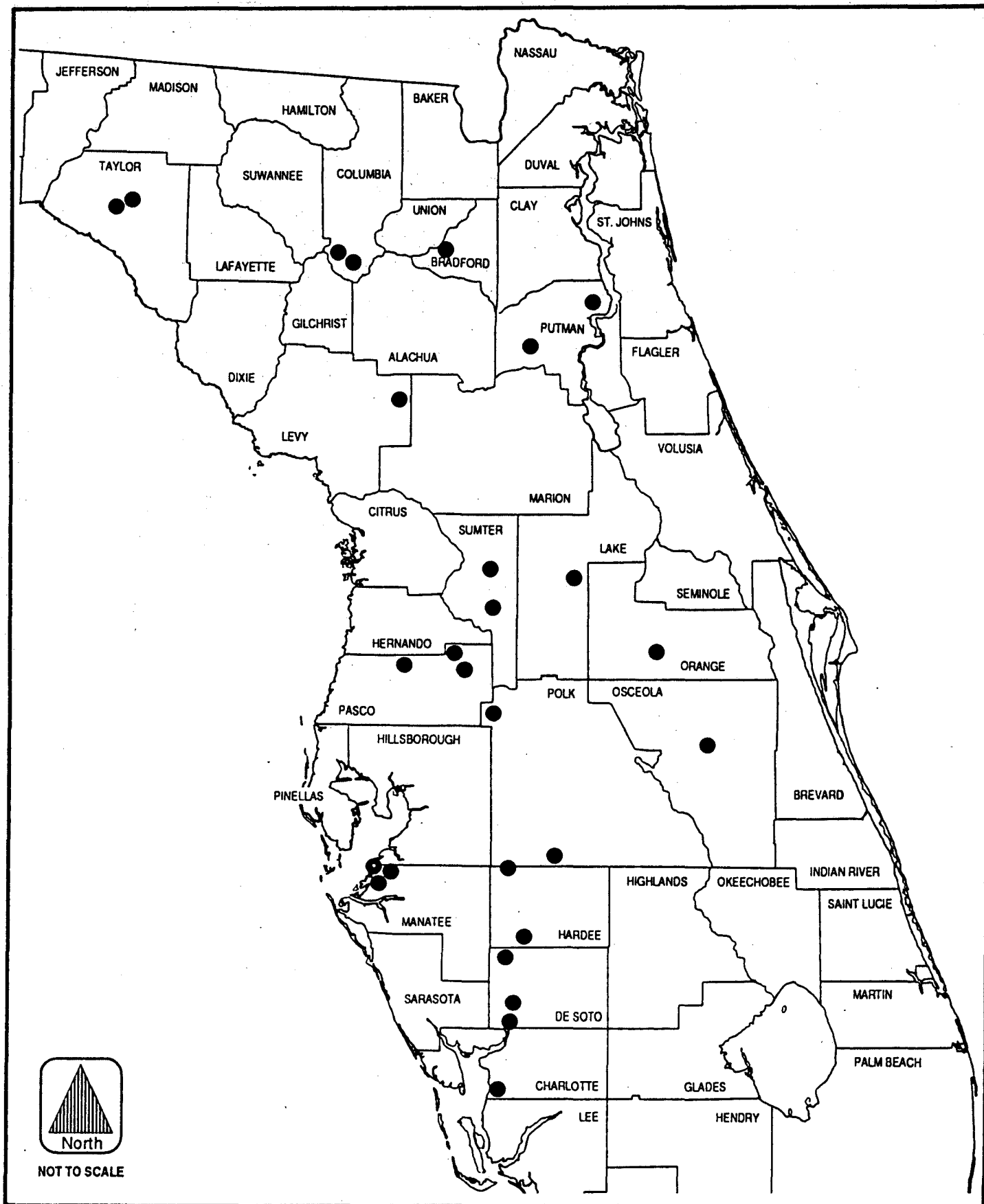


Figure 8.1.5-1 GENERAL LOCATION MAP OF POTENTIAL STUDY AREAS

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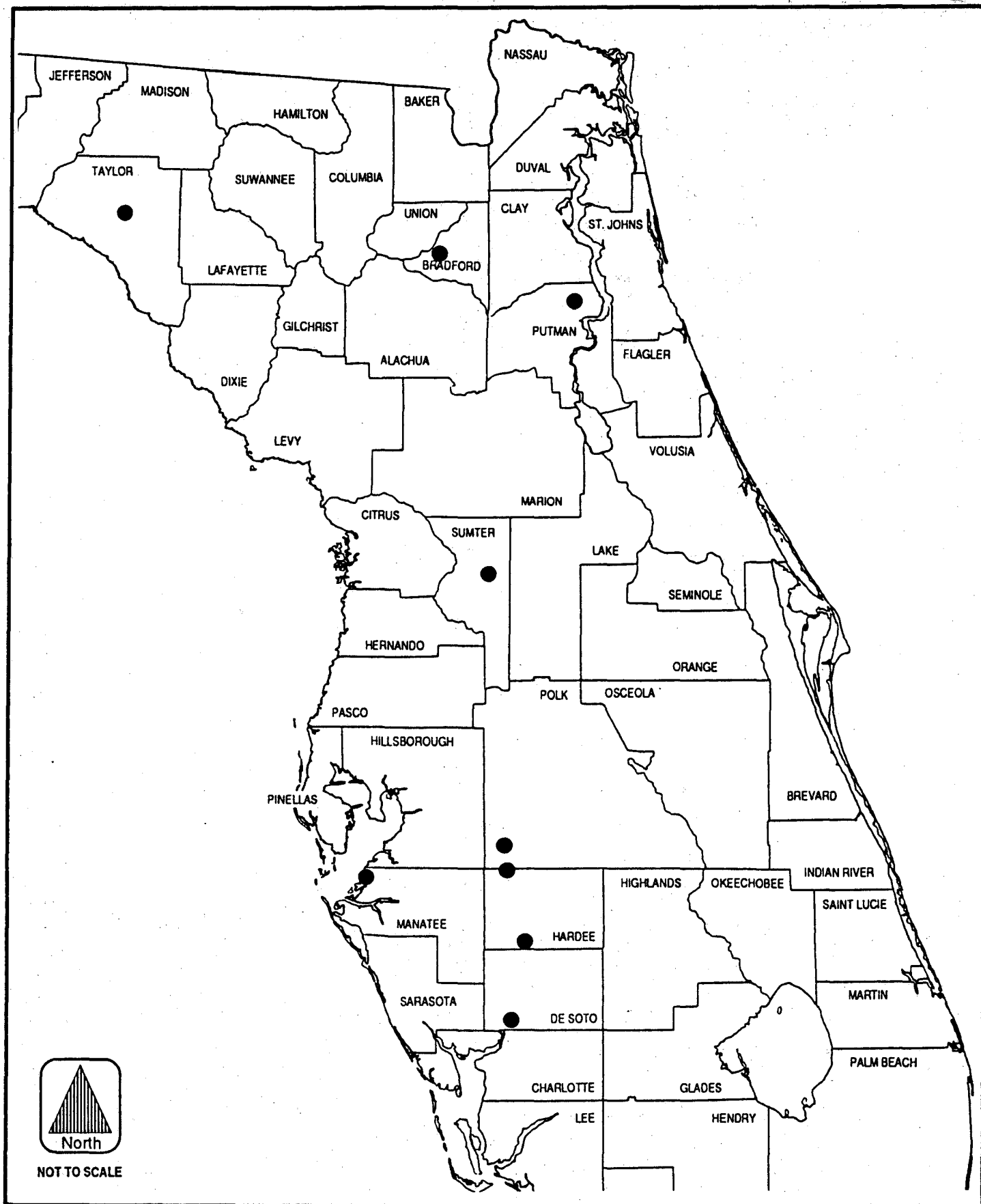


Figure 8.1.5-2 GENERAL LOCATION MAP OF CANDIDATE STUDY AREAS

Hardee Power Station

To accomplish the first task, the nine Candidate Study Areas were evaluated using an analytical technique that rates each site against four environmental disciplines: ecology, air quality, water resources, and socioeconomics and land use. These covered the range of potential environmental impacts resulting from the power plant development. To reflect the relative importance of each criterion, weights were used as a multiplier for each criterion rating.

In the second task, the nine Candidate Study Areas were subjected to a detailed cost study that evaluated natural gas delivery from the existing Florida gas transmission system, natural gas delivery from the proposed ANR Sunshine gasoline, fuel oil and coal delivery to the Candidate Study Areas, interconnecting to the Florida transmission grid system, transmission losses resulting from the preferred transmission interconnection scheme, and the benefit of the preferred transmission scheme to the applicant's long-range transmission plans.

In this evaluation, the costs for all of the criterion categories were developed or reconfirmed from the Intermediate Screening process for each of the Candidate Study Areas. A pair-wise analysis was conducted for each Candidate Study Area in each category. Numerical values obtained in the pair-wise were multiplied by weighing factors established from a pair-wise analysis conducted on each of the criteria, and a total score for each Candidate Study Area was determined.

The highest-rated areas were located in southwestern Polk County, northwestern Hardee County, and north-central Sumter County. Since the areas in Polk and Hardee Counties were similar (both areas are owned and controlled primarily by companies of the phosphate mining industry), these two general areas were combined into a single area. The Polk/Hardee area was then compared against the Sumter area to determine a preferred and alternative area. Both areas were determined to be equivalent on an economic basis.

8.1.7 Preferred and Alternative Study Areas

On March 10, 1988, the applicant's Board of Trustees selected the Polk/Hardee area as the Preferred Study Area to locate a power plant. The Sumter area was selected as the Alternative Study Area.

Properties within the Preferred Study Area were evaluated for ownership and the ability to supply contiguous land that could accommodate the following power plant requirements:

1. Power block and associated facilities on undeveloped land,
2. Cooling pond from reclaimed phosphate mining areas, or cooling towers on undeveloped land, and
3. Rail and road access.

Discussions with phosphate mining companies concerning a potential site resulted in the selection of the Agrico property located in both Polk and Hardee Counties as the preferred site. This property would allow the construction of a cooling pond from reclaimed phosphate mining areas. Also, the schedule for mining would coincide with the Applicant's requirements. The power station could be located adjacent to a cooling reservoir area and on unmined or undeveloped land.

8.2 PROPOSED SITE DESIGN ALTERNATIVES

8.2.1 Alternative Heat Rejection System

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.

8.2.1.1 System Criteria

Based on the current plant design, the following engineering criteria were established for the cooling system design and evaluation:

1. The system shall be capable of continuously rejecting 1.95×10^9 Btu/hour.
2. Cooling system water quality shall be maintained at a level satisfactory for continuous condenser cooling operation.
3. The system shall be optimized for the expected ambient conditions and performance characteristics and requirements of the various heat rejection systems.
4. The system shall be capable of supplying to the condenser a daily average water temperature of 35°C (95°F) or cooler at all times under design ambient conditions and 100% load. Additionally, the condenser back pressure shall not exceed 11.4 cm (4.5 inches) Hg.

8.2.1.2 Alternative System Designs

For the proposed plant site, two conceptual heat rejection system concepts were evaluated: a cooling reservoir and cooling towers. Given the inland location of the proposed project site, once-through cooling was not considered to be a feasible alternative, due to the difficulty of obtaining permits for such large quantities of water withdrawal and the potentially adverse environmental impacts associated with these water withdrawals.

For the two available heat rejection system concepts (i.e., reservoir or towers), five specific alternative designs were identified and evaluated:

1. A recirculating cooling water reservoir with makeup from Lower Floridan Aquifer wells,

2. A cooling tower with makeup from Lower Floridan Aquifer wells and tower blowdown discharge to the Peace River.
3. A cooling tower with makeup from Lower Floridan Aquifer wells and tower blowdown discharge to a percolation pond,
4. A cooling tower with makeup from Lower Floridan Aquifer wells and tower blowdown discharge to a deep injection well, and
5. A cooling tower with makeup from Lower Floridan Aquifer wells and tower blowdown discharge to the Payne Creek.

The five alternatives are described briefly below.

RECIRCULATING COOLING WATER RESERVOIR

In a recirculating cooling water reservoir system, water from the reservoir is continuously pumped through the condenser, where it picks up heat from the turbine exhaust steam and then returns to the reservoir. The reservoir water remains at or slightly above ambient temperature primarily through evaporative cooling. The cooling reservoir provides two critical functions: (1) it serves to collect, store and supply water for use in condenser cooling; and (2) it serves to remove excess heat through evaporative, radiant and other cooling mechanisms.

The proposed cooling reservoir, previously described in detail in Chapter 3, will be constructed on reclaimed phosphate mines and lands. To satisfy the engineering criteria previously identified in Section 8.2.1.1, approximately 230 ha (570 acres) of reservoir surface will be required.

Water makeup of the reservoir will include direct rainfall, runoff and seepage from the upland watershed and, as necessary, pumped Lower Floridan Aquifer well water. To facilitate the infrequent discharges which may be necessitated by extreme (wet) meteorological conditions, a reservoir overflow to Payne Creek will be designed. Given its storage capacity, the

cooling reservoir alternative would maximize water reuse and minimize Lower Floridan Aquifer water withdrawals.

COOLING TOWER WITH BLOWDOWN DISCHARGE TO PEACE RIVER

This alternative would use a counterflow, wood frame, rectangular mechanical draft cooling tower for waste heat rejection. In this mechanical draft cooling tower system, cooling water is pumped from the cooling tower basin through the condenser to condense the turbine exhaust steam. This heated water is returned to the cooling tower where it is distributed over the tower fill and allowed to cascade down through the tower. Large fans pull air through the tower fill; heat exchange occurs by evaporation and convection.

Cooling tower water losses would be replaced by softened Lower Floridan Aquifer water. This cooling tower alternative would route tower blowdown to a percolation pond. Anticipated Lower Floridan Aquifer water quality and water softening performance would allow approximately 10 cycles of concentration. Blowdown from the towers (necessary to maintain operational water quality within the tower) would be routed to the Peace River. Given the site location, this would require construction of a 30 cm (12 inch) diameter pipe approximately 16 km (10 miles) to the Peace River.

COOLING TOWER WITH BLOWDOWN DISCHARGE TO PERCOLATION POND

This cooling tower alternative would route tower blowdown to a percolation pond. Based on a preliminary, conceptual design evaluation of the percolation pond, a 101 to 162 ha (250 to 400 acre) pond would be required to percolate the tower blowdown, depending on the pond depth and the toe drain/seepage control system used. This percolation pond would discharge tower blowdown to the surficial aquifer. During extremely wet periods, a surface discharge from the pond would have to be provided.

COOLING TOWER WITH BLOWDOWN DISCHARGE TO DEEP INJECTION WELL

This cooling tower alternative would route tower blowdown to a deep injection well. This well would be at least 61 cm (24 inches) in diameter

and at least 914 to 1,230 m (3,000 to 4,000 ft) deep. Difficulties could be encountered in delineating deep strata that are capable of receiving adequate quantities of tower blowdown water.

COOLING TOWER WITH BLOWDOWN DISCHARGE TO PAYNE CREEK

The cooling tower alternative would route tower blowdown to Payne Creek. Given the relatively small watershed upstream of the plant site [approximately 65 km² (25 square miles)], Payne Creek is subject to regular and extended periods of very low flow. During these periods, there would be virtually no stream dilution of the continuous tower blowdown discharge. In the absence of sufficient mixing and dilution, water quality criteria could be exceeded due to tower discharges. Given these regular low flow occurrences in Payne Creek at the plant site location, this design alternative was not considered feasible and was given no additional consideration or evaluation.

8.2.1.3 Alternative Systems Environmental Evaluation

The environmental impacts of the proposed cooling water reservoir alternative have been previously discussed in Chapters 4 and 5. Based on the information presented therein, the proposed cooling water reservoir system has acceptable environmental impacts.

In comparison, the cooling tower alternatives will have greater environmental impacts in the areas of groundwater withdrawal impacts and blowdown disposal alternatives.

Based on the water balance previously presented in Figure 3.5-3, the projected average annual cooling water reservoir makeup requirement is estimated to be 1.76 mgd. The reservoir serves as an effective water management facility to minimize the total withdrawal demand placed on the Lower Floridan Aquifer groundwater system when compared to the other alternatives. The cooling reservoir alternative will have no off-site surface discharge except during extreme meteorological conditions such as

major frontal systems and hurricanes. The cooling water reservoir can be constructed and operated with minimum adverse environmental impacts.

The required cooling tower makeup is estimated to be 2.40 mgd for the same station size and load factor assumed for the reservoir alternative. Therefore, the cooling tower alternatives will require 35% more groundwater compared with the reservoir alternative. In addition, under projected average annual load conditions, cooling tower blowdown discharge is estimated to be 0.4 mgd (0.6 cfs); under maximum annual load conditions, cooling tower blowdown discharge is estimated to be 1.35 mgd (2.09 cfs).

The direct discharge of the cooling tower blowdown to the Peace River would necessitate the issuance of a mixing zone. The Peace River will be subject to period low flow conditions; for example, the 7-day, 10-year low flow for the Peace River near Zolfo Springs is estimated to be 54 cfs. Given a maximum cooling tower blowdown discharge rate of 2.09 cfs, tower blowdown discharge would be approximately 3.9% of the 7-day, 10-year low flow. Therefore, the Peace River will have sufficient flow to allow adequate mixing and dilution of the tower blowdown discharge to meet Class III water quality criteria within the maximum mixing zone length of 800 meters. Given the flow, water quality and biological conditions of the Peace River, discharge of cooling tower blowdown to the Peace River would not have unacceptable adverse environmental impacts.

Discharge of the blowdown to a percolation reservoir may result in unacceptable impacts on surficial aquifer water quality. Discharge of the blowdown to deep injection well may be very difficult or infeasible at the project site due to low transmissivity rock formations at depths greater than 3,000 ft. Either type of groundwater discharge (i.e., to the surficial to deep formations would require extensive studies to demonstrate engineering and environmental feasibility.

8.2.1.4 Preferred Heat Rejection System Alternative

Based on the information presented above, the preferred heat dissipation system alternative is a closed cycle cooling system that utilizes a cooling water reservoir constructed on reclaimed phosphate mined lands. This is the preferred alternative because the lack of any significant adverse environmental impacts associated with the proposed reservoir system; the greater potential for adverse water quality and quantity impacts associated with the cooling tower alternatives; and the decrease groundwater demand for the cooling reservoir alternative. Therefore, all planning and analysis presented in this SCA/EA have been based on the preferred alternative of a cooling water reservoir constructed on reclaimed phosphate mined lands.

Given the various environmental and engineering issues discussed above, the secondary alternative would be cooling towers with blowdown discharge to the Peace River. Environmental data collection studies of the Peace River including stream flow, water quality and aquatic ecology studies, and preliminary engineering evaluations, have been conducted in support of the cooling tower blowdown discharge alternative to the Peace River (see SECI Combined Cycle Environmental Licensing Plan of Study). Peace River flow conditions would be sufficient to allow adequate mixing and dilution within the maximum mixing zone length of 800 meters. This secondary alternative could be designed, constructed and operated without adverse environmental impacts.

8.2.2 Biological Fouling Control Alternatives

Biocide treatment of the recirculation cooling water is necessary to control biological fouling of the condensers, the associated piping, and related structures. Biocide alternatives include chlorination, bromochlorination, chlorine dioxide and ozone.

Chlorinization is the most widely used, accepted and cheapest biocide treatment currently used in the power industry. Alternative biocides (e.g., bromochlorination, chlorine dioxide and ozone) involve high

operating costs and, therefore, have not gained wide acceptance for treatment of large volumes of recirculating cooling water.

Given the large volume of the reservoir, any residual chlorine in the circulating water discharge will be "consumed" within the reservoir soon after discharge into the reservoir. By the time reservoir water reaches and seeps through the reservoir sides, there will be virtually no remaining residual chlorine. Given this factor and the infrequency of any surface discharge from the reservoir (during extreme meteorological events only), there will be no off-site impact due to chlorination. Therefore, alternative biocides do not provide any environmental advantage in this circumstance.

Chlorine is the preferred biocide for biological fouling control in the recirculation cooling water system. Chlorine use will be minimized by practicing shock chlorination, in which chlorine is periodically fed to the condenser system. The procedures for use of chlorine are discussed in Chapter 3.

8.2.3 Water Supply/Intake Alternatives

The proposed water supply for cooling water reservoir makeup and plant/potable use is groundwater from Lower Floridan Aquifer wells. Alternative water supplies potentially include withdrawals from Payne Creek or Peace River.

Both surface water supplies are subject to periodic low flow conditions. Payne Creek, near the plant site, will be subject to relatively frequent zero or near-zero flow. Therefore, Payne Creek is not an acceptable alternative.

As a continuous water supply, the Peace River will be subject to periodic low flow conditions; the 7-day, 10-year low flow for the Peace River near Zolfo Springs is estimated to be 54 cfs. Based on the water balance previously presented in Figure 3.5-1, the maximum daily plant makeup

requirement is estimated to be 7.7 mgd (or 11.9 cfs). Thus, satisfaction of this demand by withdrawal from the Peace River would require the withdrawal of approximately 22% of the 7-day, 10-year low flow. Withdrawal of the cooling reservoir makeup and plant waters has the potential for adverse flow or biological impacts during these low-flow conditions. Thus, withdrawal of water requirements from Peace River is not considered an acceptable alternative.

8.2.4 Chemical Waste and Wastewater Treatment Alternatives

Each waste stream was evaluated to determine the type of treatment needed and the waste stream's suitability for reuse. The major wastewater streams and the treatment, disposal or reuse alternatives are discussed individually below.

8.2.4.1 Steam Cycle

The proposed method of boiler blowdown disposal is discharge to the cooling reservoir and reuse in the cooling system. Alternatives for boiler blowdown wastewater disposal include discharge to a percolation pond or Payne Creek. However, since boiler blowdown will have a relatively low dissolved solids content, it can be reused in the cooling water system with no adverse engineering or environmental impacts. This reuse will both reduce or minimize total potential plant discharge and will reduce plant makeup requirements. Therefore, the preferred alternative is discharge to the cooling reservoir for reuse.

8.2.4.2 Makeup Water Demineralization

After pH adjustment, demineralized regenerant wastewater will be routed to the cooling water reservoir. Again, alternative disposal scenarios (i.e., discharge to Payne Creek) may have potential environmental impacts and offer no significant engineering or economic advantages. Therefore, the preferred alternative is discharge to the cooling reservoir for reuse.

8.2.4.3 Plant Drains

Plant drains are intermittent and may have a high oil and grease or dissolved solids content. However, water from the drain system will be routed through an oil-water separator and it is anticipated that plant drain wastewaters will then be of acceptable quality for reuse; therefore, these wastewaters will be routed to the cooling reservoir. Again, alternative disposal scenarios (i.e., discharge to Payne Creek) have potential for environmental impacts and offer no significant engineering or economic advantages. Therefore, the preferred alternative is to discharge to the cooling reservoir for reuse.

8.2.5 Plant and Sanitary Wastewater Discharge Alternatives

Plant and sanitary wastewater will be discharged to the cooling reservoir for reuse.

Disposal alternatives include discharge to Payne Creek, discharge to the Peace River, discharge to a deep injection well, or discharge to a percolation pond. All alternatives involve significant capital and operational expenses and may have significant environmental impacts. Given the lack of any significant environmental impacts associated with wastewater discharge to the proposed reservoir, the preferred alternative is discharge of plant and treated sanitary wastes to the cooling reservoir for reuse.

8.2.6 Solid Waste Disposal

Solid wastes will consist of general trash, sanitary waste treatment sludge, pretreatment and demineralizer regeneration sludges. Quantities will be small and could be disposed off site in an approved landfill. No solid combustion waste will be produced by the generation of power at the Hardee Power Station. Combustible construction wastes (e.g., paper, wood, etc.) will be burned on-site in accordance with applicable regulations.

8.2.7 Multiple Uses of the Plant

The Hardee Power Station will utilize reclaimed phosphate mining land for the cooling system. This multiple use will have the advantage of reducing overall environmental impacts that would otherwise have occurred due to reservoir construction (see Chapters 7 and 10).

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 butane or synthetic gas may serve as fuel sources. The Hardee Power Station will also have the ability to utilize medium-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 would be separately permitted and constructed as an associated facility of the Hardee Power Station. 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. In addition, a discussion of butane as a potential alternative fuel source has been provided.

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, basically, a process of combining the carbon in coal with steam and oxygen to produce a product gas composed primarily of

hydrogen and carbon monoxide. Although the gasification process affects the overall plant design, the gasification step is only one relatively small part of the overall plant.

The gasifier most widely used throughout the world is a fixed-bed design. Most recent research and development of gasifiers for electrical power generation, however, has focused on the entrained-flow designs (i.e., those by Texaco, Shell, Dow Chemical). 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 pressure gasification is typically represented by Lurgi's 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:

- o High thermal efficiency by counter current mode of operation;
- o High direct methane yield for high-Btu syngas production; and
- o Low oxygen requirement.

Disadvantages of fixed-bed gasifiers include:

- o Strict feed coal requirements in size and caking tendency;
- o Excessive steam requirement for control of ash clinkering;
- o Extensive wastewater treatment required by formation of coal tar and other hydrocarbons; and
- o 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:

- o Wide range of coal quality and fines can be used;
- o Throughput is high;
- o Operation is flexible;
- o Reliability and safety is good because of simplicity and high solid inventory;
- o Mixing of bed material alleviates local overheating;
- o Gasifier configuration and operation is simple;
- o Introduction and withdrawal of solids from gasifier is easy; and
- o Raw gas contains no tars.

Disadvantages of fluidized-bed gasification are:

- o High sensible heat loss due to high exit gas temperature;
- o High fines carry over;
- o High carbon content in ash;
- o Large volume of fluidizing media is required; and
- o Caking coal must be pretreated.

ENTRAINED-FLOW GASIFIERS

Coal particles fed into an entrained-flow gasifier are suspended or entrained by the reacting gases. Partial oxidation occurs faster and at higher temperatures and pressures than in the other two major types of gasifiers. 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. As a result, heavy tars, oils, and phenols are not produced, reducing concern for by-product 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 water-cleaned of particulate matter and condensate. The particulate-laden water is sent to a clarifier for solids removal. The separated clarifier solids are sent to disposal along with the slag, while the clarifier effluent is generally treated and recycled to the gas cleaning system. Following cooling, the gas passes to a desulfurization unit where gaseous sulfur compounds, primarily hydrogen sulfide, are absorbed from the syngas by a solvent. The sulfur compounds pass to a Claus unit, which converts them to elemental sulfur to be stored or sold as a by-product. Tail gas from the Claus unit is incinerated. The clean syngas is transferred to gas turbine combustors.

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 by-product generation during pilot and developmental projects.

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 Dow Chemical Company processes. Basically, the gasifier is a relatively small vessel with

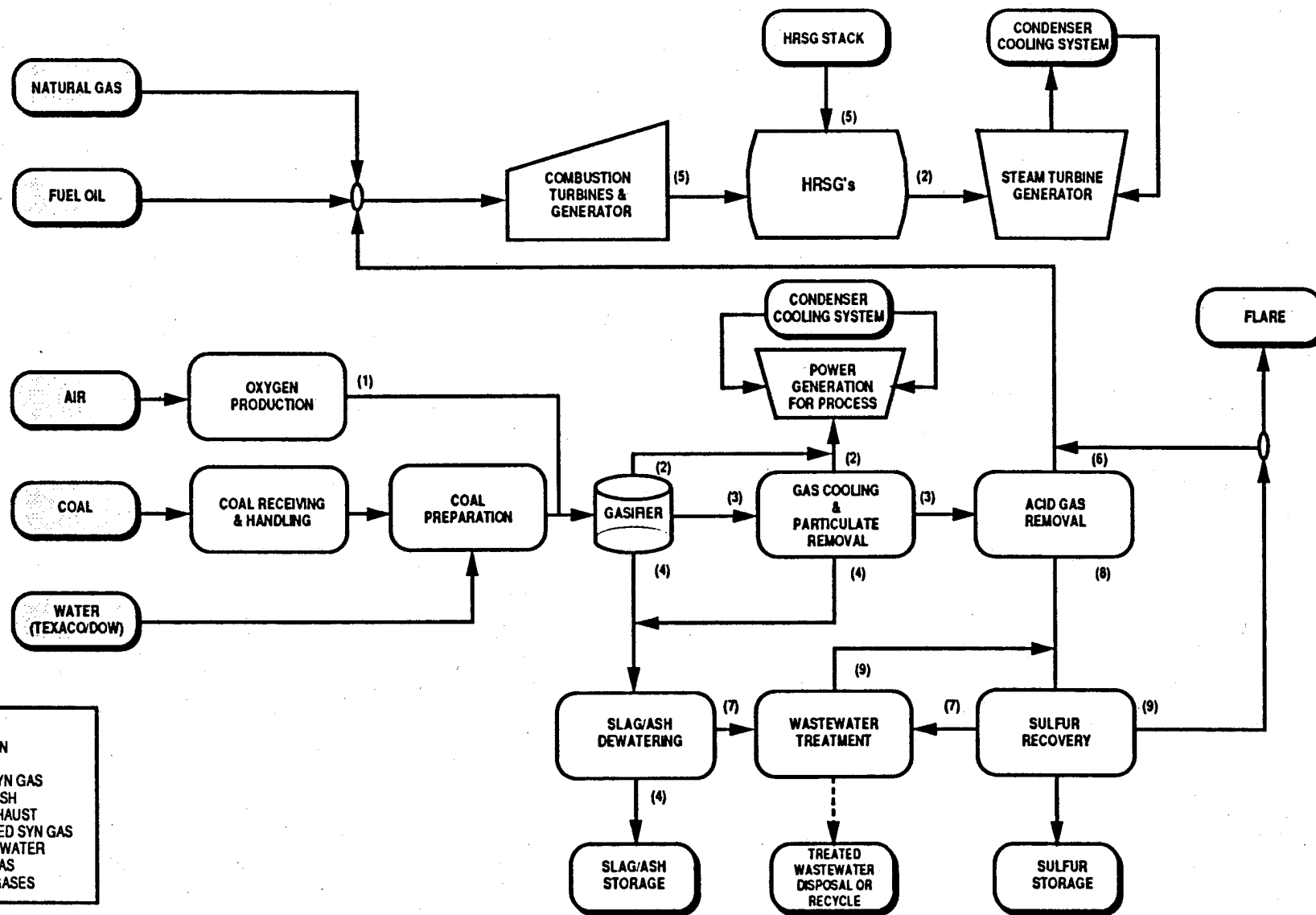


Figure 8.3.1-1 BLOCK DIAGRAM OF ENTRAINED FLOW COAL GASIFICATION PLANT AND COMBINED CYCLE POWER PLANT

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combustion burners where coal, oxygen, and steam are injected in controlled proportions. Partial combustion with oxygen occurs at pressures of 35 to 42 kg/cm² (500 to 600 pounds per square inch) gauge and high temperatures [1,260 to 1,540°C (2,300 to 2,800°F)] to produce a medium-Btu raw syngas consisting mainly of CO, H₂, CH₄, and some CO₂. The generalized formula for coal gasification is as follows:



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. This facility would be capable of producing 99% pure oxygen, which would allow the oxygen plant to produce argon as a marketable by-product.

Raw syngas produced during coal gasification is cooled to facilitate gas cleaning prior to combustion and to recover heat that can be used to generate steam for the gasification process. Several methods and devices are available to recover heat and partially cool raw syngas, including Quench Syngas Coolers, Radiant Syngas Coolers, Convection Syngas Coolers. The actual mode of cooling is determined by the type of downstream processing and by the end use of the synthetic gas. The quench mode is usually selected for the production of hydrogen, where the carbon monoxide in the raw syngas is reacted with steam to produce additional hydrogen. The radiant or convective cooler mode of operation is selected for applications which do not require adjustment of hydrogen to carbon monoxide ratios in the gas.

The effluent water from the gasification process consists of purge streams removed from the process to limit the buildup of dissolved minerals and gases (particularly ammonia) in the gasifier circulating water system. Major sources of wastewater from coal gasification include the gray waste stream and ammonia-laden condensate produced during hot syngas cooling. However, the cooling system effluent can be recycled back upstream to the

gasifier. 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, CO_2 , HCN) are removed from the raw syngas prior to combustion 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 SO_2 and COS to liquid elemental sulfur that can be stored or sold as a by-product. Remaining unconverted sulfur compounds in the tail gas from the sulfur recovery unit are further cleaned in a tail gas treatment system. Vent gas from the SCOT unit can be routed to the combustion turbine or to an incinerator and burned. Overall sulfur removal rates from raw syngas by the desulfurization process generally range from 95 to 99%.

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 Dow Chemical. 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.

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)	594,340	See Note 1
Heat Input (mm Btu/hr)	6,300	Reference 1
Coal Utilization (tons/day)	6,873	See Note 2
Coal Delivery (rail cars/week)	458	See Note 3
COAL CHARACTERISTICS		
Heat Content HHV (Btu/lb)	11,000.00	Reference 1
Ash Content (%)	10.00	Reference 1
Sulfur Content (%)	4.50	Reference 1
PERFORMANCE		
Net Heat Rate (Btu/Kw)	10,600.00	Reference 1
AIR EMISSIONS		
1. FLARE STACK		
NOx (lb/hr)	0.15	Reference 2
CO (lb/hr)	1.39	Reference 2
SO2 (lb/hr)	1.39	Reference 2
H2SO4 Mist (lb/hr)	0.04	Reference 2
Hg (lb/hr)	4.65E-07	Reference 2
Be (lb/hr)	9.29E-07	Reference 2
F (lb/hr)	1.55E-04	Reference 2
Pb (lb/hr)	6.20E-06	Reference 2
PM (lb/hr)	1.08	Reference 2
2. Process Fugitive Emissions		
CO (lb/day)	28.81	References 3 and 4
H2S (lb/day)	10.16	References 3 and 4
COS (lb/day)	0.26	References 3 and 4
NH3 (lb/day)	11.17	References 3 and 4
HCN (lb/day)	1.67E-03	References 3 and 4
HC (lb/day)	1.67E-04	References 3 and 4
3. Fugitive Dust		
Coal Handling - & Storage - TSP (lb/day)	274	See Note 4
Coal Handling Storage - PM10 (lb/day)	205	See Note 4
Slag/Ash Handling & Storage - TSP (lb/day)	178	See Note 4
Slag/Ash Handling & Storage - PM10 (lb/day)	153	See Note 4

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 (gal/day)	715,700	See Note 5
Process (gal/min)	2,004	References 3 and 4
WASTEWATER DISCHARGE		
Treated Effluent (gal/min)	389	Reference 2
Demineralizer Regenerant (gal/min)	48	Reference 2
Misc. (gal/min)	15	Reference 2
BY-PRODUCTS		
Slag/Ash (tons/day)	1,375	See Note 6
Sulfur (tons/day)	294	See Note 7
Water Treatment Sludges (tons/day)	2	Reference 2

References: 1. ESE, 1988
 2. EPRI, 1989
 3. EPRI, 1984
 4. Fluor, 1986

Notes:

1. Calculated from heat rate and heat input.
2. Calculated based on heat input and coal heat content.
3. Calculated based on 105 tons/rail car.
4. Calculated from maximum coal utilization and site layout.
5. Calculated based on gasification plant size and cooling reservoir use.
6. Calculated based on ash content and 50% moisture in slag/ash.
7. Calculated based on 95% sulfur removal.

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 tail gas flare or incinerator, process fugitive emissions and fugitive dust emissions. The emission estimates from these sources have been quantified in Table 8.3.2-1.

The tail gas flare would be used to incinerate vent gas released during slag/ash removal and gas leaks collected across relief valve seats. Vent gas from sulfur recovery could be routed to the combustion turbines and subsequently oxidized. The flare would also be used during start-up, shutdown, emergency relief, and upset conditions. During 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 emissions would result from small albeit numerous leaks from equipment, i.e., valves, pumps, compressors, and connections. Fugitive particulate 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. 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 98%. Other emissions would be typical of natural gas firing.

8.3.2.3 Wastewater

The wastewater streams of a gasification plant primarily consist of grey water from slag/ash quenching and particulate removal, and condensates from

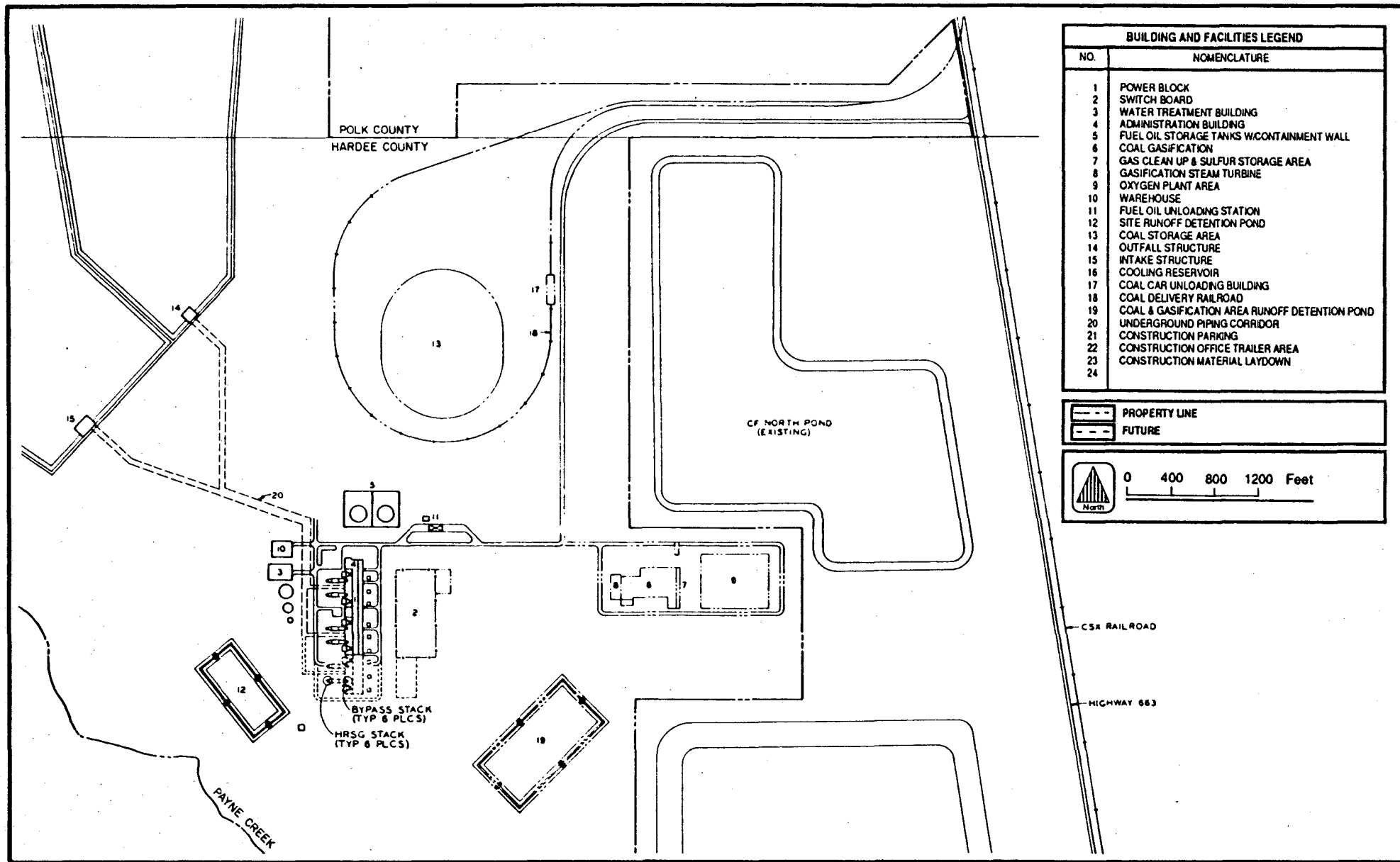


Figure 8.3.2-1 CONCEPTUAL LAYOUT OF A COAL GASIFICATION FACILITY AT THE SITE

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the gasification process, raw gas cleaning 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 By-products

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 by-products 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 (EPRI, 1986). EPRI is currently looking at artificial reefs as suitable disposal sites for slag materials. 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 by-product storage facility of approximately 60 ha (150 acres) based on a capacity factor of 72% over 30 years. Ideally, the applicant would attempt to sell the by-product. By-product material would be placed in a storage area using the best management practices for utility solid by-products storage sites.

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 by-products 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.

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

8.3.3.1 Air Emissions Impacts

The potential air quality impacts from a coal gasification plant are primarily associated with the tail gas flare. An intermittent source of air emissions would result from start-up and emergency conditions where raw synthetic gas would be incinerated in a 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% and 99.13%, respectively. Thus, flaring of raw synthetic gas or acid gas having high sulfur contents would be unlikely.

The maximum predicted impacts for those sources which operate continuously are expected to be less than the PSD increments and 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

To evaluate and predict cooling reservoir performance (e.g., temperature and evaporation) under the increased thermal loading associated with gasifier operation, a revised reservoir thermal analysis was performed using the monthly energy budget/equilibrium temperature model, previously described in Section 5.1.1.

For this analysis, the previous modeling parameters and data were used, except for the plant and gasifier thermal load to the reservoir (see Table 8.3.3-1). Based on a review of available process information, the increase in total required heat rejection to the reservoir was estimated to be approximately 37%. Thus, the total condenser circulating cooling water flow was increased by 37% to accomplish the required heat rejection, based

Table 8.3.3-1. Estimation of Evaporation from the Proposed SECI Cooling Reservoir based on Maximum Annual Load Factor and Coal Gasifier Cooling Requirements (Page 1 of 2).

Item	Units	Jan	Feb	Mar	Apr	May	Jun	Jul
Average Air Temperature	Degrees F	61.8	63.1	67.1	72.1	76.6	80.2	81.3
Average Dew Point Temperature	Degrees F	53	54	57	60	67	72	73
Relative Humidity	%	73	72	70	66	72	76	76
Daily Average Wind Speed	mph	7	8	9	8	7	6	6
Wind Speed Function		104.3	114.8	126.7	114.8	104.3	95.2	95.2
Net Short Wave Radiation	BTU/ft2/day	1,210	1,447	1,754	1,994	2,205	2,124	1,976
Cloud Cover Fraction	%	53	47	48	47	46	58	63
Net Incoming Radiation	BTU/ft2/day	3,669	3,911	4,335	4,709	5,039	5,133	5,048
Water Vapor Pressure	mm Hg	10.2	10.6	11.8	13.2	16.8	19.9	20.6
Equilibrium Temperature	degrees F	64.2	65.7	68.5	72.2	77.8	87.1	89.0
Saturated Vapor Pressure	mm Hg	15.2	16.1	17.7	20.1	24.2	32.6	34.7
Evaporation at Equilibrium Temperature	Gal per day Inches/month	1,482,870 2.9	1,795,370 3.5	2,125,580 4.2	2,252,370 4.4	2,194,650 4.3	3,437,870 6.8	3,816,850 7.5
Plant Operational Load Factor	%	100	100	100	100	100	100	100
Minimum Operational Res. Temperature	degrees F	73.7	74.1	75.5	79.4	84.8	93.4	95.0
Saturated Vapor Pressure	mm Hg	24.8	25.3	26.8	30.3	36.1	47.1	49.5
Evaporation at Heated Temperature	Gal per day Inches/month	4,329,990 8.5	4,798,530 9.4	5,404,020 10.6	5,581,970 11.0	5,723,880 11.3	7,363,010 14.5	7,823,190 15.4

Note: Maximum delta T across condenser = 20 degrees F
Maximum Circulating Water Pump Rate = 267,150 gallons/minute
Cooling Reservoir Size = 570 acres

Table 8.3.3-1. Estimation of Evaporation from the Proposed SECI Cooling Reservoir based on Maximum Annual Load Factor and Coal Gasifier Cooling Requirements (Page 2 of 2).

Item	Units	Aug	Sep	Oct	Nov	Dec	Summary
Average Air Temperature	Degrees F	81.6	80.2	74.7	67.4	62.7	--
Average Dew Point Temperature	Degrees F	73	72	66	58	54	--
Relative Humidity	%	75	76	74	72	73	--
Daily Average Wind Speed	mph	6	6	7	7	8	--
Wind Speed Function		95.2	95.2	104.3	104.3	114.8	--
Net Short Wave Radiation	BTU/ft2/day	1,828	1,672	1,480	1,317	1,110	--
Cloud Cover Fraction	%	61	60	47	46	52	--
Net Incoming Radiation	BTU/ft2/day	4,896	4,694	4,267	3,896	3,589	--
Water Vapor Pressure	mm Hg	20.6	19.9	16.2	12.3	10.6	--
Equilibrium Temperature	degrees F	83.8	80.0	72.6	67.6	63.9	--
Saturated Vapor Pressure	mm Hg	29.4	26	20.3	17.1	15.1	--
Evaporation at Equilibrium Temperature	Gal per day	2,382,150	1,651,260	1,215,950	1,423,560	1,468,940	2,103,950 Gallons per day
	Inches/month	4.7	3.2	2.4	2.8	2.9	49.6 Inches per year
Plant Operational Load Factor	%	100	100	100	100	100	100
Average Operational Pond Temperature	degrees F	96.1	92.8	85.8	81.5	77.7	--
Minimum Operational Pond Temperature	degrees F	90.6	87.4	80.5	76.5	72.6	--
Saturated Vapor Pressure	mm Hg	43.2	39	31.3	27.3	24.1	--
Evaporation at Heated Temperature	Gal per day	6,117,790	5,170,350	4,478,270	4,448,620	4,406,820	5,470,540 Gallons per day
	Inches/month	12.0	10.2	8.8	8.7	8.7	129.0 Inches per year

Note: Maximum delta T across condenser = 20 degrees F
Maximum Circulating Water Pump Rate = 267,150 gallons/minute
Cooling Reservoir Size = 570 acres

on an allowable water temperature increase of 11°C (20°F) across the plant and gasifier condensers.

During maximum operating conditions the maximum predicted average monthly discharge condition is 35°C (95.0°F) during July. Under similar maximum load conditions without the gasifier, the predicted July discharge condition is 33.7°C (92.6°F). Under these conditions daily variations of up to 1°C (2°F) can be expected. Thus, at 100% load during July, the maximum daily reservoir discharge temperature could be approximately 36.1°C (97°F).

Unless the plant and/or gasifier designs were modified to incorporate this higher temperature, some decrease in plant efficiency could be encountered during these extreme conditions. This potential decrease in plant efficiency could be avoided or mitigated by the incorporation of helper cooling towers to reduce the circulating water temperature prior to discharge to the reservoir.

Under this 100% load gasifier scenario, total annual evaporation from the pond is estimated to average 5.5 mgd. Under similar operating/load conditions without the gasifier, total annual evaporation from the reservoir is estimated to average 4.8 mgd. Thus, with the gasifier alternative, total evaporative losses and the associated reservoir makeup requirements will increase by 0.7 mgd or approximately 15%. This increased demand would have to be supplied by additional withdrawals from the Lower Floridan Aquifer wells. Any adverse groundwater impact due to the increased water withdrawal and the potential increase in the size of the cone of the depression surrounding the well field can be avoided or mitigated by increasing the number of wells or by modifying the well field geometry.

8.3.3.3 Wastewater

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 390 gpm or 0.56 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 Hardee Power Station 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 By-Product Impacts

By-products 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 by-product; 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 by-products 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 by-product storage facility will require a land area of approximately 61 ha (150 acres) over a lifetime expectancy of 30 years for the gasification facility. Roughly 1,248,000 kg (1,375 tons) per day of slag and ash would be generated, which translates to a maximum of 957 m³ (33,782 ft³) per day and an average of 689 m³ (24,323 ft³) per day. These calculations are based on anticipated plant syngas requirements and physical characteristics for maximum dry density and interconnected porosity of slag material.

USEPA (USEPA, 1986) data have demonstrated that slag by-products from entrained-flow coal gasifiers are non-hazardous based on 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 Hardee Power Station site in an environmental suitable manner. As gasification designs improve in the future, this technology may

become increasingly viable from economic, operational and environmental stand points. Any site specific environmental constraints could be overcome by proper design.

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- U.S. Environmental Protection Agency (USEPA). 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.
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CHAPTER 9

COORDINATION

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9.0 COORDINATION

Federal, state, regional, and local agencies as well as the general public were contacted to provide input for the Hardee Power Station Project and associated facilities. These contacts involved both formal, multiple-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.

- o FDER Interagency Meeting:

- September 29, 1988: Tallahassee, Florida

- Purpose: to seek comment on proposed project, in particular the Plan of Study

- o REA Interagency Meeting:

- December 20, 1988: Wauchula, Florida

- Purpose: to seek agency comment on proposed project including identification of key issues

- o REA Public and Scoping Meetings:

- December 20, and 21, 1988: Wauchula and N. Fort Myers, Florida, respectively

- Purpose: to seek input on proposed project including identification of key issues

- o Transmission Line Public Workshops:

- February 20, 21 and 23, 1989: Wauchula, Arcadia and N. Fort Myers, Florida, respectively

- Purpose: to seek input on transmission line corridor selection process and potential candidate corridors

Table 9.0-1 presents an overall list of agency and public organization contacts.

Table 9.0-1. Hardee Power Station Agency and Public Organization Contacts

DATE	AGENCY	PURPOSE	CONTACT
1988			
3/17	Sumter County Property Appraiser	Tax Assessment	R. Hawkins
3/18	Polk County Commission & Economic Development	Describe Combined Cycle Project (CCP)	L. Libertore, <u>et al.</u>
3/22	U.S. Environmental Protection Agency (EPA)	Cooling Reservoir Considerations	C. Kaplan
3/24	Florida Department of Natural Resources (FDNR)	Cooling Reservoir on Reclaimed Lands	R. Bushey, <u>et al.</u>
3/28	Florida Department of Commerce (FDOC)	Economic Development Funds	B. Merrill, <u>et al.</u>
3/28	Polk County Planning Department	Describe CCP	R. Borchers, <u>et al.</u>
3/28	Polk County Zoning Department	Power Plant and Transmission Line Zoning	M. Paules
3/28	Polk County Codes Division	Local Reclamation Ordinances	D. Robertson
3/29	DeSoto County Commissioner	Describe CCP	K. Roan
3/29	Hardee County Commissioners	Describe CCP	B. Albritton, <u>et al.</u>
3/31	Sumter County Commissioners	Describe CCP	T. Blackman, <u>et al.</u>
4/1	Lake County Planning Department	Describe CCP	G. Burhans
4/5	Rural Electrification Administrator (REA)	Describe CCP State/Federal Permitting Requirements	R. Quigel
4/12	Hardee County Industrial Development Authorities	Economic Development Funds, Taxes Assessment	J. Davis

Table 9.0-1. Hardee Power Station Agency and Public Organization Contacts
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DATE	AGENCY	PURPOSE	CONTACT
4/13	Lee County Commissioner	Describe CCP	B. Fussell
4/13	Charlotte County Commissioner	Describe CCP	D. Schmidt
5/17	Hardee County Commissioner	Describe CCP	J. Moye
5/17	Hardee County Commissioner	Describe CCP	M. Henderson
5/17	Hardee County Commissioner	Describe CCP	S. Rawls
5/17	CF Industries	Describe CCP	J. Holmes
5/17	Florida Public Service Commission (PSC)	Deposition for Need Hearing	S. Brownless
5/20	Hardee County	Describe CP	R. Skipper
6/15	FDER, FDNR & Florida Department of Community Affairs (FDCA)	Project Description Cooling Pond Discussion	H. Oven, <u>et al.</u>
6/30	Hardee County Industrial Development Authority	Project Description	
7/7	Hardee County Commission	Describe CCP	
7/14	Fort Green Springs	Describe CCP	
7/28	Southwest Florida Water Management District (SWFWMD)	Describe CCP	R. Viertel
7/28	Wauchula Lion's Club	Project Description	
7/28	FDER - Tampa Office	Project Description	B. Thomas
7/29	Sumter County Planning Department	Project Description	G. Nelson

Table 9.0-1. Hardee Power Station Agency and Public Organization Contacts
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DATE	AGENCY	PURPOSE	CONTACT
8/3	REA	Project Description	R. Quigel
8/10	U.S. Army Corps of Engineers (COE)	Project Description	D. Rosensweig
8/19	Central Florida Regional Planning Council (CFRPC)	Project Description	J. Duane
9/14	Florida Game and Fresh Water Fish Commission	Project Description	D. Bailey
9/20	Hardee County Kiwanis Club	Project Description	A. French
9/20	EPA	Project Description	R. Howard
9/22	Hardee County	Project Description	
9/22	Lee County Planning Department	Transmission Line	B. Spikowski
9/27	Hardee County Business and Professional Women's Association	Project Description	
9/27	Federal Energy Regulation Commission (FERC)	Gas Pipeline Permitting	R. Szekely
9/28	PSC	Coal Gasification	J. Jenkins
9/29	FDER Inter-Agency Meeting	Plan of Study (POS) Description	FDER, FDNR, EPA, FDCA
10/3	Hardee County American Legion	Project Description	
10/7	Hardee County Women's Club	Project Description	
10/10	Wauchula City Council Meeting	Project Description	

Table 9.0-1. Hardee Power Station Agency and Public Organization Contacts
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DATE	AGENCY	PURPOSE	CONTACT
10/10	Polk County Zoning Department	Plant, Transmission Line & Gas Pipeline Zoning Requirements	R. Feagel
10/11	Bowling Green City Council Meeting	Project Description	
10/12	Federal Interagency Meeting	POS, Project Review	REA, EPA
10/14	School Board of Hardee County	Project Description	
10/18	First Baptist Church Meeting - Hardee Co.	Project Description	
10/21	Hardee County AARP	Project Description	
11/18	REA	Scoping Meeting Format	R. Quigel
12/7,8	PSC	Need Determination Hearing	S. Brownless
12/8	DeSoto County Planning	CCP, Reservoir and Transmission Line	J. Lee
12/20	REA EIS Interagency Meeting	Scoping Issues	R. Quigel
12/20	REA EIS Scoping Meeting Wauchula	Scoping Issues	R. Quigel
12/21	REA EIS Scoping Meeting Ft. Myers	Scoping Issues	R. Quigel
1989			
1/4/89	Hardee County Zoning Department	Plant & Transmission Line Zoning Requirements	R. Stowers
1/9	Polk County Zoning Department	Plant & Transmission Line Zoning Requirements	R. Feagle

Table 9.0-1. Hardee Power Station Agency and Public Organization Contacts
(Page 5 of 5)

DATE	AGENCY	PURPOSE	CONTACT
2/14	Charlotte County Planning Department	Transmission Line Corridors	G. Kelly
2/14	Polk County Planning Dept.	Transmission Line Corridors	A. Kurtzman
2/20	City of Wauchula	Public Workshop	
2/21	City of Arcadia	Public Workshop	
2/23	City of N. Fort Myers	Public Workshop	
3/15	REA	Project Meeting	R. Quigel
3/21	Desoto County Planning Department	Transmission Line Corridors	J. Lee
3/23	Cape Coral City Planning	Transmission Line Corridors	
4/11	FDER - Tallahassee	Transmission Line Corridors	H. Oven
4/17	Hardee County Zoning Department	Re-Zoning Application	R. Stowers
4/18	REA	Loan Application	J. Douvlos
5/1	REA, EPA	Project Update	R. Quigel
5/2	FDER - Tallahassee	Project Update	H. Oven
5/2	FERC	Natural Gas Pipeline	R. Szekely
5/2	FDNR	Cooling Reservoir	R. Bushey
5/4	Hardee County Zoning Board	Plant Site Rezoning	R. Stowers
5/11	Hardee County Commission	Plant Site Rezoning	B. Albritton
5/11	EPA	Flyover of Plant Site & Transmission Line Corridors	C. Berish
6/22	FDNR - Tallahassee	Cooling Reservoir	R. Bushey

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CHAPTER 10

**HARDEE POWER STATION
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REQUIREMENTS**

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10.0 HARDEE POWER STATION PROJECT AND SITE RECLAMATION REQUIREMENTS

The purpose of this chapter of the SCA/EA is to highlight the proposed Hardee Power Station and Associated Facilities in light of the Agrico reclamation plan. The Hardee Power Station is proposed to be constructed and operated on approximately 526 ha (1,300 acres) of mined and unmined lands (see Section 1.2 Overview of Hardee Power Station Project, 2.2.2 Zoning and Land Use Plans, 2.3.5 Vegetation/Land Use). Of this area, approximately 231 ha (570 acres) will be used for construction of a cooling reservoir, and intake and discharge structures. All remaining facilities will be built on unmined lands. This chapter outlines the consistency between FDNR's reclamation requirements and standards and the construction and operation of the proposed project.

SECI will work in coordination with Agrico in modifying Agrico's current reclamation plan to accommodate the cooling reservoir engineering requirements as described in this application. To the extent that Some of the criteria as identified in Chapter 16C-16 F.A.C. cannot be fully met because of engineering and functional requirements, variances from Chapter Section 16C-16.0051(1), F.A.C., and Section 16C-16.0051(5) will be required. This variance request is discussed in Appendix 11.10. SECI is currently and will continue to work with Agrico and FDNR's Bureau of Land Reclamation regarding modifications of the reclamation plan.

10.1 BACKGROUND OF SITE RECLAMATION REQUIREMENTS AND PLANS

10.1.1 Past and Present Reclamation Plans

Agrico has been given approval for a reclamation plan for the Payne Creek Mine property which now includes the proposed Hardee Power Station site. As a part of that reclamation plan, 162+ ha (400+ acres) of mined lands were to be reclaimed into lakes. The cooling reservoir for Hardee Power Station will occupy 231 ha (570 acres) and will be built on portions of the mined-out lands of the Payne Creek Mine. The cooling reservoir is considered as a reclamation alternative for the originally proposed reclaimed lakes.

in addition, Agrico is establishing a 205 ha (506 acre) reclamation project adjacent to the Payne Creek floodplain in Sections 23 and 26, Township 32S,

Range 23E, some distance west of the Hardee Power Plant site, to mitigate for current and planned mining. The Agrico reclamation project will include the creation of 83 ha (206 acres) of wetlands. Approximately 42 ha (104 acres) will be forested wetland and 42 ha (104 acres) will be herbaceous wetlands. Forested wetland trees will include water oak (Quercus nigra), sweet bay (Magnolia virginiana), swamp bay (Persea palustris), pop ash (Fraxinus caroliniana), blackgum (Nyssa biflora), dahoon holly (Ilex cassine), bald cypress (Taxodium distichum), pond cypress (Taxodium ascendens) and water hickory (Carya aquatica). Marshes will be planted with native plants found in the region and will specifically exclude cattail, primrose willow, and exotics. This part of the reclamation project will not be affected by the Hardee Power Station project.

The reclamation plans for Agrico's Payne Creek Mine include mined areas of the Hardee Power Station. This reclamation plan proposes pastureland and mixed forest as post-mining uses. The wetlands that are mined in this area are to be replaced by created wetlands consisting of forested wetlands. The original Agrico reclamation plan showed that some of these wetlands would border lakes created during reclamation and would also include a created drainage to replace a tributary that was destroyed by mining. This original plan cannot be completely implemented when the Hardee Power Station is built because of the construction of the cooling reservoir and must be amended by a new reclamation plan. The amended Agrico reclamation plan will reflect the construction of the 231 ha (570 acre) cooling reservoir as a part of the reclamation plan for the Payne Creek Mine.

10.1.2 Applicable FDNR Reclamation Rules

Chapter 16C-16 F.A.C. sets forth phosphate mine reclamation requirements of the State of Florida. All are applicable to the Agrico mining and reclamation plan. Certain sections of these requirements have particular applicability to the Hardee Power Station project which will utilize some of the mined out lands for its facilities. Table 10.1.2-1 lists the FDNR reclamation requirements applicable to the Hardee Power Station project and the information sources which describe relevant corresponding

Table 10.1.2-1. FDNR Reclamation Requirements (Chapter 16C-16 FAC)
Applicable To The Hardee Power Station Project (Cooling
Reservoir) (Page 1 of 2)

Applicable Section	Relevant Information Sources
16C-16.003(1)(d) Amendment	Agrico's Amendment Application
16C-16.0042 Programs and Amendments (2) Amendment	Agrico's Amendment Application and SCA/EA Section 3.5.1 Heat Dissipation
16C-16.0051 Reclamation and Restoration Standards (1)(a) Site Cleanup	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact
(2) Backfilling and Contouring	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact
(3) Soil Zone	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact
(4) Wetlands and (5) Wetlands and Water Bodies	Agrico's Amendment Application and SCA/EA Section 3.5.1 Heat Dissipation System, Section 4.2 Impact on Surface Water Bodies and Uses, and Section 5.8 Changes in Non-Aquatic Species Populations
(6) Water Quality	Agrico's Amendment Application and SCA/EA Section 3.5.1 Heat Dissipation System, Section 4.2 Impact on Surface Water Bodies and Uses, Section 4.3 Groundwater Impacts, Section 5.2 Effects of the Operation of the Heat Dissipation System, and Section 5.3 Impacts on Water Supplies
(7) Flooding and Drainage	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact
(8) Waste Disposal	Agrico's Amendment Application and SCA/EA Section 5.4 Solid/Hazardous Waste Disposal Impacts
(9) Revegetation	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact, Section 4.4 Ecological Impact, and Section 5.8 Changes in Non-Aquatic Species Populations

Table 10.1.2-1. FDNR Reclamation Requirements (Chapter 16C-16 FAC)
Applicable To The Hardee Power Station Project (Cooling
Reservoir) (Page 2 of 2)

Applicable Section	Relevant Information Sources
(10) Wildlife	Agrico's Amendment Application and SCA/EA Section 4.1 Land Impact, Section 4.4 Ecological Impact, and Section 5.8 Changes in Non-Aquatic Species Populations
16C-16.0053 Remaining Natural Resources	Agrico's Amendment Application and SCA/EA Chapter 4.0 Effects of Site Preparation, Plant and Associated Facilities Construction and Chapter 5.0 Effects of Plant Operation
16C-16.0068 Release Procedures	Agrico's Amendment Application

information/analysis. Besides Agrico's reclamation amendment application, various chapters and sections of the SCA/EA describe construction and operational conditions and impacts which relate to the use of the mined and reclaimed portions of the site.

10.2 RELATIONSHIP OF PROPOSED PLANT AND ASSOCIATED FACILITIES TO RECLAMATION PLANS

10.2.1 Plant and Associated Facilities Location

The facilities and proposed site layout are described in Chapter 3. The proposed structures, e.g., power block, fuel oil storage tanks, etc., will not be constructed on mined lands and will not affect the proposed reclamation plans or FDNR reclamation rules. An access road will be built from CR 663 to the plant site. This road will be located partially on mined lands.

The cooling reservoir will be constructed by Agrico from mined lands outside of the 100-year floodplain. The Applicant will build an overflow weir and sufficient riprap along the discharge swale and at the border of the discharge swale to prevent erosion and flooding (see Section 3.5.1 Heat Dissipation System). Consistency with the reclamation plan and FDNR's requirements are discussed in Section 10.2.2 and Appendix 11.10.

Three 230 kV transmission lines will be constructed north and south from the plant site (see Section 6.1 Transmission Lines). Only the Pebbledale Line will cross mined and to be reclaimed lands on the site. The other two lines will exit the site to the east and will not affect the planned reclamation. The proposed reclaimed lands along the proposed corridor are pastureland. Construction of the transmission lines will not change or affect the resulting land use.

A 48 cm (18-inch) underground natural gas pipeline will be constructed from the plant site to an existing natural gas pipeline north of the site (see Section 6.2). The proposed pipeline will approach the site from the north

and will use existing highway and railroad ROWs. It will enter the site from CR 663, co-located with the access road.

10.2.2 Plant and Associated Facilities Operational Aspects

The operational impacts of the Hardee Power Station are described in Chapter 5 Effects of Plant Operation. The Hardee Power Station project will not have any significant adverse effect on existing or future natural and cultural resources, including reclaimed areas. Table 10.1.2-1 lists applicable FDNR requirements which assure protection of natural resources including: soils and topography, wetlands and water bodies, water quality, vegetation, and wildlife. The following is a summary of the relevant operational aspects of the project to these natural resources and the reclamation requirements.

SOIL AND TOPOGRAPHICAL CONSIDERATIONS

The proposed cooling reservoir is the only major facility planned to be constructed on mined lands. The reclamation requirements [16C-16.0051 (2)] call for slopes of reclaimed lands to be no greater than 4 to 1. The cooling reservoir design is discussed in Section 3.5.1. Its proposed slopes (4 to 1 inside and 20 to 1 and 30 to 1 outside) and other design aspects are consistent with FDNR requirements. Appropriate vegetative cover will be grown, established and maintained on the outside slopes.

WETLANDS AND WATER BODIES

The plant and associated facilities will be constructed outside of the 100-year floodplain. No impacts to offsite wetlands will result from the Hardee Power Station. One contiguous forested wetland [2.4 ha (5.9 acres)] will be lost during construction of the cooling reservoir (see Sections 2.3.6.1 and 4.2.1.2). The loss of this wetland is not considered significant adverse effects because of the small size and isolation due to surrounding mining activities. Since approval for mining of these wetlands has been requested and granted as part of Agrico's mining and reclamation plan and dredge and fill permit, the Applicant will also not seek approval (See Appendix 11.1.3) for dredging of these wetlands as part of construction for the cooling reservoir. The piping and access road will

cross a small section [0.18 ha (0.45 acres)] of currently mined and to be reclaimed vegetated forested wetland (See Appendix 11.13).

The environmental impacts of the loss of this currently mined and to be reclaimed wetland are not considered adverse or significant. The wetland loss is a very small percentage (2.0 percent) of the total forested wetlands reclaimed on the site. No effects will occur to the connection of the upstream wetlands connected to Payne Creek. The drainage function of the reclaimed wetlands passing next to the cooling reservoir will be maintained during construction by the use of temporary culverting. Potential downstream sedimentation impacts during construction will be minimized by proper sediment control techniques. No impacts to Payne Creek are anticipated. These wetland losses will be mitigated as part of Agrico's amended reclamation plan (See Appendix 11.11). Water subsidies to the wetlands after construction of the plant and associated facilities will be similar to, if not better than, those prior to mining (see Section 5.8 Changes To Non-Aquatic Population).

WATER QUALITY AND QUANTITY

All waters leaving the cooling reservoir and the site will meet applicable water quality standards of the Florida Department of Environmental Regulation at the point of discharge or at the end of a mixing zone and will have no adverse impact to fish and wildlife (see Sections 5.1 Effects of Operation of the Heat Dissipation System, 5.2 Effects of Chemical and Biocide Discharges, and 5.3 Impacts on Water Supplies).

As recommended by FDNR, the HEC-1 model was used to evaluate event specific discharges to Payne Creek and associated dilution for the 10-year, 24-hour storm and the 25-year, 24-hour storm (see Section 5.1.1 Temperature Effect On Receiving Body of Water). The format methodology followed that described in the existing Ardaman & Associates study entitled "Hydrological Analysis of the Agrico Payne Creek Mine Reclamation Plan" dated October 5, 1987. The assumptions and use of the model are described in Section 5.1 Effects Of Operation of the Heat Dissipation System. This analysis, along with other analyses, shows that the cooling reservoir will not discharge under the 10-year, 24-hour storm, but only during storms which are larger and

less frequent. The emergency spillway will be adequate to handle all runoff and discharge from the 25-year, 24-hour storm. No reduction in downstream flow conditions or reduced water quality will occur from the construction and operation of the cooling reservoir. As a result, no effects to downstream permit condition, e.g., mixing zones, or other approved activities, will result (see Section 5.3 Impacts on Water Supplies).

No adverse water quality impacts, including impacts on aquatic life, will result from the operation of the cooling reservoir (see Sections 5.1 Effects of Operation of the Heat Dissipation System, 5.2 Effects of Chemical and Biocide Discharges, and 5.3 Impacts on Water Supplies).

WILDLIFE AND ENDANGERED SPECIES

The major wildlife habitat of the site is along Payne Creek (see Section 2.3.6). This habitat and its connection to surrounding habitats will be protected. No significant wildlife habitat will be lost or impacted by construction and operation of the cooling reservoir. The cooling reservoir will provide a water subsidy to the Payne Creek wetlands, which have been hydrologically altered by past mining in the area. The water subsidy from the cooling reservoir will thus enhance this habitat (see Section 5.3.1 Surface Water and Section 5.8 Changes to Non-Aquatic Populations). The wetland losses within the proposed cooling reservoir area will be mitigated through the creation of artificial wetlands as a part of the Agrico reclamation plan. As a consequence, no significant adverse impacts to wildlife and habitat, including endangered and threatened species, will occur.

10.2.3 Release Procedures

It is the intent of SECI to seek release from reclamation requirements prior to operation of the cooling reservoir.

10.2.4 Financial Responsibilities

It is the intent of the Applicant to take responsibility for the Hardee Power Station site after reclamation has been satisfactorily demonstrated to FDNR. Agrico will assume financial responsibility for compliance with

the reclamation plan. The Applicant will maintain the reservoir after taking ownership.

10.3 AMENDMENTS AND VARIANCES

An amendment to the Agrico reclamation plan will be required to incorporate the proposed cooling reservoir. Agrico is preparing this amendment in accordance with 16C-16.0042 Programs and Amendments (See Appendix 11.11).

A variance is sought from Section 16C-16.0051(1), F.A.C., and Section 16C-16.0051(5), F.A.C., Reclamation Standards. Appendix 11.10 includes a request for variance from these standards and provides supporting information for this request.

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SUBMITTED BY:

TECO POWER SERVICES

TAMPA ELECTRIC COMPANY

**SEMINOLE ELECTRIC
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 - 11.5.6 SWFWMD PERMIT INFORMATION
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FOR PIPING AND ACCESS ROAD CORRIDOR

11.1 STATE AND FEDERAL PERMIT APPLICATIONS

11.1.1 NPDES APPLICATION/PERMIT

FORM 1 GENERAL		U.S. ENVIRONMENTAL PROTECTION AGENCY GENERAL INFORMATION <i>Consolidated Permits Program</i> (Read the "General Instructions" before starting.)		I. EPA I.D. NUMBER	
LABEL ITEMS		PLEASE PLACE LABEL IN THIS SPACE		GENERAL INSTRUCTIONS	
I. EPA I.D. NUMBER				If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete items I, III, V, and VI (except VI-B which must be completed regardless). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.	
II. FACILITY NAME					
V. FACILITY MAILING ADDRESS					
VI. FACILITY LOCATION					

II. POLLUTANT CHARACTERISTICS			
INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.			
SPECIFIC QUESTIONS	MARK 'X'		
	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	
B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)	X		X
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	X		X ⁺

III. NAME OF FACILITY	
1	SKIPP HARDEE POWER STATION-TECO POWER SERVICES

IV. FACILITY CONTACT	
A. NAME & TITLE (last, first, & title)	
2	JERRY L WILLIAMS, DIRECTOR ENV *
B. PHONE (area code & no.)	
8	13 228 4111

V. FACILITY MAILING ADDRESS	
A. STREET OR P.O. BOX	
3	702 N. FRANKLIN STREET
B. CITY OR TOWN	
4	TAMPA
C. STATE	
FL	
D. ZIP CODE	
33602	

VI. FACILITY LOCATION	
A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER	
5	COUNTY ROAD 663
B. COUNTY NAME	
R	DEE
C. CITY OR TOWN	
6	FORT GREEN
D. STATE	
FL	
E. ZIP CODE	
33834	
F. COUNTY CODE (if known)	

VII. SIC CODES (4-digit, in order of priority)

A. FIRST										B. SECOND										
C	7	4	9	1	1	(specify)					C	7	(specify)							
13	16									13	16									
Electric Generation																				
C. THIRD										D. FOURTH										
C	(specify)									C	7	(specify)								
13	16									13	16									

VIII. OPERATOR INFORMATION

A. NAME																														B. Is the name listed in Item VIII-A also the owner?									
C	8	T	E	C	O	P	O	W	E	R	S	E	R	V	I	C	E	S	C	O	R	P																	
15	16																			55																			
C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)																				D. PHONE (area code & no.)																			
F = FEDERAL S = STATE P = PRIVATE										M = PUBLIC (other than federal or state) O = OTHER (specify)										P (specify)																			
																				A 8 1 3 2 2 8 4 1 1 1																			
																				15 16 17 18 19 20 21 22 23 24 25																			
E. STREET OR P.O. BOX																																							
7 0 2 N F R A N K L I N S T R E E T																																							
25 35																																							
F. CITY OR TOWN																				G. STATE					H. ZIP CODE					IX. INDIAN LAND									
B T A M P A																				F L					3 3 6 0 2					Is the facility located on Indian lands?									
																														☐ YES ☒ NO									
																														52									

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)															D. PSD (Air Emissions from Proposed Sources)																
C	9	N	N O N E												C	9	P	N O N E													
15	16	17	18													15	16	17	18												
B. UIC (Underground Injection of Fluids)															E. OTHER (specify)																
C	9	U	N O N E												C	9	N O N E														
15	16	17	18													15	16	17	18												
C. RCRA (Hazardous Wastes)															E. OTHER (specify)																
C	9	R	N O N E												C	9	N O N E														
15	16	17	18													15	16	17	18												

XI. MAP

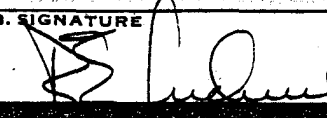
Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

Proposed 660 MW Combined Cycle Electric Generating Facility.
See Section 3.0 of the SCA/EA for project description, including information regarding the cooling reservoir construction and operation.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)															B. SIGNATURE															C. DATE SIGNED									
Richard E. Ludwig President, TECO Power Services Corp.																														7/26/89									

COMMENTS FOR OFFICIAL USE ONLY

C																														
15	16																													

Please type or print in the unshaded areas only

EPA ID Number (copy from Item 1 of Form 1)

Form Approved
OMB No. 2040-0086
Approval expires 7-31-88Form
2D
NPDES**New Sources and New Dischargers**
EPA Application for Permit to Discharge Process Wastewater**I. Outfall Location**

For each outfall, list the latitude and longitude, and the name of the receiving water.

Outfall Number (list)	Latitude			Longitude			Receiving Water (name)
	Deg	Min	Sec	Deg	Min	Sec	
001	27	39	00	81	58	45	Payne Creek
002	27	38	00	81	58	15	Payne Creek

II. Discharge Date (When do you expect to begin discharging?)**III. Flows, Sources of Pollution, and Treatment Technologies**

A. For each outfall, provide a description of (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and stormwater runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary. (See attached outfall descriptions)

Outfall Number	1. Operations Contributing Flow (list)	2. Average Flow (include units)	3. Treatment (Description or List Codes from Table 2D-1)
001	Recirculation Cooling		
	Reservoir with makeup from		
	the following sources:		
	• Rainfall	2,267,000 gpd	---
	• Well water	2,372,000 gpd	---
	• Surface runoff	187,000 gpd	---
	• Seepage	375,000 gpd	---
	• Demineralization		
	Regeneration		
	Basin Effluent	57,000 gpd	Neutralization & Sedimentation
			(2-K & 1-U)
	• Oil Separator Effluent	35,000 gpd	Oil Flotation (1-H)
	• Sanitary Effluent	6,000 gpd	Biological Treatment (3-A)
			Sedimentation (1-U)
			Chlorine Disinfection (2-F)
	Continued on next page..		

Form
2D
NPDES



New Sources and New Dischargers

Application for Permit to Discharge Process Wastewater

I. Outfall Location

For each outfall, list the latitude and longitude, and the name of the receiving water.

Outfall Number (list)	Latitude			Longitude			Receiving Water (name)
	Deg	Min	Sec	Deg	Min	Sec	

II. Discharge Date (When do you expect to begin discharging?)

III. Flows, Sources of Pollution, and Treatment Technologies

A. For each outfall, provide a description of (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and stormwater runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary. (See attached outfall descriptions)

[illegible]

Outfall Descriptions

Outfall #001

Outfall #001 is an emergency overflow from the 570 acre recirculating cooling reservoir to be constructed as part of the 660 MW combined cycle power plant. This recirculating cooling reservoir will function as water supply for use in condenser cooling and heating dissipation system for the Heat Recovery Steam Generator portion of the combined cycle plant.

Water makeup to the reservoir includes: rainfall onto the reservoir; surface runoff and surficial aquifer seepage from the upland basin; treated sanitary and plant wastewaters discharged to the reservoir; and makeup water pumped from the lower Floridan Aquifer wells. The reservoir will also receive discharge from temporary construction dewatering activities during plant construction. This water will be similar in quality to surficial aquifer quality. Water flows out of the reservoir include: evaporation; lateral seepage through the confining berm into the surficial aquifer; leakage down through the confining layers into deeper confined aquifers; and discharges to Payne Creek.

Based on long term water balance modeling (51 years of data analysis) and HEC-1 hydraulic modeling, the proposed cooling reservoir will only discharge in cases caused by extreme or cumulative rainfall in excess of the 10- year 24-hour hydrologic event, where unavoidable to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures.

Outfall #002

Outfall #002 is the overflow discharge from the plant site stormwater retention pond. This stormwater pond has been designed to meet all applicable Southwest Florida Water Management District and Florida Department of Environmental Regulation stormwater quantity and quality control requirements. Specifically, the pond will provide retention with filtration for runoff from the first 1 inch of rainfall, and post development peak flows will not exceed pre-development peak flows for the 25 year - 24 hour rainfall storm.

The pond will also receive discharge from temporary construction dewatering activities during construction. After removal of suspended materials through sedimentation, this water will be similar in quality to surficial aquifer water quality.

Given the proposed fuels for the proposed combined cycle plant (i.e., gas or oil), no fuel related stormwaters (e.g., coal pile runoff) will be directed to this pond. Influent plant site stormwater is expected to be similar to stormwater from other light industrial sites.

B. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item III-A. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g., for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures. Water Balance attached.

C. Except for storm runoff, leaks, or spills, will any of the discharges described in item III-A be intermittent or seasonal?

☒ Yes (complete the following table)

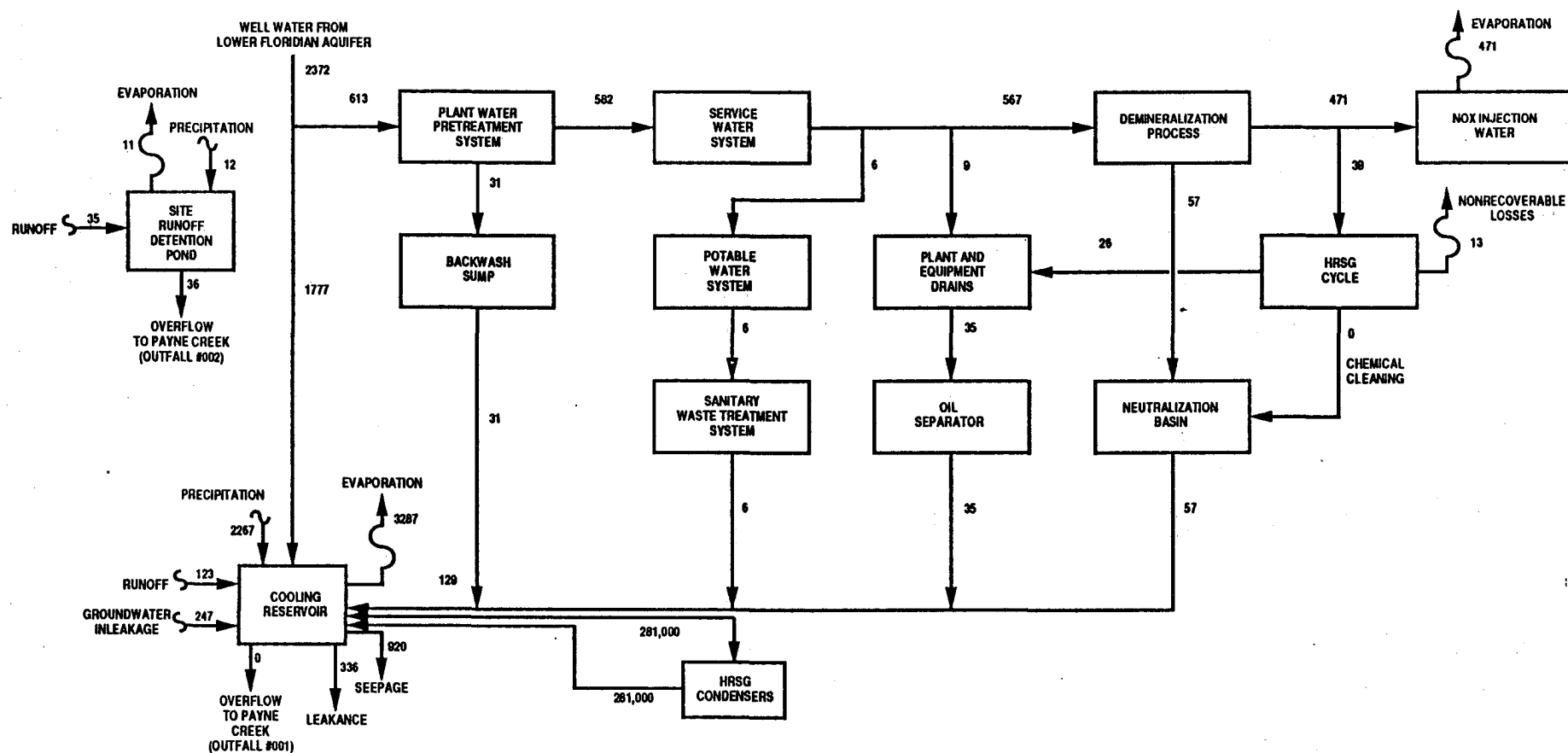
☐ No (go to item IV)

Outfall Number	1. Frequency		2. Flow		
	a. Days Per Week <i>(specify average)</i>	b. Months Per Year <i>(specify average)</i>	a. Maximum Daily Flow Rate <i>(in mgd)</i>	b. Maximum Total Volume <i>(specify with units)</i>	c. Duration <i>(in days)</i>
001 - Cooling reservoir	Cooling reservoir will only discharge due to extreme or cumulative rainfall in excess of the 10-year 24-hour storm, where unavoidable to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures.		0.213 MGD (see note 1)	2.3 acre-feet	7 days (see note 1)
			Note 1: Flow estimates are based on the 25-year 24-hour rainfall.		
002 - Stormwater Retention Pond Including Temporary Construction Dewatering	Temporary Activity During Construction; 7 Days per Week for 6 Months during Construction		0.526 MGD	291 acre-ft	180 days during construction

IV. Production

If there is an applicable production-based effluent guideline or NSPS, for each outfall list the estimated level of production (projection of actual production level, not design), expressed in the terms and units used in the applicable effluent guideline or NSPS, for each of the first 3 years of operation. If production is likely to vary, you may also submit alternative estimates (attach a separate sheet).

Year	a. Quantity Per Day	b. Units of Measure	c. Operation, Product, Material, etc (specify)



NOTES: 1. FLOWS ARE EXPRESSED AS 1000 GALLONS PER DAY.
2. FLOWS ARE FOR 660 MW PLANT.

**WATER MASS BALANCE:
ANNUAL AVERAGE MAKEUP**

**Hardee
Power Station**

A, and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

CONTINUE ON REVERSE

Table V-1. Estimated Cooling Reservoir Discharge (Outfall #001) Effluent
Water Quality (Page 1 of 2)

Parameter	Cooling Reservoir Discharge (Outfall #001) Quality ¹	Source
Biochemical Oxygen Demand (5-day), mg/L	<5	See note 2
Chemical Oxygen Demand, mg/L	<40	
Total Organic Carbon, mg/L	NA	
Total Suspended Solids, mg/L	<25	
Flow, cfs see note	3	
Ammonia Nitrogen, mg/L	0.4	
Temperature, maximum summer, °C	35	
Temperature, average summer, °C	32	
Temperature, maximum winter, °C	23	
Temperature, average winter, °C	18	
pH, units	6-9	
Calcium, mg/L as CaCO ₃	240	
Magnesium, mg/L as CaCO ₃	100	
Sodium, mg/L as CaCO ₃	200	
Potassium, mg/L as CaCO ₃	16	
Total Hardness, mg/L as CaCO ₃	340	
Alkalinity, mg/L as CaCO ₃	260	
Sulfate, mg/L as CaCO ₃	250	
Chloride, mg/L as CaCO ₃	50	
Silica, mg/L	60	
Fluoride, mg/L	4.1	
Cyanide, mg/L	0.01	
MBAS, mg/L	0.36	
Oil and Grease, mg/L	<5	
Turbidity, NTU	31	
Total Dissolved Solids, mg/L	860	
Specific Conductivity, umhos/cm	1080	
Total Kjeldahl Nitrogen, mg/L	0.9	
Unionized Ammonia, mg/L (4)	0.014	
Organic Nitrogen, mg/L	0.4	
Nitrate+Nitrite-Nitrogen, mg/L	0.1	
Total Nitrogen, mg/L	1.0	
Orthophosphorus, mg/L	0.5	
Total Phosphorus, mg/L	0.8	

Table V-1. Estimated Cooling Reservoir Discharge (Outfall #001) Effluent Water Quality (Page 2 of 2)

Parameter	Cooling Reservoir Discharge (Outfall #001) Quality ¹	Source
Arsenic, ug/L	20	See note 2
Barium, ug/L	150	
Beryllium, ug/L	4.0	
Cadmium, ug/L	2.6	
Chromium, ug/L	28	
Copper, ug/L	27	
Iron, ug/L	980	
Lead, ug/L	29	
Manganese, ug/L	47	
Mercury, ug/L	0.5	
Nickel, ug/L	49	
Selenium, ug/L	32	
Silver, ug/L	0.8	
Strontium, ug/L	610	
Zinc, ug/L	280	
Alpha, Gross (pC/L)	22.2	
Radium 226 (pC/L)	6.2	

- Note:
1. Reservoir effluent estimates are based on mass balances and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which may occur in the reservoir and act to remove material from the water column and thus reduce reservoir concentrations. Estimated values are average values unless otherwise noted.
 2. All parameter concentrations were estimated based on engineering studies (Source Code 1) and Best Professional Estimates (Source Code 4).
 3. Discharge will only occur in cases caused by extreme or cumulative rainfall in excess of the 10-year 24-hour hydrologic event, where unavoidable to prevent loss of life, severe property damage, or damage to the physical integrity of the cooling reservoir or its structures.
 4. Unionized ammonia concentrations are based on a worst case reservoir water temperature of 95°F (35°C).

Table V-2. Estimated Stormwater Detention Pond Discharge (Outfall #002) Water Quality
(Page 1 of 2)

Parameter	Stormwater Detention Pond Discharge (Outfall #002) Quality	Source
Biochemical Oxygen Demand (5-day), mg/L	<5	
Chemical Oxygen Demand, mg/L	<50	
Total Organic Carbon, mg/L	NA	
Total Suspended Solids, mg/L	<25	
Ammonia N, mg/L	0.5	
Flow, gallons/day	36,000	
Temperature, Average Winter, °C	18	
Temperature, Average Summer, °C	32	
pH	6-9	
Calcium, mg/L as CaCO ₃	63	See note 1
Magnesium, mg/L as CaCO ₃	39	
Sodium, mg/L as CaCO ₃	17	
Potassium, mg/L as CaCO ₃	0	
Alkalinity, mg/L as CaCO ₃	61	
Sulfate, mg/L as CaCO ₃	37	
Chloride, mg/L as CaCO ₃	21	
Silica, mg/L	5.4	
Fluoride, mg/L	1.0	
Cyanide, mg/L	<0.004	
Methylene Blue Active Substances, mg/L	0.040	
Oil and Grease, mg/L	<5	

Table V-2. Estimated Stormwater Detention Pond Discharge (Outfall #002) Water Quality
(Page 2 of 2)

Parameter	Stormwater Detention Pond Discharge (Outfall #002) Quality	Source
pH, units	7	See note 1
Total Dissolved Solids, mg/L	190	
Specific Conductivity, umhos/cm	173	
Total Kjeldahl Nitrogen, mg/L	0.74	
Ammonia Nitrogen, mg/L	0.11	
Organic Nitrogen, mg/L	0.65	
Nitrate+Nitrite-Nitrogen, mg/L	0.50	
Total Nitrogen, mg/L	1.24	
Orthophosphorus, mg/L	0.41	
Total Phosphorus, mg/L	0.44	
Arsenic, ug/L	<5	
Barium, ug/L	<10	
Beryllium, ug/L	<3	
Cadmium, ug/L	<0.4	
Chromium, ug/L	<10	
Copper, ug/L	7	
Iron, ug/L	293	
Lead, ug/L	6.1	
Manganese, mg/L	7.9	
Mercury, ug/L	0.24	
Nickel, ug/L	16	
Selenium, ug/L	<5	
Silver, ug/L	<0.08	
Strontium, ug/L	100	
Zinc, ug/L	7.4	
Alpha, Gross (pC/L)	1.7	
Radium 226 (pC/L)	0.7	

Note: 1. All parameter concentrations were estimated based on engineering studies of Payne Creek water quality (Source Code 1) and Best Professional Estimates (Source Code 4).

C. Use the space below to list any of the pollutants listed in Table 2D-3 of the instructions which you know or have reason to believe will be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it will be present.

1. Pollutant	2. Reason for Discharge
Outfall #001 Strontium	Trace amounts of naturally occurring strontium have been detected in upland surface runoff (100/ug/L) and Lower Floridan aquifer well makeup water (300 ug/L). Therefore, similar trace levels can be expected in the recirculation cooling reservoir. No strontium will be used in the operation of the proposed combined cycle power plant.

VI. Engineering Report on Wastewater Treatment

A. If there is any technical evaluation concerning your wastewater treatment, including engineering reports or pilot plant studies, check the appropriate box below.



Report Available



No Report

Engineering studies and evaluations are included as part of the Site Certification Application to the State of Florida.

B. Provide the name and location of any existing plant(s) which, to the best of your knowledge, resembles this production facility with respect to production processes, wastewater constituents, or wastewater treatments.

Name	Location
No power plant cooling reservoirs have been built on reclaimed phosphate mines.	

VII. Other Information (Optional)

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations for the proposed facility. Attach additional sheets if necessary.

VIII. Certification

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

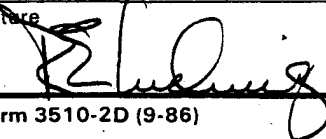
A. Name and Official Title (type or print)

Richard E. Ludwig
President, TECO Power Services Corp.

B. Phone No.

(813) 228-4111

C. Signature



D. Date Signed

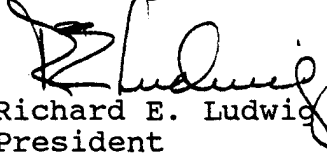
7/26/89

TECO
POWER SERVICES
A TECO ENERGY COMPANY

TO WHOM IT MAY CONCERN:

Please be advised that Jerry L. Williams, Director of Environmental for Tampa Electric Company, is the authorized representative of TECO Power Services Corporation concerning matters with which this permit application deals.

Sincerely,



Richard E. Ludwig
President

REL:ams

11.1.2 CONSUMPTIVE USE PERMIT APPLICATION

*This application has been prepared for information purposes
only as required by FDER Form 17-1.211(1).
Refer to Applicant Information in the SCA.*



SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
CONSUMPTIVE USE PERMIT APPLICATION
2379 Broad Street
Brooksville, Florida 34609-6899

GENERAL INSTRUCTIONS. PLEASE READ BEFORE PROCEEDING

PURPOSE: This application is for obtaining a permit, permit modification, or permit renewal from the Southwest Florida Water Management District (SWFWMD) for the consumptive use of ground or surface water, or both, and is required in accordance with Chapter 40D-2, Florida Administrative Code. This application and attached supplemental form(s) are to be completed in detail in order to facilitate a comprehensive evaluation of your water requirements. Insufficient information will delay application processing. Supplemental form(s) are a part of this application. Assistance with this application can be obtained by calling (904) 796-7211, Brooksville, Florida; (813) 985-7481, Tampa, Florida; (813) 533-6972, Bartow, Florida or (813) 488-4666, Venice, Florida. There is no permit fee.

APPLICANT: Enter the name in which the Consumptive Use Permit (CUP) will be issued. Identify applicant as an individual, partnership, corporation or other legal entity. If there is more than one owner, name the one on whose property the withdrawal point(s) are located. A permit may be issued to a lessee if a copy of the lease is furnished. In the case of a verbal lease agreement, the owner's signature on the application will be sufficient.

LOCAL CONTACT: Enter the name and address of an individual who has knowledge of the property and the application and who may be contacted for any additional information needed, if other than the applicant.

OWNER: Enter the name and address of the owner(s) of the property if other than the applicant.

PROPERTY: Include only the contiguous acreage covered by this application. A SEPARATE APPLICATION MUST BE COMPLETED FOR EACH NON-CONTIGUOUS TRACT OF LAND.

ANSWER ALL QUESTIONS, DO NOT USE PENCIL

Date _____

1. **APPLICANT** Refer to Applicant Information in SCA

Address, City, State, Zip Code

Telephone w/area code

2. **LOCAL CONTACT** Refer to Applicant Information in SCA

Address, City, State, Zip Code

Telephone w/area code

3. **OWNER** Refer to Applicant Information in SCA

Address, City, State, Zip Code

Telephone w/area code

4. **PROPERTY** 35 and 36 32S 23E

Polk & Hardee

Section(s), Township(s), Range(s)

County

Acres: owned _____ leased _____ serviced* _____ total _____

* An applicant (other than Public Supply) delivering water to another property owner must include a signed statement of that arrangement. Copies of all written agreements and/or contracts must be attached.

5. TYPE OF APPLICATION: new X renewal _____ modification _____ current CUP No. _____
6. COMPLETE SUPPLEMENTAL INFORMATION FORM(S): Complete the enclosed form(s) applicable to your water use category: Public Supply, Industrial, Agricultural. Attach as part of this application.
7. CLASSIFICATION OF USE: (Estimate percentages of total supply).
- | | |
|---|---------|
| Attractions (public parks, etc.) | _____ % |
| Public Supply | _____ % |
| Essential services (fires, hospitals, etc.) | _____ % |
| Industrial | _____ % |
| Irrigation | _____ % |
| Lawns | _____ % |
| Livestock | _____ % |
| Mining | _____ % |
| Perishable food processing | _____ % |
| Power | _____ % |
| Recreational | _____ % |
| Total | _____ % |

8. LIST OF ADJACENT PROPERTY OWNERS FOR GROUND WATER WITHDRAWALS:
- a. If the total average daily withdrawal (pumpage) for all wells on the property will not exceed 100,000 gallons per day (gpd) and if the withdrawal during any single day for all wells on the property will not exceed 1,000,000 gallons it is not necessary to list adjacent property owners.
- b. Complete part c. below if your average daily withdrawal is to exceed 100,000 gpd or if the withdrawal during any single day is to exceed 1,000,000 gallons, and this application is for a (1) new use, (2) modification or renewal of a permit which requests an increase of water withdrawals from what is currently permitted.
- c. List below the name and mailing address of all current owners of real property whose property is located within the distances prescribed below, according to withdrawal quantities:

FOR WITHDRAWALS OF:

Average GPD on an Annual Basis	OR	Maximum GPD During Any Single Day	
More than 100,000 but not more than 500,000		More than 1,000,000 but not more than 5,000,000	All property owners within 660' of the well, or within 100' of your property boundary.
More than 500,000 but not more than 1,000,000		More than 5,000,000 but not more than 10,000,000	All property owners within 1,320' of the well, or within 200' of your property boundary.
More than 1,000,000		More than 10,000,000	All property owners within 2,640' of the well, or within 400' of your property boundary.

Name	Address
CF Industries	P.O. Box 1549, Wauchula, FL 33873
Agrico Chemical Co.,	P.O. Box 110, Mulberry, FL 33860

All Notices will be made by SWFWMD. If additional space is needed, add a separate sheet.

9. LIST OF ADJACENT PROPERTY OWNERS FOR SURFACE WATER WITHDRAWALS:

- a. Complete parts b. and/or c. below, if the described situation applies, and this application is for a (1) new use, (2) modification or renewal of a permit which requests an increase of water withdrawals from what is currently permitted.
- b. If your withdrawal is from a lake or other impoundment with a surface area of:
- | | |
|------------------|---|
| 80 acres or less | List below all riparian owners on the lake or impoundment. |
| Over 80 acres | List below all riparian owners in either direction 660' from point where applicant's property intersects the shoreline. |
- c. If your withdrawal is from a stream and if the total daily average pumpage is:
- | | |
|---|--|
| Not more than 5,000,000 gallons during a single day | List below all riparian owners 660' upstream and 1,320' downstream from your property boundaries at the shoreline. |
| More than 5,000,000 gallons during a single day | List below all riparian owners 1,320' upstream and 2,640' downstream from your property boundaries at the shoreline. |

Name	Address
N/A	

All Notices will be made by SWFWMD. If additional space is needed, add a separate sheet.

10. PROPERTY LOCATION MAPS: Property location maps are contained on pages 4 and 5 of this application. Instructions for completing the maps are on each page. If your property cannot be located on either attached map, submit a separate map locating (1) property boundaries, (2) all wells (active and inactive), (3) all surface withdrawals, and (4) all discharge points. Boundary lines, withdrawal and discharge points should be referenced to Section, Township, and Range, or Latitude and Longitude. Use a scale of not less than 1 inch to 2,000 feet. Special requirements for industrial applications are contained in paragraph 4 of the Industrial Supplemental Form.

I hereby certify that the information as contained in this application including all attachments is true and accurate and based upon the best information available and further that the undersigned has the legal authority to execute this application.

SIGNATURE OF APPLICANT _____

SIGNATURE OF OWNER _____

THANK YOU

CONSERVE WATER TODAY FOR TOMORROW

R-10/1/88

PROPERTY LOCATION MAP ONE SECTION

*See SCA/EA Sections 2.1 for property boundaries and Section 2.3.3 for description of active and inactive wells.

INSTRUCTIONS: THE MAP BELOW REPRESENTS ONE SECTION OF LAND. IF YOUR PROPERTY IS LOCATED ENTIRELY WITHIN ONE SECTION, DRAW THE PROPERTY BOUNDARIES ON THIS MAP. LOCATE ALL WELLS (ACTIVE AND INACTIVE), SURFACE WITHDRAWALS, AND DISCHARGE POINTS, IF APPLICABLE, ON YOUR PROPERTY.

SECTION _____ TOWNSHIP _____ RANGE _____

NW1/4 OF NW1/4	NE1/4 OF NW1/4	NW1/4 OF NE1/4	NE1/4 OF NE1/4
NW1/4		NE1/4	
SW1/4 OF NW1/4	SE1/4 OF NW1/4	SW1/4 OF NE1/4	SE1/4 OF NE1/4
NW1/4 OF SW1/4	NE1/4 OF SW1/4	NW1/4 OF SE1/4	NE1/4 OF SE1/4
SW1/4		10A	5A 20A
SW1/4		SE1/4	
SW1/4 OF SW1/4	SE1/4 OF SW1/4	SW1/4 OF SE1/4	SE1/4 OF SE1/4

INDUSTRIAL
Supplemental Information Form

Answer all questions. If a question is not applicable, state N/A. If there are public supply or agriculture wells located on your property, complete the appropriate supplemental form. This form must be completed for an initial permit, permit modification, or permit renewal. This form provides the basic information for evaluation of your application.

1. APPLICANT

(same as shown on CUP application form)

2. OPERATION

The well field will make up water for the cooling water reservoir which
(brief description of operation and product produced)

in turn is used as a heat rejection system for combined cycle electric generating facilities.

3. ATTACH A WATER BALANCE, based on requested average daily withdrawals, showing the amount of water going into and coming out of each step in your process. Include all causes of water loss, and final disposition of water. See SCA/EA Chapter 3.0 for project description and water balance.

4. PROPERTY LOCATION MAP: The appropriate property location map on pages 4 or 5 may be used to locate your property. Locate all (1) wells (active and inactive), (2) surface withdrawals, (3) meters/gauges, (4) monitor sites, and (5) final discharge points, as applicable. If application is for water use in (1) phosphate mining, (2) beneficiation, (3) chemical processing, (4) rock mining, (5) sand mining, (6) power generation, this information should also be plotted on aerial photography, with a minimum scale of 1 inch to 2,000 feet. Aerial maps will be requested separately for any other industrial uses, if required. See SCA/EA Section 2.1 for property map and Section 2.3.3-1 for well locations.

5. TOTAL REQUESTED WITHDRAWAL:

average daily (gpd) 3,800,000 maximum daily (gpd) 8,640,000

6. WATER SUPPLY: Withdrawal points must agree with those shown on property location map.
See Figure 3.2-1 in the SCA

a. GROUND WATER WITHDRAWALS: Include all wells both active and inactive (existing and proposed, standby, capped, etc.). 3 wells proposed - See SCA/EA Section 5.3.2 for impact discussion

Well ID number	Well Dia. size	Well depth casing/total	Beg. W/D Date	Pump Cap. (gpm)	Withdrawal (gpd) x 1,000 average maximum	Metered Yes/No	Use if more than one, list percent each
	22"	surface to 160'		2,000	3,800 8,640	No	50%
each	18"	160' to 480'		Proposed for full 660 MW			
well	16"	480' to 1300'		build out; 1500 gpm pump capacity			
				will be required for Phase 1-A, the			
				295 MW capacity facility (see SCA/EA			
				Section 3.1 for project description)			

b. SURFACE WITHDRAWALS:

Source Name and Intake Diameter	Beg. W/D Date	Pump Cap. (gpm)	Withdrawal Information		Metered Yes/No	Use if more than one, list percent each
			average	maximum		
N/A						

7. WITHDRAWAL DATE: (to be) initiated N/A most recent date of use N/A.

8. PRODUCTION RATE: Presently N/A Projected 3,800,000 gpm as of 1991.
(average daily)

9. SOURCE OF POTABLE WATER SUPPLY well water Daily Work Population: *
* 225 workers for 26-month construction period and approximately 80 workers for operation
of 295MW facility.

10. METHOD OF DISPOSAL:

Individual septic tank	_____	%	
Spray irrigation	_____	%	
Percolation and ponding	<u>100</u>	%	Pond acreage: <u>570 acres</u>
Off-site discharge	_____	%	discharges to: <u>Payne Creek</u>
Total	<u>100</u>	%	

Are there any DER/NPDES discharge permits? yes
Number and type of Permit. one
NPDES/DER permits applied for as part of the SCA/EA Application.

11. LIST OF ADJACENT PROPERTY OWNERS: If applicable, complete Items 8 and/or 9, Pages 2 and 3 of the CUP application form.

Agrico Chemical Co., P. O. Box 110, Mulberry, FL 33860

CF Industries, P.O. Box 1549, Wauchula, FL 33873

**11.1.3 JOINT APPLICATION - DEPARTMENT OF THE ARMY/
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION**

JOINT APPLICATION DEPARTMENT OF THE ARMY/FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION For Activities in the Waters of the State of Florida	
CORPS APPLICATION NUMBER (official use only) 	DER APPLICATION NUMBER (official use only)
1. APPLICANT'S NAME AND ADDRESS S E M I N O L E E L E C T R I C C O O P E R A T I V E NAME 1 6 3 1 3 N . D A L E M A B R Y H I G H W A Y STREET T A M P A F L 3 3 6 8 8 2 0 0 0 CITY STATE ZIP TELEPHONE NUMBER (Day) <u>(813) 963-0994</u> (Night) () Same	
2. Name, address, zip code and title of applicant's authorized agent for permit application coordination W. Micheal Roddy Seminole Electric Company 16313 N. Dale Mabry Highway Tampa, FL 33688-2000 Telephone Number <u>(813) 963-0994</u>	
3. NAME OF WATERWAY AT LOCATION OF THE ACTIVITY. Wetlands with intermittent drainage to Payne Creek	DER Code. _____ W/W Code _____
4. LOCATION WHERE PROPOSED ACTIVITY EXISTS OR WILL OCCUR. <u>Hardee Power Station Site</u> Street, road or other descriptive location <u>N/A</u> Incorporated city or town <u>Polk</u> County <u>35 & 36</u> Section <u>32S</u> Township <u>23E</u> Range Latitude Longitude Tax Assessors Description: (if known) Map No. Subdiv. No. Lot No.	
5. NAME AND ADDRESS INCLUDING ZIP CODE OF ADJOINING PROPERTY OWNERS WHOSE PROPERTY ALSO ADJOINS THE WATERWAY. CF Industries, P.O. Box 1549, Wauchula, FL 33873 Agrico Chemical Co., P.O. Box 1110, Mulberry, FL 33860	
6. PROPOSED USE Private Single Dwelling [] Commercial [] Private Multi-dwelling [] Other ☒ (Explain in remarks) Public [] energy facility	

7. DESCRIPTION OF PROJECT (Use additional sheets, if necessary)

A. Structures: 1. New work ☒ Maintenance of existing structure ☐

COE
Work Code

--	--	--

2. Piers, docks and use: Commercial ☐ Private ☐ Public ☐

a. Single pier ☐ length _____ width _____

b. Number of piers ☐ length _____ width _____

c. Number of boat slips ☐ length _____ width _____

d. Number of finger piers ☐ length _____ width _____

e. Other (please describe) _____

3. Seawalls, revetments, bulkheads: length _____

a. Type: Vertical ☐ Riprap ☐ Slope: _____ Horizontal: _____ Vertical _____

b. Material to be used _____

4. Other type of structure Cooling water reservoir, See SCA/EA Section 3.5.1

B. Excavation or Dredging: New Work ☒ Maintenance work ☐ Total acreage involved 570
(12.3 acres below O.H.W.)

1. Access Channel ☐ or Canal ☐ Length _____ ft. Width _____ ft. Depth _____ ft.

2. Boat Basin ☐ or Boat Slip ☐ Length _____ ft. Width _____ ft. Depth _____ ft.

3. Other Cooling water reservoir Length 730 ft. Width 4500 ft. Depth >10 ft.
(max)

4. Cubic yards: Total for project 24,830,000 cyd

a. 536,000 cyd. waterward/ 24,294,000 cyd. landward of ordinary/mean high water

b. Type of material to be excavated/dredged overburden, see SCA/EA Section 2.3.6.1, and 4.2.1.2

C. Fill:

1. Amount of material

DER
Code
253
403

a. Cubic yards placed waterward of ordinary/mean high water 0

b. Cubic yards placed landward of ordinary/mean high water 0

c. Total acreage to be filled 10 Total acreage of wetlands involved 0

2. Containment for fill

a. Dikes ☐ b. Seawall, etc. ☐ c. Other (please explain) berms

See SCA/EA Section 3.5.1, 4.1

3. Type of fill material to be used none

4. Source of fill material to be used _____

8. Date activity is proposed to commence October 1990 ; to be completed February 1991 .

9. Previous permits for this project have been DER #53112 0329 Corps # Polk County
A. Denied (date) _____
B. Issued (date) _____
C. Other (please explain) Agrico has applied for a permit under permit Application No. 531120329
Differentiate between existing work and proposed work on the drawings.

10. Remarks (See Instruction Pamphlet for additional information required for all applications and certain activities. Use additional sheets if necessary.)

See SCA/EA 1.0 and 3.0 for descriptions and need of the projections, Section 8.2 for alternatives and Sections 4.1, 4.2, 4.4, 5.1 and 5.8 for impacts.

11. AFFIDAVIT OF OWNERSHIP OR CONTROL of the property on which the proposed project is to be undertaken

I CERTIFY THAT: (please check appropriate space)

☐ I am the record owner, lessee, or record easement holder of the property described below.

☒ I am not the record owner, lessee, or record easement holder of the property described below, but I will have before undertaking the proposed work the requisite property interest. (Please explain what the interest will be and how it will be acquired.)

LEGAL DESCRIPTION OF PROPERTY SITUATED IN Polk COUNTY, FLORIDA
(Use additional sheets if necessary)

The west 1400.00 feet of east 2700.00 feet of the south 3300.00 feet of Section 36, Township 32 south, Range 23 east, Polk County, Florida.

Michael P. Polinski
Signature

Sworn and subscribed before me at HILLSBOROUGH County,
FLORIDA, this 27TH day of JUNE, 1989.

Kenneth L. Scharf
NOTARY PUBLIC

My commission expires: Notary Public, State of Florida
My Commission Expires Dec. 3, 1989

12. Application is made for a permit(s) to authorize the activities described herein.

- A. I authorize the agent listed in Item #2 to negotiate modifications or revisions, when necessary, and accept or assent to any stipulations on my behalf.
- B. I understand I may have to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable State Water Quality Standards or other environmental standards both before construction and after the project is completed.
- C. In addition, I agree to provide entry to the project site for inspectors with proper identification or documents as required by law from the environmental agencies for the purpose of making preliminary analyses of the site. Further, I agree to provide entry to the project site for such inspectors to monitor permitted work if a permit is granted.
- D. Further, I hereby acknowledge the obligation and responsibility for obtaining all of the required state, federal or local permits before commencement of construction activities. I also understand that before commencement of this proposed project I must be granted separate permits or authorizations from the U.S. Corps of Engineers, the U.S. Coast Guard, the Department of Environmental Regulation, and the Department of Natural Resources, as necessary.

I CERTIFY that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.


Signature of Applicant

6-25-89
Date

NOTE: THIS APPLICATION MUST BE SIGNED by the person who desires to undertake the proposed activity or by an authorized agent. If an agent is applying on behalf of the applicant, attach proof of authority for the agent to sign and bind the applicant.

18 U.S.C. Section 1001 provides that: Whoever in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

NOTICE TO PERMIT APPLICANTS

This is a Joint Application; it is NOT a Joint Permit!

You Must Obtain All Required Local, State, and Federal

Authorizations or Permits Before Commencing Work!!

For your information: Section 370.034, Florida Statutes, requires that all dredge and fill equipment owned, used, leased, rented or operated in the state shall be registered with the Department of Natural Resources. Before selecting your contractor or equipment you may wish to determine if this requirement has been met. For further information, contact the Chief of the Bureau of Licenses and Motorboat Registration, Department of Natural Resources, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303. Telephone Number 904/488-1195. THIS IS NOT A REQUIREMENT FOR A PERMIT FROM THE DEPARTMENT OF ENVIRONMENTAL REGULATION.

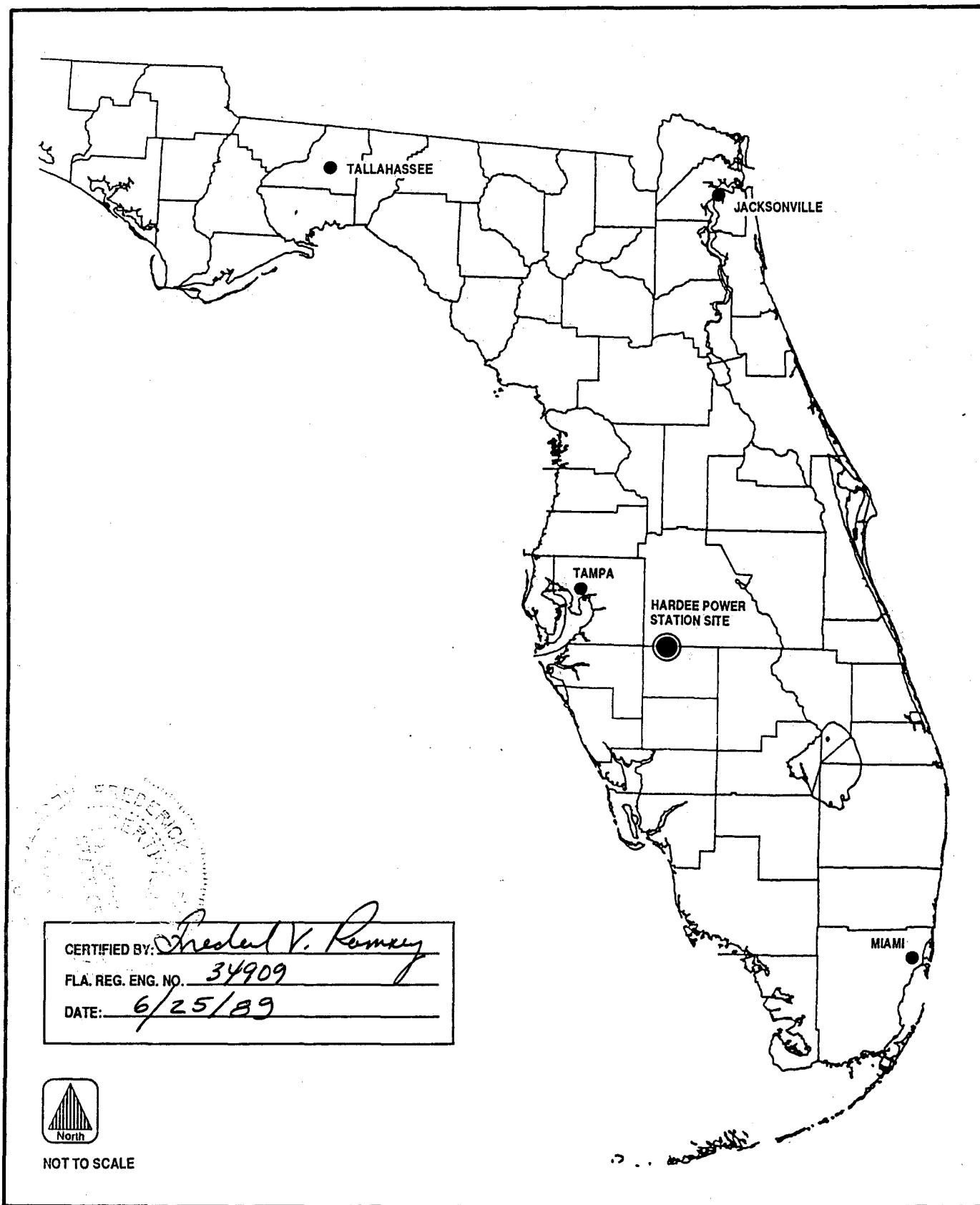


Figure 1 GENERAL LOCATION OF HARDEE POWER STATION

**Hardee
Power Station**

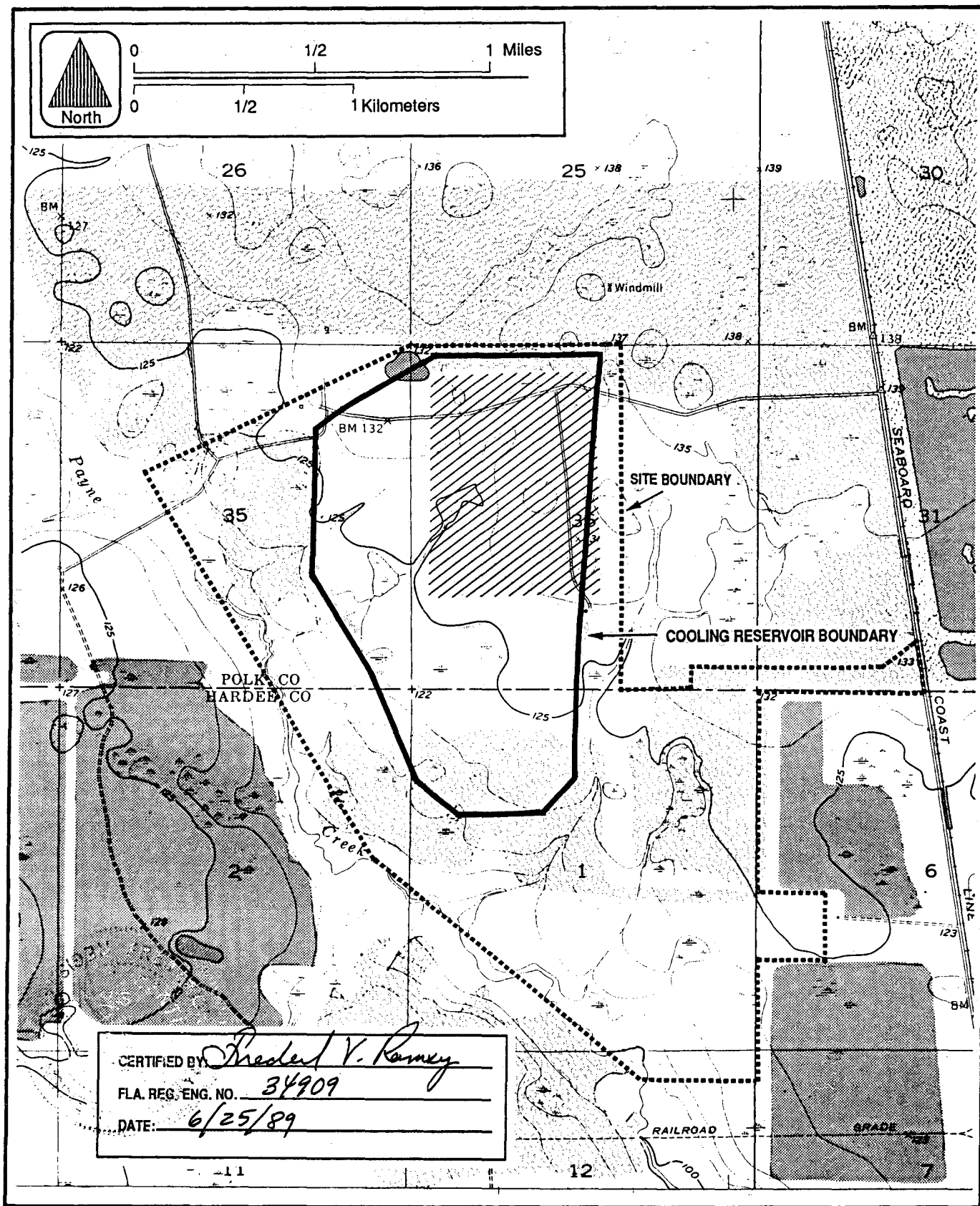


Figure 3 LOCATIONS OF SITE BOUNDARY (PERIMETERS)
AND PERMIT APPLICATION AREA

**Hardee
Power Station**

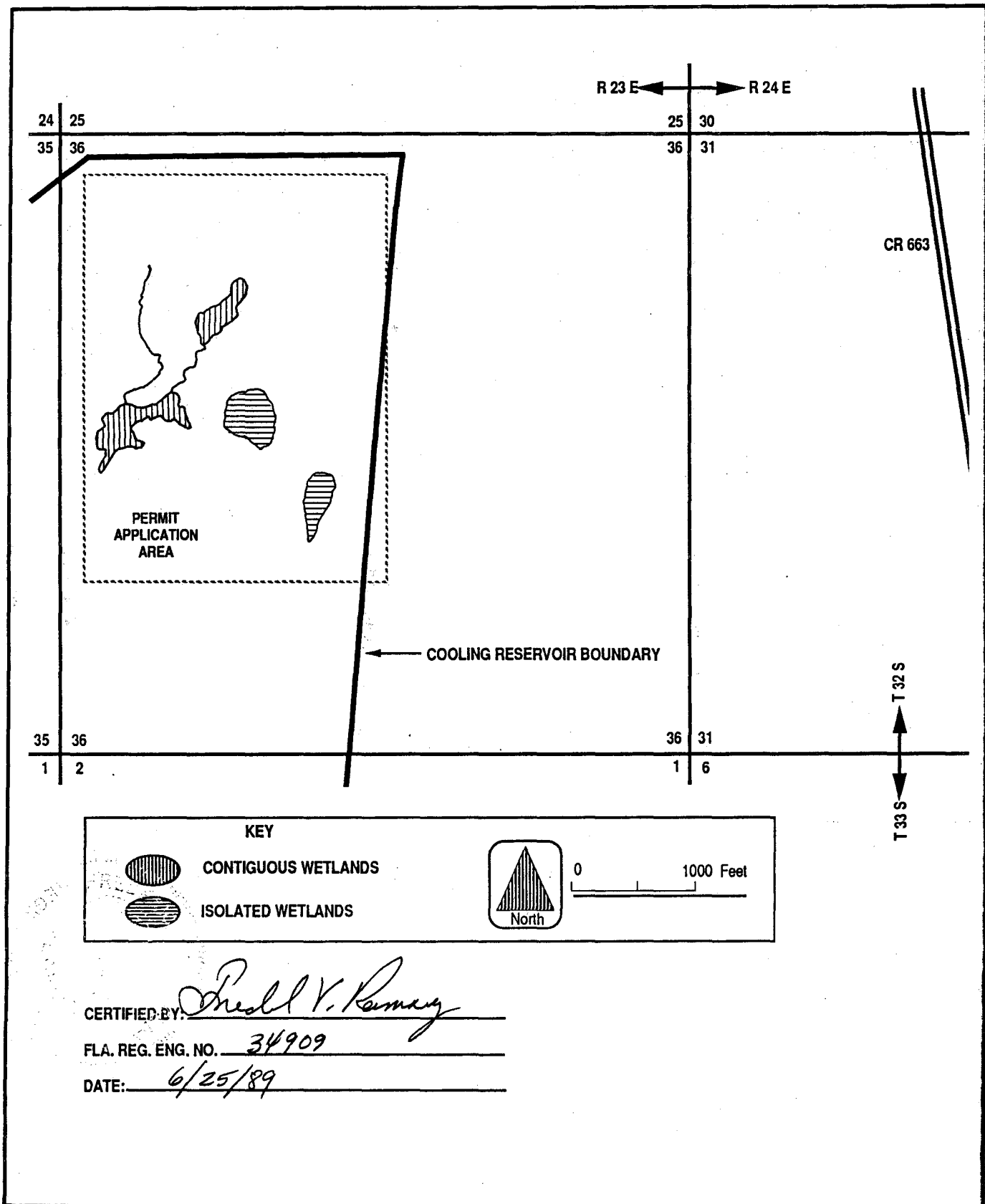


Figure 4 PLAN VIEW

**Hardee
Power Station**

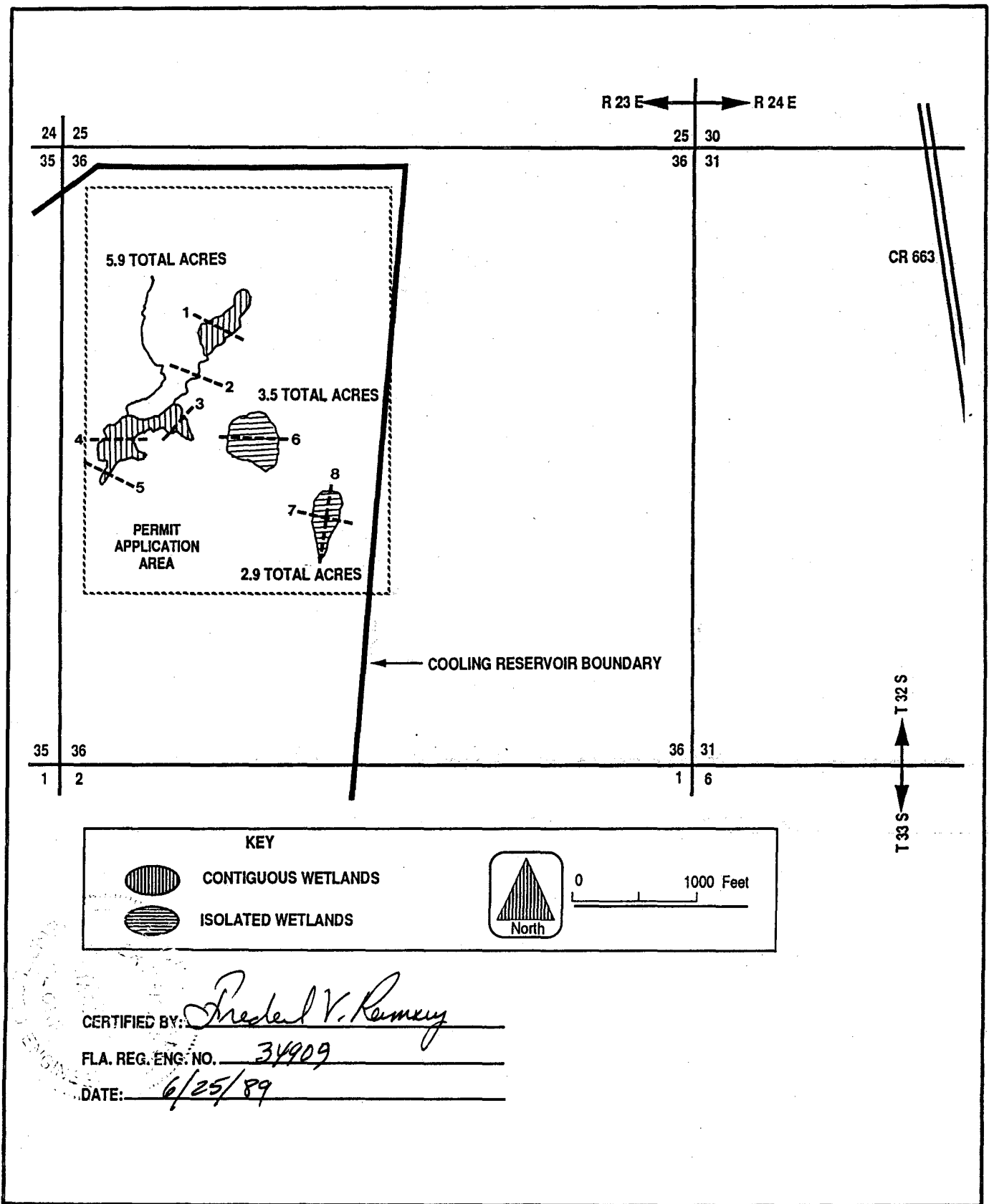
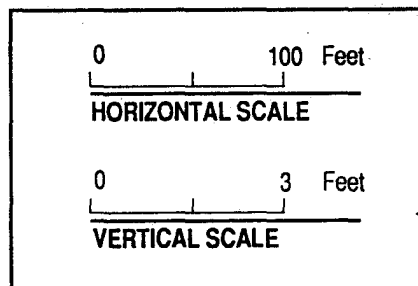
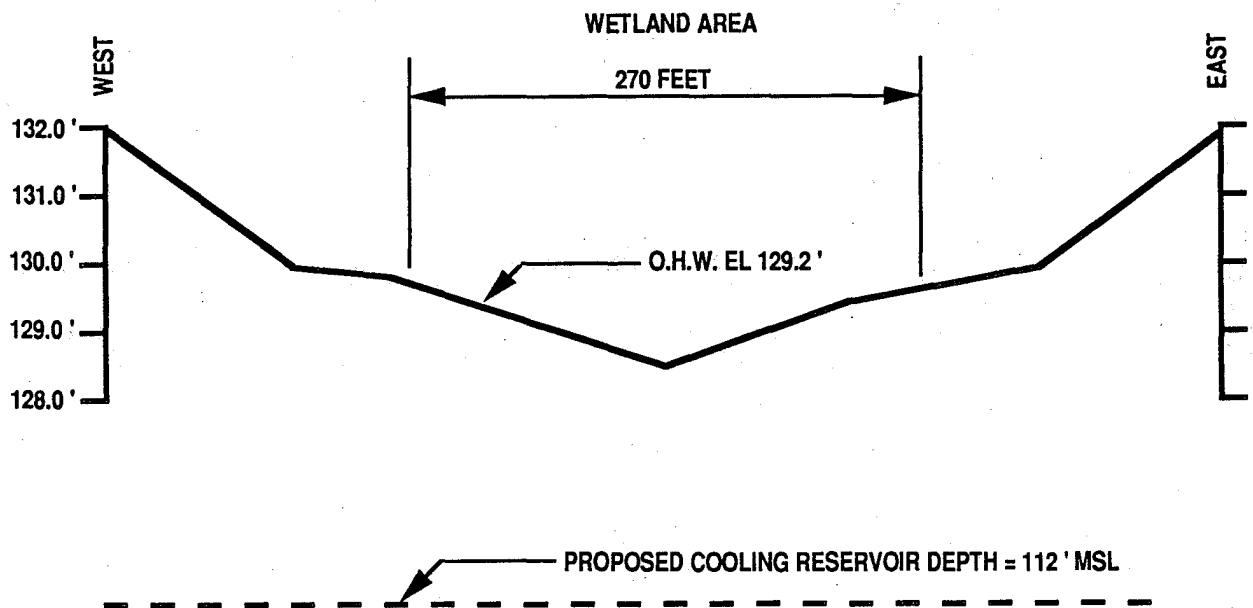


Figure 5 PLAN VIEW - LOCATION OF CROSS SECTIONS

**Hardee
Power Station**



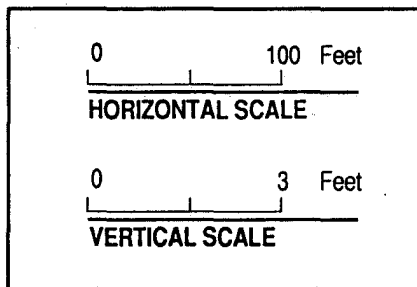
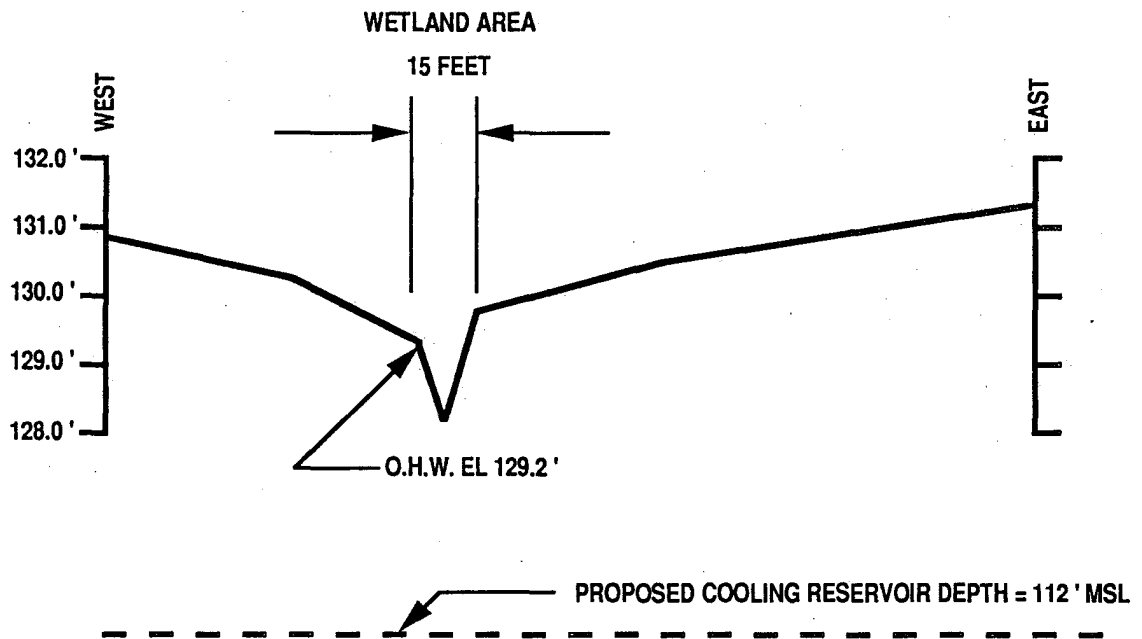
CERTIFIED BY: Paul V. Ramsey

FLA. REG. ENG. NO. 34909

DATE: 6/25/89

Figure 6 CROSS SECTION NO. 1 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



CERTIFIED BY:

Frederick V. Ramsey

FLA. REG. ENG. NO.

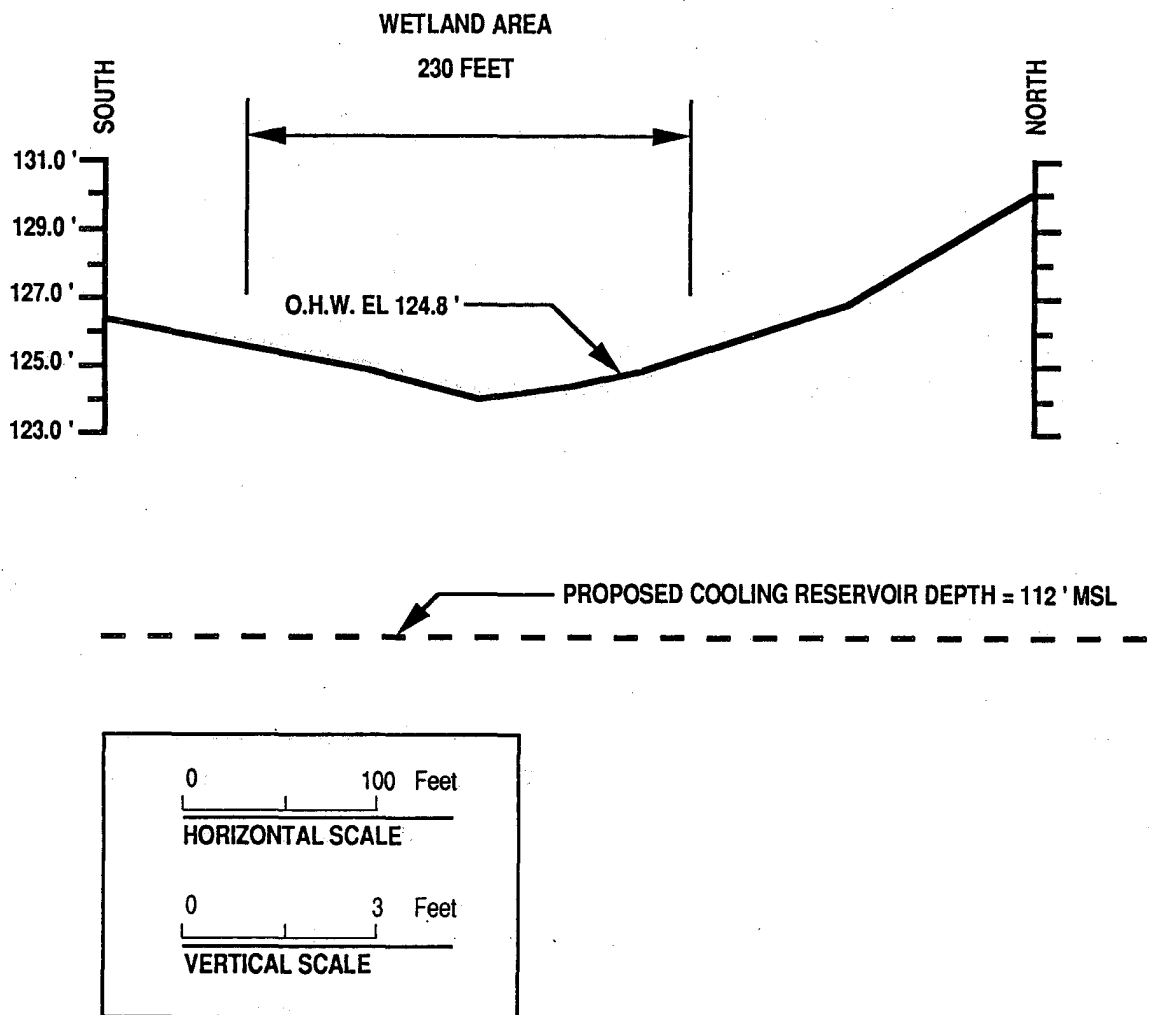
34909

DATE:

6/25/89

Figure 7 CROSS SECTION NO. 2 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



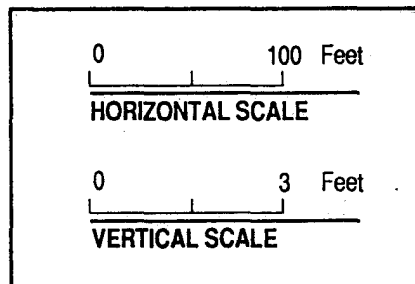
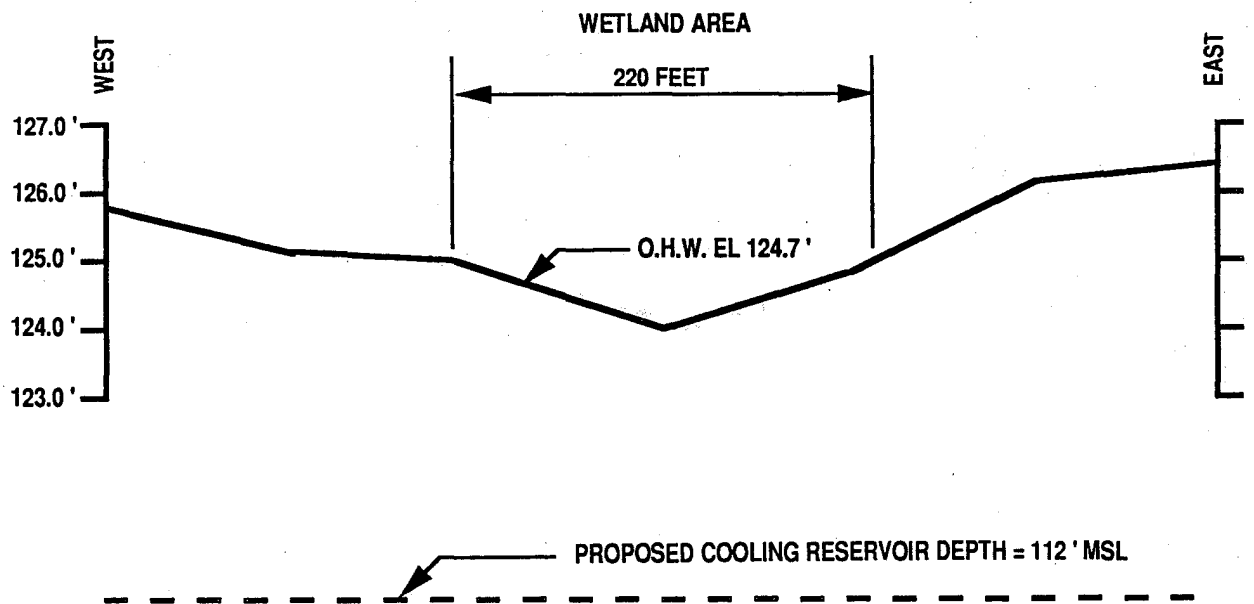
CERTIFIED BY: Frederic V. Ramsey

FLA. REG. ENG. NO. 34909

DATE: 6/25/89

Figure 8 CROSS SECTION NO. 3 - LOOKING WEST
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



CERTIFIED BY:

Fred V. Ramsey

FLA. REG. ENG. NO.

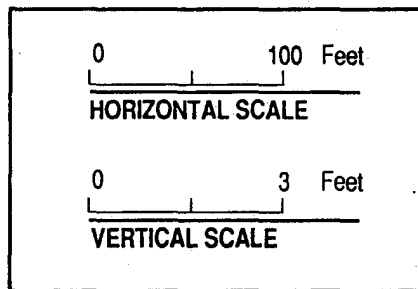
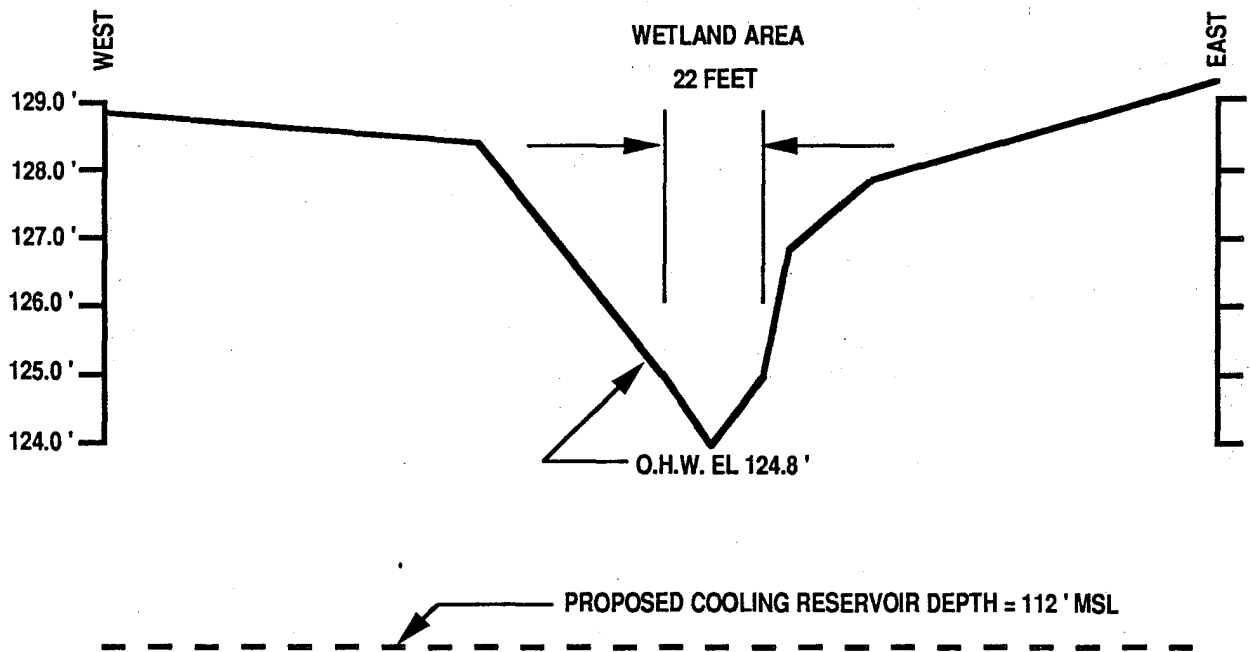
34909

DATE:

6/25/89

Figure 9 CROSS SECTION NO. 4 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



CERTIFIED BY:

Freddie V. Ramsey

FLA. REG. ENG. NO.

34909

DATE:

6/25/89

Figure 10 CROSS SECTION NO. 5 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**

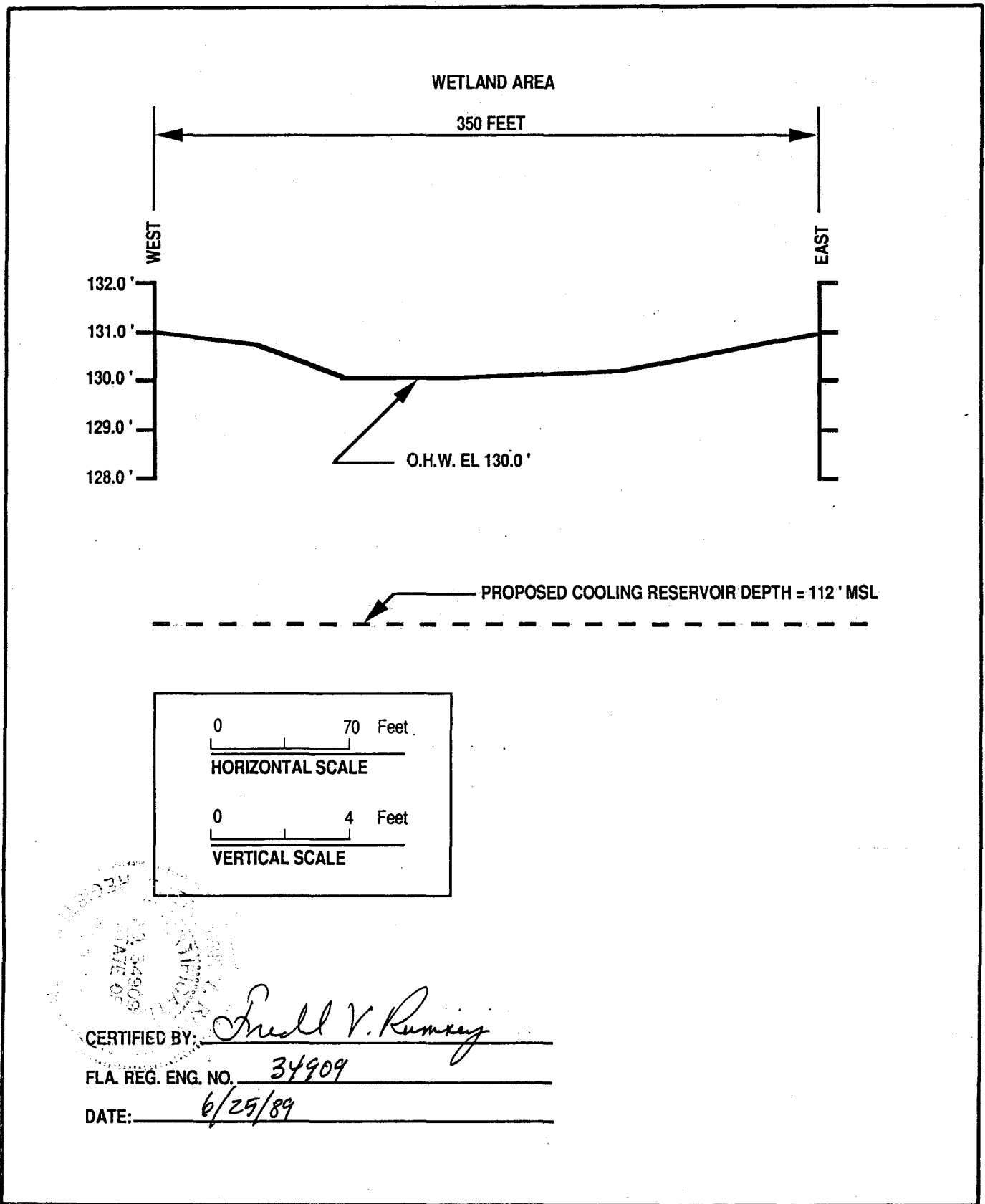
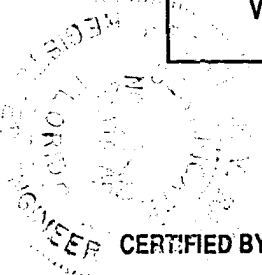
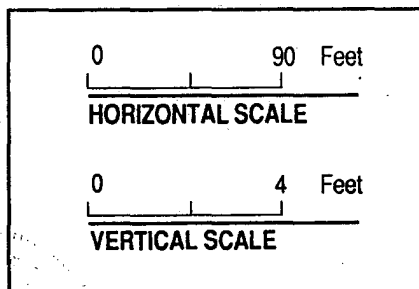
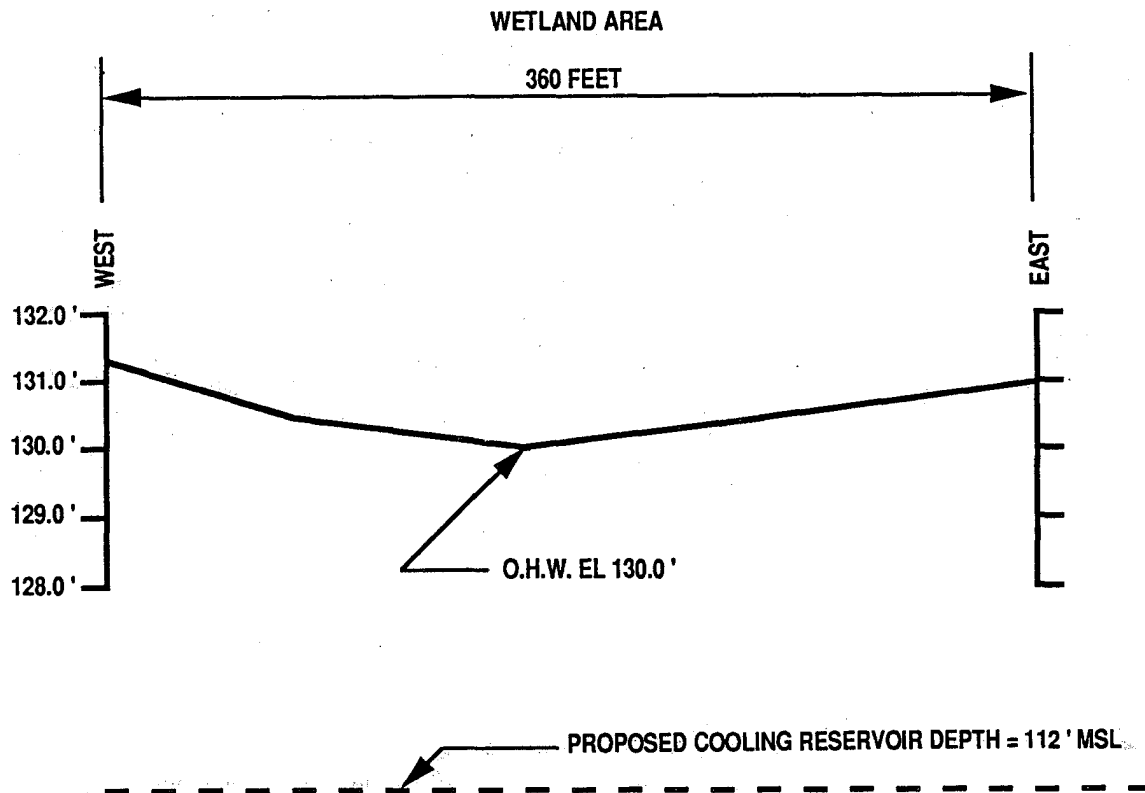


Figure 11 CROSS SECTION NO. 6 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



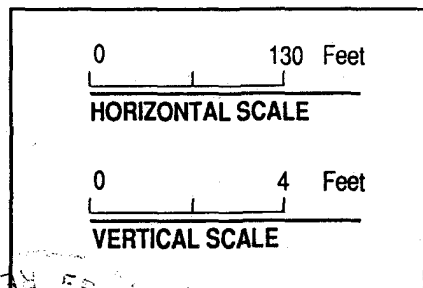
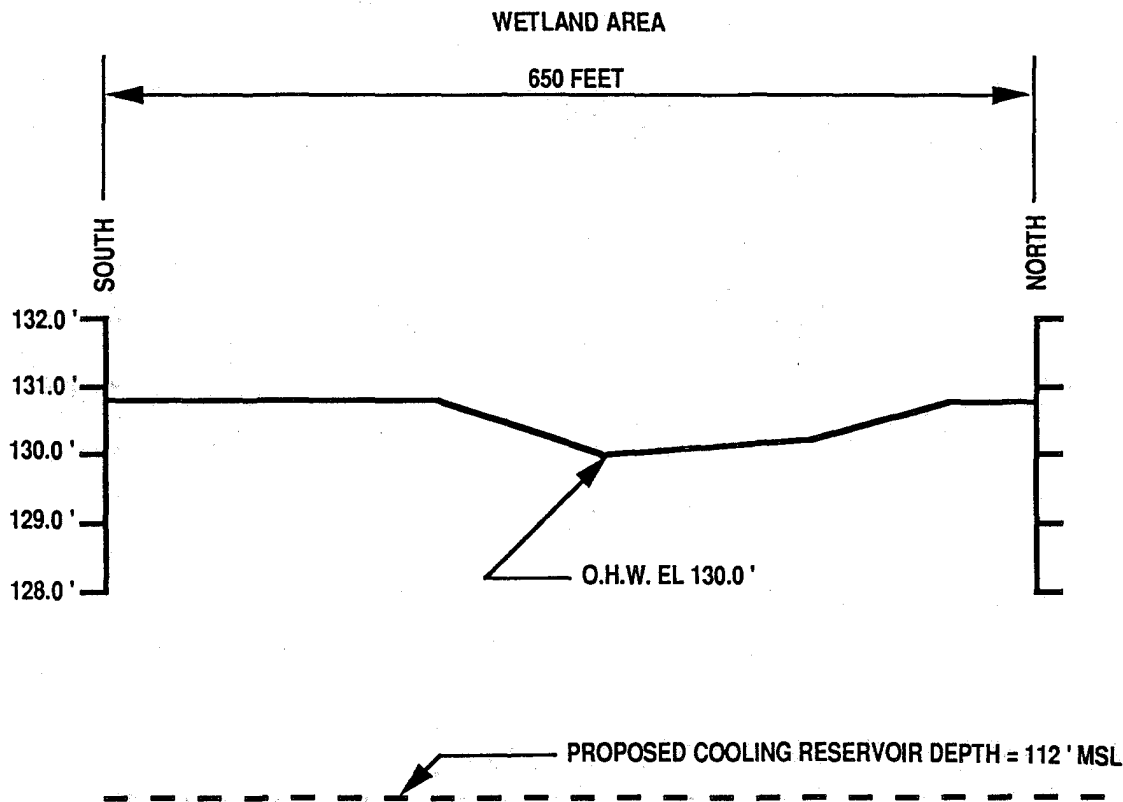
CERTIFIED BY: Frederick V. Ramsey

FLA. REG. ENG. NO. 34909

DATE: 6/25/89

Figure 12 CROSS SECTION NO. 7 - LOOKING NORTH
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**



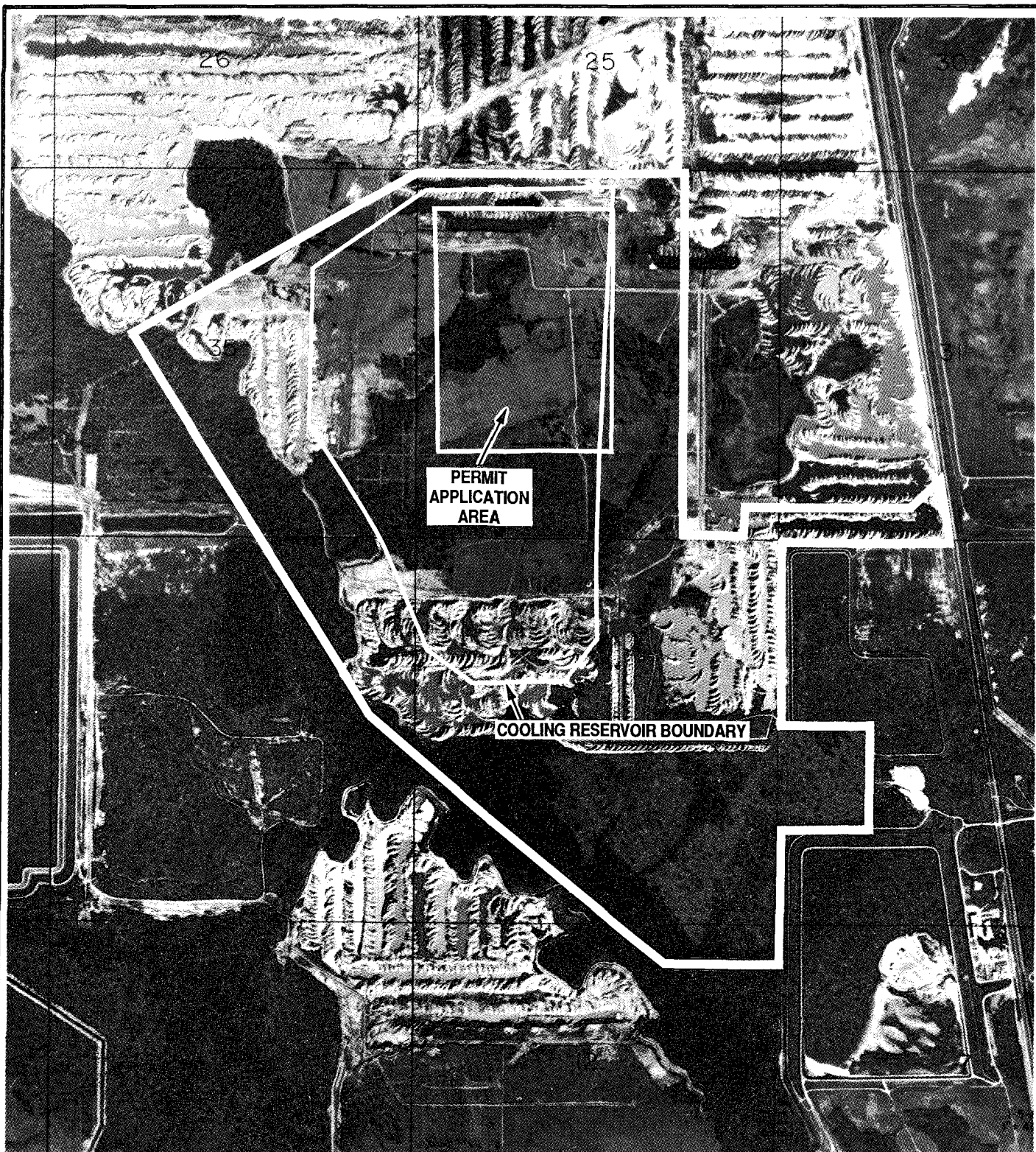
CERTIFIED BY: Frederick V. Ramsey

FLA. REG. ENG. NO. 34809

DATE: 6/25/89

Figure 13 CROSS SECTION NO. 8 - LOOKING WEST
(SEC. 36, T. 32S, R. 23E)

**Hardee
Power Station**

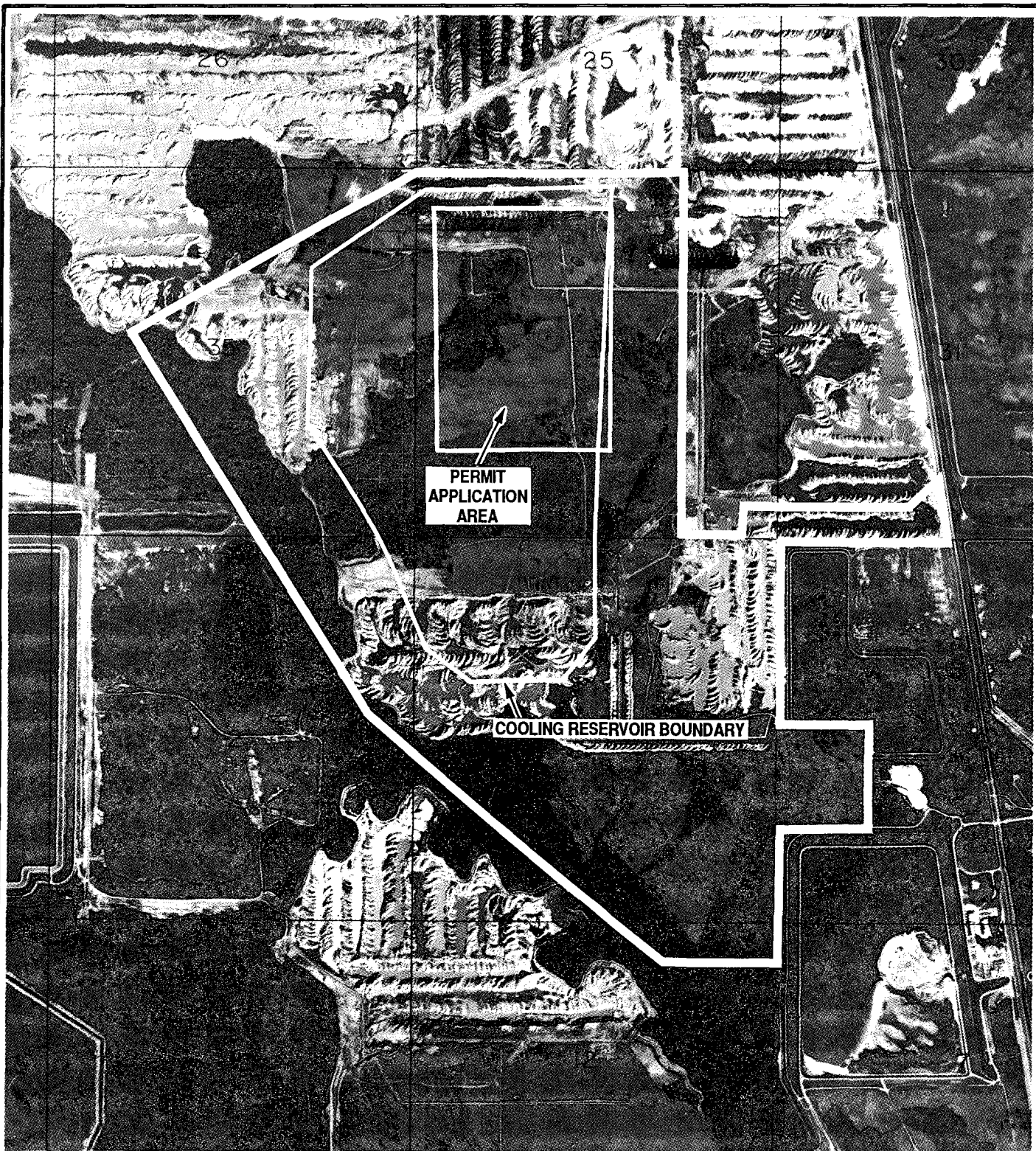


0 1/2 1 Miles
0 1/2 1 Kilometers

1/5/89

AERIAL PHOTO OF PERMIT APPLICATION AREA

**Hardee
Power Station**



0 1/2 1 Miles
0 1/2 1 Kilometers

1/5/89

AERIAL PHOTO OF PERMIT APPLICATION AREA

**Hardee
Power Station**

11.1.4 PREVENTION OF SIGNIFICANT DETERIORATION

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1.0 INTRODUCTION

The Hardee Power Station, will consist of a combined cycle power plant that will burn natural gas and distillate fuel oil. The facility will be constructed in modules that will consist of combustion turbines and associated electric generator, and heat recovery steam generators (HRSG); the HRSG will utilize the waste heat from the combustion turbines to generate steam for producing additional electricity in a steam turbine. Each module will have a nominal generating capacity of 220 MW (net) and would likely consist of two combustion turbines and associated electric generators, and two HRSGs and one steam electric generator. The ultimate capacity of the facility is being planned for 660 MW; however, but only 295 MW will be initially constructed.

The Hardee Power Station will emit air pollutants above regulatory threshold amounts which will require a Prevention of Significant Deterioration (PSD) review promulgated under 40 Code of Federal Regulations (CFR) Part 52.21 and implemented through delegation by the Florida Department of Environmental Regulation (FDER) and its regulations codified in Chapter 17-2.510 Florida Administrative Code (F.A.C.). This document provides the technical information and analyses required by these regulations. The information and analyses provided herein are based on a nominal 660 MW plant configuration; however they are transferable for smaller configurations since conservative emissions and impact analyses were assumed.

While this document is an appendix to the Site Certification Application (SCA), it has been prepared as a stand alone PSD application. The application is divided into seven major sections. Section 2.0 presents a description of the facility, and emissions and stack parameters. PSD review requirements and applicability are presented in Section 3.0. The control technology review, including the Best Available Control Technology (BACT) evaluation is presented in Section 4.0. Sections 5.0, 6.0, 7.0 and 8.0 present the air quality monitoring information and the methodology and results of the impact analyses performed for the project.

2.0 PROJECT DESCRIPTION

2.1 GENERAL DESCRIPTION

The combined cycle facility will be constructed in modules to achieve the desired capacity additions. The final design will depend on the selected combustion turbine with either five or six combustion turbines required to achieve the ultimate capacity of 660 MW. Both simple cycle and combined cycle operation are planned; the latter would use by-pass stacks when only combustion turbine operation is needed, or the steam cycle is inoperable. The HRSG would not be supplementally fired.

2.2 FACILITY EMISSIONS AND STACK OPERATING PARAMETERS

The performance information and stack parameters that envelope the combustion turbine manufacturer's designs currently being considered for the project are presented in Table 2-1. This information provides conservative emission estimates of criteria pollutants (Table 2-2), other regulated pollutants (Table 2-3), and non-regulated pollutants (Table 2-4). Specific manufacturer designs would provide emissions no greater than those shown in these tables. The fuel specifications for natural gas and distillate oil are presented in Tables 2-5 and 2-6, respectively.

For a 660-MW (nominal) facility, the maximum emissions are produced with five combustion turbines; the design, stack, and emission characteristics are presented in Tables 2-1 through 2-4. This configuration will also have the highest exhaust flow. Lower exhaust flow rates and emissions will occur for a 660-MW (nominal) facility using six of the smaller combustion turbines. The exhaust flow and corresponding emissions are important in establishing air quality impacts and must be determined separately for each configuration. As a result, the range in stack parameters used in modeling, as well as corresponding sulfur dioxides (SO₂) emissions, are presented in Table 2-7. In either configuration the maximum potential air quality impacts will occur during combined cycle operation when the exhaust temperature is 240°F.

Table 2-1. Maximum Design and Stack Parameters for Each Combustion Turbine
Associated with the Hardee Power Station Combined Cycle Plant

Data	Gas Turbine Natural Gas @ 32°F	Gas Turbine No.2 Oil @ 32°F	Gas Turbine Natural Gas @ 95°F	Gas Turbine No.2 Oil @ 95°F
General:				
Heat Input (mmBtu/hr)	1,268.4	1,312.3	1,074.1	1,107.2
Natural Gas (mcf/hr)	1,251.4	NA	1,059.8	NA
Fuel Oil (lb/hr)	NA	73,437.1	NA	61,956.3
Fuel:				
Heat Content - Gas (LHV)	1014 Btu/cf	NA	1014 Btu/cf	NA
Heat Content - Oil (LHV)	NA	17,870 Btu/lb	NA	17,870 Btu/lb
% Sulfur	NA	0.5	NA	0.5
Stack:				
Volume Flow (acfm)	1,924,021	1,929,288	1,707,645	1,782,889
Volume Flow (scfm)	713,401	714,351	615,452	628,415
Mass Flow (lb/hr)	3,110,000	3,114,140	2,683,000	2,739,512
Temperature (°F)*	964	966	1,005	1,038
Diameter (ft)	16.0	16.0	16.0	16.0
Velocity (ft/sec)	159.5	159.9	141.6	147.8
Height (ft)	75.0	75.0	75.0	75.0
Moisture (%)	10.3	9.3	13.5	12.4
Oxygen (%)	12.8	12.1	12.5	12.0
Water Injected (lb/hr)	76,010	96,698	63,350	82,047

* Exhaust from HRSG Stack will be 240°F.

NA = Not Applicable

Note: Data Presented in this table represent the design information used to produce maximum emissions from a single combustion turbine. Tables 2-2 through 2-3 present the maximum estimated emissions.

Table 2-2. Maximum Estimated Emissions for Each Combustion Turbine Associated with the Hardee Power Station Combined Cycle Plant Criteria Pollutants

Pollutant	Gas Turbine Natural Gas @ 32°F	Gas Turbine No. 2 Oil @ 32°F	Gas Turbine Natural Gas @ 95°F	Gas Turbine No. 2 Oil @ 95°F
Particulate:				
Basis*	0.8 g/s	7.2 g/s	0.63 g/s	6 g/s
lb/hr	6.3	57.1	5.6	55.5
TPY	27.8	250.1	24.3	243.1
Sulfur Dioxide:				
Basis*	20 gr/100 scf	0.5 % Sulfur	20 gr/100 scf	0.5 % Sulfur
lb/hr	35.75	734.37	30.28	619.56
TPY	156.6	3,216.5	132.6	2,713.7
Nitrogen Oxides:				
Basis*	42 ppm**	65 ppm**	42 ppm**	65 ppm**
lb/hr	215.9	383.8	174.9	311.5
TPY	945.7	1,680.9	766.0	1,364.3
ppm	42.0	65.0	42.0	65.0
Carbon Monoxide:				
Basis*	41 ppm**	13 ppm**	41 ppm**	13 ppm**
lb/hr	128.3	46.7	103.9	37.9
TPY	562.0	204.6	455.2	166.1
ppm	41.0	13.0	41.0	13.0
VOC's:				
Basis*	10 ppm**	10 ppm**	10 ppm**	10 ppm**
lb/hr	17.9	20.5	14.5	16.7
TPY	78.2	89.9	63.4	73.0
ppm	10.0	10.0	10.0	10.0
Lead:				
Basis		USEPA(1988)		USEPA(1988)
lb/hr	neg.	0.01	neg.	0.01
TPY	neg.	0.05	neg.	0.04

* From manufacturers estimates.

** Corrected to 15% O₂ dry conditions.

Neg. = negligible

Emission factors used: No. 2 Fuel Oil; Lead - 8.9 lb/10¹² Btu from USEPA (1988).

Table 2-3. Maximum Estimated Emissions for Each Combustion Turbine Associated with the Hardee Power Station Combined Cycle Plant Other Regulated Pollutants

Pollutant	Gas Turbine Natural Gas @ 32°F	Gas Turbine No. 2 Oil @ 32°F	Gas Turbine Natural Gas @ 95°F	Gas Turbine No. 2 Oil @ 95°F
Arsenic (As) (lb/hr) (TPY)	neg. neg.	0.0055 0.0241	neg. neg.	0.0047 0.0204
Beryllium (Be) (lb/hr) (TPY)	neg. neg.	0.0033 0.0144	neg. neg.	0.0028 0.0121
Mercury (Hg) (lb/hr) (TPY)	0.0144 0.0633	0.0039 0.0172	0.0122 0.0536	0.0033 0.0145
Fluorides (F) (lb/hr) (TPY)	neg. neg.	0.0427 0.1868	neg. neg.	0.0360 0.1576
H2SO4 Mist (lb/hr) (TPY)	1.6 7.2	33.7 147.6	1.4 6.1	28.4 124.6

Neg. = Negligible

Emission factors used:

Natural gas:

Hg - 11.34 lb/10¹² Btu,

H₂SO₄ mist - 3% of Sulfur Emissions;

No. 2 Fuel Oil:

As - 4.2 lb/10¹² Btu, Be - 2.5 lb/10¹² Btu,

Hg - 3.0 lb/10¹² Btu, F - 32.5 lb/10¹² Btu,

H₂SO₄ mist - 3% of Sulfur Emissions.

Sources: USEPA, 1980 for Hg from natural gas firing; USEPA 1981 for F from oil
USEPA, 1988 for all others.

Table 2-4. Maximum Estimated Emissions for Each Combustion Turbine Associated with the Hardee Power Station Combined Cycle Plant Non-Regulated Pollutants

Pollutant	Gas Turbine Natural Gas @ 32°F	Gas Turbine No. 2 Oil @ 32°F	Gas Turbine Natural Gas @ 95°F	Gas Turbine No. 2 Oil @ 95°F
Manganese (lb/hr) (TPY)	neg. neg.	0.0085 0.0370	neg. neg.	0.0071 0.0312
Nickel (lb/hr) (TPY)	neg. neg.	0.2231 0.9772	neg. neg.	0.1882 0.8244
Cadmium (lb/hr) (TPY)	neg. neg.	0.0138 0.0604	neg. neg.	0.0116 0.0509
Chromium (lb/hr) (TPY)	neg. neg.	0.0623 0.2730	neg. neg.	0.0526 0.2303
Copper (lb/hr) (TPY)	neg. neg.	0.3674 1.6094	neg. neg.	0.3100 1.3578
Vanadium (lb/hr) (TPY)	neg. neg.	0.0915 0.4007	neg. neg.	0.0772 0.3381
Selenium (lb/hr) (TPY)	neg. neg.	0.0308 0.1349	neg. neg.	0.0260 0.1138
POM (lb/hr) (TPY)	0.0008 0.0036	0.0004 0.0016	0.0007 0.0031	0.0003 0.0014
Formaldehyde (lb/hr) (TPY)	0.1120 0.4906	0.5315 2.3279	0.0949 0.4155	0.4484 1.9640

Neg. = Negligible

Emission Factors Used:

Natural Gas: Polycyclic Organic Matter (POM) - $0.65 \text{ lb}/10^{12} \text{ Btu}$,
Formaldehyde - $0.088 \text{ lb}/10^9 \text{ Btu}$;

No. 2 Fuel Oil: Manganese - $6.44 \text{ lb}/10^{12} \text{ Btu}$,
Nickel - $170 \text{ lb}/10^{12} \text{ Btu}$, Cadmium - $10.5 \text{ lb}/10^{12} \text{ Btu}$,
Chromium - $47.5 \text{ lb}/10^{12} \text{ Btu}$, Copper - $280 \text{ lb}/10^{12} \text{ Btu}$,
Vanadium - $69.7 \text{ lb}/10^{12} \text{ Btu}$, Selenium - $23.5 \text{ lb}/10^{12} \text{ Btu}$,
POM - $0.279 \text{ lb}/10^{12} \text{ Btu}$ (emission factor indicated as a less than in reference),
Formaldehyde - $405 \text{ lb}/10^{12} \text{ Btu}$.

Source: USEPA, 1988.

Table 2-5. Typical Natural Gas Specification*

<u>Constituents, Percent by Volume</u>	
Hydrogen (H ₂)	--
Methane (CH ₄)	83.40
Ethylene (C ₂ H ₄)	--
Ethane (C ₂ H 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 ₂ S), max.	1 grain/100 SCF
Water (H ₂ O) 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>	
Sulfur (S), max.	20 grains/100 SCF
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
Btu/lb of Fuel (HHV)	23,170
(LHV)	20,870

* Pipeline Grade.

Table 2-6. Typical Fuel Oil Specification*

Specific gravity, 60°F	0.82 - 0.86
Viscosity, cSt, 100°F, min.	0.5
Pour point, max, °F	0
Gross heating value, kcal/kg	10,500 - 10,950
Gross heating value, Btu/lb	19,000 - 19,600
Filterable dirt, mg/100 ml	4
Carbon residue (10% Bottoms), %, max.	0.25
Carbon residue (100% Sample), %, max.	1.0
Sulfur, %, maximum	0.5
Nitrogen, %	0.005 - 0.015
Hydrogen, %	12.2 - 13.2
Ash (fuel as delivered), ppm, 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

* Specification is typical of American Society of Testing and Materials (ASTM) Grade of No. 2 (ASTM D-398).

Table 2-7. Stack Parameters and SO₂ Emissions Used in Modeling for the Hardee Power Station

	<u>Highest Emission</u>		<u>Lowest Flow Rate</u>	
	32°F	95°F	32°F	95°F
	CASE 1	CASE 2	CASE 3	CASE 4
Stack Gas Flow (ACFM)	947,056	833,126	770,627	654,455
Stack Gas Temperature (°F)	240	240	240	240
Stack Velocity (ft/sec)	78.5	69.1	63.9	54.2
Stack Diameter (ft)	16	16	16	16
Stack Height (ft)*	75	75	75	75
SO ₂ Emissions (lb/hr)	734.37	619.56	558.04	456.34

* This stack height was used for the HRSG exhaust along with worst case structure dimensions (see Table 6-13) to conservatively estimate air quality impacts.

Note: Cases 1 and 2 are for five combustion turbines.
 Cases 3 and 4 are for six combustion turbines.
 Stack parameters and emissions are shown on a per-unit basis.

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to the project. These regulations must be satisfied before the proposed facility can operate.

3.1 NATIONAL AND STATE AAQS

The existing applicable National and Florida ambient air quality standards (AAQS) are presented in Table 3-1. 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.

3.2 PSD REQUIREMENTS

3.2.1 General Requirements

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 the U.S. Environmental Protection Agency (USEPA). (For sources in Florida, PSD review and approval has been delegated to FDER.) A "major stationary source" is defined as any one of 28 named source categories which has the potential to emit 100 tons per year (TPY) or more, or any other stationary source which has the potential to emit 250 TPY or more, of any pollutant regulated under CAA. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment.

A "major modification" is defined under PSD regulations as a change at an existing major stationary source which increases emissions by greater than "significant amounts." PSD significant emission rates are shown in Table 3-2.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significance Levels ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	AAQS			PSD Increments		Significant Impact Levels
		National		State of Florida	Class I	Class II	
		Primary Standard	Secondary Standard				
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum ⁺	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	NA	NA	1
	24-Hour Maximum ⁺	150	150	150	NA	NA	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum ⁺	365	NA	260	5	91	5
	3-Hour Maximum ⁺	NA	1,300	1300	25	512	25
Carbon Monoxide	8-Hour Maximum ⁺	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum ⁺	40,000	40,000	40,000	NA	NA	2000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5 ^{**}	25 ^{**}	1
Ozone	1-Hour Maximum ⁺⁺	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	NA	NA	NA

⁺ Maximum concentration not to be exceeded more than once per year.

^{*} Achieved when the expected number of exceedances per year is less than 1.0.

^{**} The State of Florida has not yet adopted the PSD Increments for NO₂ concentrations.

⁺⁺ Achieved when the expected number of days per year with concentrations above the standard is less than 1.0.

NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.

40 CFR 50

40 CFR 52.21

Table 3-2. PSD Significant Emission Rates and De Minimis Air Quality Impact Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	<u>De Minimis</u> Air Quality Impact (ug/m ³)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, Annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY ⁺
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	*
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	*
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	0	*
Radionuclides	NESHAP	0	*
Inorganic Arsenic	NESHAP	0	*

*No ambient measurement method.

+Increases in VOC emissions.

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

NAAQS = National Ambient Air Quality Standards.

NSPS = New Source Performance Standards.

NESHAP = National Emission Standards for Hazardous Air Pollutants.

Sources: 40 CFR 52.21.

Chapter 17-2, Florida Administrative Code

06/23/89

PSD review is used to determine whether significant air quality deterioration will result from the new or modified source. PSD requirements are contained in 40 CFR 52.21, Prevention of Significant Deterioration of Air Quality. Major sources and modifications are required to undergo the following analysis related to PSD for each pollutant emitted in "significant" amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new source must also be reviewed with respect to Good Engineering Practice (GEP) stack height regulations. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 Increments/Classifications

In promulgating the 1977 CAA Amendments, Congress specified that certain increases above an air quality "baseline concentration" level of SO₂ and 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 Class I (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) or as Class II (all areas not designated as Class I). Class III areas, which would be allowed greater deterioration than Class II areas, have not been designated. USEPA then promulgated as regulations the requirements for classifications and area designations.

On October 17, 1988, the USEPA promulgated regulations to prevent significant deterioration due to NO_x emissions and established PSD increments for NO₂ concentrations. The USEPA class designations and

allowable PSD increments are presented in Table 3-1. The Florida DER has adopted the USEPA class designations and allowable PSD increments for SO₂ and PM but has not yet adopted the NO₂ increments.

The term "baseline concentration" evolves from federal and state PSD regulations and denotes a fictitious concentration level corresponding to a specified baseline date 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 emissions of major stationary sources which commenced construction before January 6, 1975, 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 emissions from any major stationary source on which construction commenced after January 6, 1975 for SO₂ and TSP concentrations and February 8, 1988, for NO₂ concentrations; 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 SO₂ and TSP concentrations and February 8, 1988, for NO₂ 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.

3.2.3 Control Technology Review

The control technology review requirements of the federal PSD regulations require that all applicable federal and state emission limiting standards be met and that Best Available Control Technology (BACT) be applied to control emissions from the source (40 CFR 52.21). The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the source or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in 40 CFR 52.21 as:

An emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act...which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable...through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant.... If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology.

The requirements for BACT were promulgated within the framework of PSD in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and thereby enlarge the potential for future economic growth without significantly degrading air quality (USEPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in USEPA's "Guidelines for Determining Best Available Control Technology (BACT)," (USEPA, 1978) and in the "PSD Workshop Manual" (USEPA, 1980). These guidelines were promulgated by USEPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area.

According to USEPA (1980), "BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis."

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with NSPS for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgement, balancing environmental benefits with energy, economic, and other impacts (USEPA, 1978).

3.2.4 Air Quality Analysis

In accordance with requirements of 40 CFR 52.21(m), any application for a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary source or major modification. For a new major source, the affected pollutants are those that the source would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

According to CAA, ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of four (4) months of data is required. Existing data from the vicinity of

the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in USEPA's "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (USEPA, 1987a).

The regulations include an exemption which excludes or limits the pollutants for which an air quality analysis must be conducted. This exemption states that the Administrator may exempt a proposed major stationary source or major modification from the monitoring requirements of 40 CFR 52.21(m) with respect to a particular pollutant if the emissions increase of the pollutant from the source or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 3-2.

3.2.5 Source Impact Analysis

A source impact analysis must be performed by a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically require the use of atmospheric dispersion models in performing impact analysis, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated USEPA models must normally be used in performing the impact analysis. Specific applications for other than USEPA-approved models require USEPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the USEPA publication, "Guideline on Air Quality Models (Revised)" (USEPA, 1987b). The source impact analysis for criteria pollutants may be limited to only the new or modified source if the net increase in impacts due to the new or modified source is below significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be utilized for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" refers to the highest of

the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor must normally be used for comparison to air quality standards.

3.2.6 Additional Impact Analysis

In addition to air quality impact analyses, federal PSD regulations require analyses of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source. These analyses are to be conducted primarily for PSD Class I areas. Impacts due to general commercial, residential, industrial, and other growth associated with the source must also be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

3.2.7 Good Engineering Practice Stack Height

The 1977 CAA Amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP, or any other dispersion technique. On July 8, 1985, USEPA promulgated final stack height regulations (USEPA, 1985). GEP stack height is defined as the highest of:

1. 65 meters (m), or
2. A height established by applying the formula:

$$H_g = H + 1.5L$$

where: H_g = GEP stack height,

H = Height of the structure or nearby structure, and

L = Lesser dimension (height or projected width) of nearby structure(s).

3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than

0.8 km. Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

The stack height regulations also allow increased GEP stack height beyond that resulting from the above formula in cases where "plume impaction" occurs. Plume impaction is defined as concentrations measured or predicted to occur when the plume interacts with "elevated terrain." "Elevated terrain" is defined as terrain which exceeds the height calculated by the GEP stack height formula. Because the terrain in the vicinity of the proposed facility is flat, plume impaction was not considered in determining the GEP stack height.

3.3 NONATTAINMENT RULES

On August 7, 1980, USEPA promulgated rules for review of major new sources and major modifications in areas where air quality does not meet federal standards [Emission Offset Interpretative Ruling (40 CFR 51, Appendix S), which applies to new and modified major sources affecting nonattainment areas.] Under Section IV.A of the Ruling, such sources are required to: (1) meet an emission limitation which specifies the lowest achievable emission rate for such sources, (2) certify that all existing major sources owned or operated by the applicant in the same state are in compliance with all applicable emission limitations and standards under the Act, (3) obtain emission offsets such that there will be reasonable progress toward attainment of the applicable national AAQS, and (4) demonstrate that the emission offsets would provide a positive net air quality benefit in the affected area [not applicable for volatile organic compounds (VOC) or NO_x]. FDER has promulgated rules that are consistent with the USEPA requirements [17-2.510 Florida Administrative Code]. Based on these current nonattainment provisions, all major new sources and modifications to existing major sources located in the nonattainment area must undergo the nonattainment review procedures if the proposed facility or source has the potential to emit 100 TPY or more of the nonattainment pollutant, or the

major modification results in a significant net emission increase at the facility of the nonattainment pollutant.

For major sources or major modifications which locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area (F.A.C, Section 17-2.510). The area of influence is defined as an area which is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on F.A.C, Section 17-2.510(2)(a) 2.a, all VOC sources which are located within an area of influence are exempt from the provisions of new source review for nonattainment areas. Sources which emit other pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 SOURCE APPLICABILITY

3.4.1 PSD Review

3.4.1.1 Potential Emissions

The proposed facility would be considered a "major source" if the emission rate for one of the regulated pollutants exceeds 100 TPY. Once the source is considered to be a major source, PSD review is required for any pollutant that exceeds the PSD significant emission rates presented in Table 3-2. As presented in Table 3-3, the proposed source will have potential emissions of SO₂, NO₂, PM, CO, VOC, and sulfuric acid mist that are major and will exceed the PSD significant emission rates for Be, Hg and As. Therefore, the proposed facility is a major source and is subject to PSD review for those pollutants.

3.4.1.2 Area Classification

The proposed facility unit will be located in Hardee County which is designated by FDER as an attainment area for all criteria pollutants, and a PSD Class II area for SO₂, TSP and NO₂. The nearest nonattainment area is Hillsborough County which is nonattainment for ozone. Also, portion

Table 3-3. Potential Emissions and Predicted Impacts of the Project Compared to PSD Significant Emission Rates and De Minimis Air Quality Impacts Levels (Page 1 of 2)

Pollutant	Emissions (TPY)		Signif- icant Emission Rate	Impacts (ug/m ³)	
	Potential From Proposed Source ⁺⁺			Predicted Impacts	<u>De Minimis</u> Air Quality Impact Level
Sulfur Dioxide	16,083	40	62.5	13, 24-hour	
Particulate Matter (TSP)	1,250	25	7.5	10, 24-hour	
Particulate Matter (PM10)	1,250	15	7.5	10, 24-hour	
Nitrogen Dioxide	8,405	40	4.6	14, Annual	
Carbon Monoxide	2,810	100	38.0	575, 8-hour	
Votatile Organic Compounds	450	40	--	Emissions Increase of 100 TPY	
Lead	0.25	0.6	**	0.1, Calendar quarter	
Sulfuric Acid Mist	738	7	*	*	
Total Fluorides	0.93	3	**	0.25, 24-hour	
Total Reduced Sulfur	NEG	10	**	10, 1-hour	
Reduced Sulfur Compounds	NEG	10	**	10, 1-hour	
Hydrogen Sulfide	NEG	10	**	0.2, 1-hour	
Asbestos	NEG	0.007	*	*	
Beryllium	0.072	0.0004	0.0004	0.001, 24-hour	
Mercury	0.32	0.1	0.0016	0.25, 24-hour	
Vinyl Chloride	NEG	1	**	15, 24-hour	
Benzene	NEG	0	*	*	
Radionuclides	NEG	0	*	*	
Inorganic Arsenic	0.12	0	+	*	

Table 3-3. Potential Emissions and Predicted Impacts of the Project Compared to PSD Significant Emission Rates and De Minimis Air Quality Impacts Levels (Page 2 of 2)

Note : NA = Not applicable.
NEG = Negligible.

- * No acceptable ambient measurement method has been developed and, therefore, de minimis levels have not been established by USEPA.
- + Predicted impacts are presented in Section 8 to assess effects on soils and vegetation.
- ** Predicted impacts are not required because emissions are less than significant emission rates.
- ++ Based on 100 percent capacity factor at 100 percent load when firing oil at 32°F conditions; all pollutant emissions based on 5 combustion turbines which produce the maximum emissions for an ultimate capacity of 660 MW.

of Hillsborough County has been reclassified by FDER from a TSP nonattainment area to unclassifiable for PM10. This change will go into effect upon USEPA approval. The proposed facility will also be located more than 100 km from the PSD Class I areas of the Chassahowitzka National Wilderness Area and the Everglades National Park. Because impacts from the proposed source's emissions are not expected to be significant at such distances, potential impacts on the Class I area were not addressed in the analysis.

3.4.1.3 Ambient Monitoring

Based upon the pollutant impacts presented in Table 3-3, a PSD preconstruction ambient monitoring analysis is required for SO₂, NO₂, PM, CO, VOC, sulfuric acid mist, Be, Hg and As. However, if the impact of these pollutant emissions is less than the de minimis levels, then an exemption from the preconstruction ambient monitoring requirement may be granted. Predicted impacts are less than de minimis levels for all pollutants, except SO₂ (refer to Table 3-3). For SO₂ concentrations, the Applicant has requested and received from the Florida DER an exemption from PSD preconstruction monitoring. For ozone concentrations, the de minimis air quality impact level is specified as an increase of 100 TPY or more of VOC emissions. Because the maximum potential VOC emissions from the proposed plant are greater than 100 TPY, preconstruction monitoring review is required for O₃ concentrations. However, because of the rural nature of the proposed site and locations of existing monitoring stations, data from existing monitoring stations will be used to fulfill the ambient monitoring requirements for this application. A more detailed discussion about the preconstruction monitoring exemption and use of existing ambient data is presented in Section 5.0.

3.4.1.4 GEP Stack Height Impact Analysis

The GEP stack height regulations allow any stack to be at least 65 meters high. The proposed stack heights are 75 and 90 ft (23 and 27 meters), respectively, for the by-pass and HRSG stacks; therefore, they do not exceed the GEP stack height. Impact analyses were performed with both stacks at

75 ft (23 m) to produce worst case ambient impacts. The potential for downwash of the units' emissions due to nearby structures is discussed in Section 6.0, Air Quality Modeling Approach.

3.4.2 Nonattainment Review

Although the proposed facility is located in an attainment area for all regulated pollutants, it may be subject to nonattainment review if it is located within the area of influence of a nonattainment area (F.A.C., Section 17-2.510).

The proposed facility is located approximately 9 km from Hillsborough County, which is designated as nonattainment for O₃ concentrations, and 40 km from that portion of Hillsborough County designated as nonattainment for TSP concentrations. Therefore, the proposed facility is located within the area of influence of both nonattainment areas. However, based on FDER regulations, the proposed facility is exempt from nonattainment review for VOC emissions but must comply with PSD review requirements. Based on the maximum concentrations predicted for the proposed facility presented in Section 7.0, the maximum allowable TSP emissions will produce impacts that are not significant within the reclassified nonattainment area. In fact, the proposed facility has a significant TSP impact that extends out to only about 10 km from the project site. Based on these results, the proposed facility is not subject to nonattainment review for either VOC or PM emissions.

4.0 CONTROL TECHNOLOGY REVIEW

4.1 APPLICABILITY

The Control Technology review requirements of the PSD regulations are applicable to emissions of NO_x, CO, SO₂, TSP/PM₁₀, VOC, mercury, inorganic arsenic and sulfuric acid mist and beryllium (see Section 3.0). This section presents the applicable New Source Performance Standards (NSPS) and the proposed BACT for these pollutants. The approach to BACT analyses are based on the regulatory definitions of BACT.

4.2 NEW SOURCE PERFORMANCE STANDARDS

The applicable NSPS for gas turbines are codified in 40 CFR part GG. These regulations apply to:

1. "Electric utility stationary gas turbine" with a heat input at peak load of greater than 100 million Btu/hr [40 CFR 60.332 (b)];
2. "Stationary gas turbines" with a heat input at peak load between 10 and 100 million Btu/hr [40 CFR 60.332 (c)]; or
3. "Stationary gas turbines" with a manufacture's rate based load at ISO conditions of 30 MW or less [40 CFR 60.332 (d)].

The "electric utility stationary gas turbine" provisions apply to stationary gas turbines constructed for the purpose of supplying more than one-third of its potential electric output capacity to any utility power distribution system for sale [40 CFR 60.331 (q)]. The requirements for "electric utility stationary gas turbines" are applicable to the project and are the most stringent provision of the NSPS and are a technically feasible control alternative for the project. These requirements are summarized in Table 4-1 and were considered in the BACT analysis.

As noted from Table 4-1, the NSPS can be adjusted upward to allow for fuel bound nitrogen. For a fuel bound nitrogen concentration of 0.015% or less no increase in the NSPS is provided; for a fuel bound nitrogen concentration of 0.06% the NSPS is increased by 0.0024% or 24 ppm.

Table 4-1. Federal NSPS for Stationary Gas Turbines

Pollutant	Emission Limitation*
Sulfur Dioxide	Maximum of 0.015 percent by volume at 15 percent oxygen on a dry basis <u>or</u> sulfur in fuel no greater than 0.8 percent by weight
Nitrogen Oxides ⁺	0.0075 percent by volume (75 ppm) at 15 percent O ₂ on a dry basis adjusted for heat rate and fuel nitrogen

* Applicable to electric utility gas turbines with a heat input at peak load of greater than 100×10^6 Btu/hr.

⁺ Standard is multiplied by $14.4/Y$; where Y is the manufacturer's rated heat rate in kilojoules per watt at rated load or actual measured heat rate based on the lower heating value of fuel measured at actual peak load Y cannot be greater than 14.4.

** Standard is adjusted upward (additive) by the percent of nitrogen in the fuel:

Fuel-bound nitrogen (percent by weight)	Allowed Increase NO _x percent by volume
N<0.015.....	0
0.015<N<0.1.....	0.04(N)
0.1<N<0.25.....	0.004+0.0067(N-0.1)
N>0.25.....	0.005

where:

N = the nitrogen content of the fuel (percent by weight).

Source: 40 CFR 60 Subpart GG.

4.3 BEST AVAILABLE CONTROL TECHNOLOGY

4.3.1 Nitrogen Oxides

4.3.1.1 Emission Control Hierarchy

NO_x emissions from combustion of fossil fuels consist of thermal NO_x and fuel bound NO_x. Thermal NO_x is formed from the reaction of oxygen and nitrogen in the combustion air at combustion temperatures. Formation of thermal NO_x depends on the flame temperature, residence time, combustion pressure, and air to fuel ratios in the primary combustion zone. The design and operation of the combustion chamber dictates these conditions. Fuel bound NO_x is created by the oxidation of volatilized nitrogen in the fuel. Nitrogen content in the fuel is the primary factor in its formation.

Table 4-2 presents a listing of the LAER/BACT decisions for gas turbines made by state environmental agencies and EPA regional offices. This table was developed from the information contained in the LAER/BACT clearinghouse documents (USEPA, 1985, 1986b, 1987c 1988c) and by contacting state agencies such as the California Air Control Board and the South Coast Air Quality Management District.

Presently, there are about 35 operating and permitted facilities with Selective Catalytic (SCR) in the United States. Almost all of these facilities were required to have SCR due to nonattainment status of the area where the facility was located. The requirement for SCR in these cases was to meet the Lowest Achievable Emission Rate (LAER). LAER is defined as follows:

Lowest achievable emission rate means, for any source, the more stringent rate of emissions based on the following: (i) The most stringent emissions limitation which is contained in the implementation of any State of such class or category of stationary source, unless the owner or operator of the proposed stationary source demonstrates that such limitations are not achievable; or (ii) The most stringent emissions limitation which is achieved in practice by such class or

Table 4-2. LAER/BACT Decisions

Company Name	State	Unit Description	Capacity (Size)	Date of Permit	Emission Limit	Emission Control
Virginia Power	VA	GE Turbine	1,875 MMBTU/hr	Apr-88	NOx 42ppm 490 lb/hr	Steam Injection W/Maximization NSPS subpart GG
Trunkline LNG	LA	Gas Turbine	147,102 SCF/hr	May-87	NOx 59 lb/hr	
Wichita Falls E. I., I.	TX	Gas Turbine	20 MW	Jun-86	NOx 684 TPY CO 420 TPY	Steam Injection
Merck Sharp & Pohme	PA	Turbine	310 MMBTU/hr	May-88	NOx 42 ppm @ 15% O ₂	Steam Injection
California Dept. of Corr.	CA	Gas Turbine	5.1 MW	Dec-86	NOx 38 ppmv @ 15% O ₂	1 to 1 H ₂ O injection
City of Santa Clara	CA	Gas Turbine		Jan-87	NOx 42 ppmvd @ 15% O ₂	Water Injection
Combined Energy Resources	CA	Cogeneration Fac.	27 MW	Mar-87	NOx 199 lb/D	SCR Unit, Duct Burner H ₂ O Injection, Low NOx Design
Double 'C' Limited	CA	Gas Turbine	25 MW	Nov-86	NOx 194 lb/D	H ₂ O Inj. & Selected Catalytic Red. 95.80 Efficiency
Kern Front Limited	CA	Gas Turbine	25 MW	Nov-86	NOx 194 lb/D 4.5 ppmvd @ 15% O ₂	H ₂ O Inj. & Selected Catalytic Red. 95.80 Efficiency
Midway - Sunset Project	CA	Gas Turbine	973 MMBTU/hr	Jan-87	NOx 113.4 lb/hr 16.31 ppmv	H ₂ O Injection, 73% Efficiency
O'Brien Energy Systems	CA	Gas Turbine	359.5 MMBTU/hr	Dec-86	NOx 30.3 lb/hr 15 ppmvd @ 15% O ₂	Duct Burner, H ₂ O Injection and Scrubber
PG & E, Station T	CA	GE Gas Turbine	396 MMBTU/hr	Aug-86	NOx 25 ppm @ 15% O ₂ 63 lb/hr	Steam Injection @ Steam/Fuel Ratio of 1.7/1, 75% Efficiency
Sierra LTD.	CA	GE Gas Turbine	11.34 MMCF/D		NOx 4.04 lb/hr 0.016 lb/MMBTU	Scrubber & CO Catalytic Converter Steam Injection 95.86 Efficiency

Table 4-2. LAER/BACT Decisions (Page 2 of 5)

Company Name	State	Unit Description	Capacity (Size)	Date of Permit	Emission Limit	Emission Control
Sycamore Cogeneration Co.	CA	Gas Turbine	75 MW	Mar-87	CO 10 ppmv @ 15% O ₂ 3 hr Avg	CO Oxidizing Catalyst Combustion Control
U.S. Borax & Chemical Corp.	CA	Gas Turbine	45 MW	Feb-87	NOx 40 lb/hr 25 ppm @ 15% O ₂ Dry CO 23 lb/hr	Scrubber Proper Combust. Techniques
Western Power System, Inc	CA	GE Gas Turbine	26.5 MW	Mar-86	NOx 9 ppmvd @ 15% O ₂	H ₂ O Injection, Selective Cat. Red. 80% Efficiency
CalcoGen, Cal Polytechic	CA	Gas Turbine	21.4 MW	Apr-84	NOx 42 ppm @ 15% O ₂	H ₂ O Injection, 70% Efficiency
Greenleaf Power Co.	CA	GE Gas Turbine	35.62 MW	Apr-85	NOx 42 ppm @ 15% O ₂ 91 lb/hr CO 20.4 lb/hr	H ₂ O Injection Good Eng. Practices
		Duct Burner	63.7 MMBTU/hr	Apr-85	NOx 0.1 lb/MMBTU 6.4 lb/hr CO 0.12 lb/MMBTU 7.6 lb/hr	Low NOx Design
OLS Energy	CA	GE Gas Turbine	256 MMBTU/hr	Jan-86	NOx 9 PPMVD @ 15% O ₂	H ₂ O Injection & Scrubber 80% Eff. for Scrubber
Ciba Giegy Corp.	NJ	Gas Turbine	3 MW	Jan-85	NOx 11.06 lb/hr CO 9.4 lb/hr	SIP, H ₂ O Injection, 55% Eff.
Energy Reserve, Inc.	CA	Gas Turbine	322.5 MMBTU/hr	Oct-85	NOx 185.4 lb/D	H ₂ O Injection, Select. Cat. Red. 92.5% Efficiency
Gilroy Energy Co.	CA	Gas Turbine	60 MW	Aug-85	NOx 25 PPMDV @ 15% O ₂	Steam Inj., Quiet Combustor
		Auxiliary Boiler	90 MMBTU/hr		NOx 40 PPMDV @ 3% O ₂	Low NOx Burners

Table 4-2. LAER/BACT Decisions (Page 3 of 5)

Company Name	State	Unit Description	Capacity (Size)	Date of Permit	Emission Limit	Emission Control
Kern Energy Corp.	CA	Gas Turbine	8.8 MMCF/D	Apr-86	NOx 8.29 lb/hr 0.023 lb/MMBTU	Scrubber w/ NH3 Red. Agent Steam Inj. & Low NOx Config. Exh. Duct Burner 87% Efficiency
Moran Power, Inc.	CA	Gas Turbine	8.0 MMCF/D	Apr-86	NOx 8.29 lb/hr 0.023 lb/MMBTU	Scrubber w/ NH3 Red. Agent Steam Inj. & Low NOx Config. Exh. Duct Burner 87% Efficiency
Northern California Power	CA	GE Gas Turbine	25.8 MW	Apr-85	NOx 75 ppm	H2O Injection
Shell California Production	CA	Gas Turbine	22 MW	Apr-85	NOx 42 ppm @ 15% O2 35 lb/hr CO 10 PPMV @ 15% O2 22 lb/hr	H2O Inj. Proper Combustion
Southeast Energy, Inc.	CA	Gas Turbine	8.0 MMCF/D	Apr-86	NOx 8.29 lb/hr 0.023 lb/MMBTU	Scrubber w/ NH3 Red. Agent Steam Inj. & Low NOx Config. Exh. Duct Burner 87% Efficiency
Sunlaw/Industrial Park	CA	Gas Turbine	412.3 MMBTU/hr	Jun-85	NOx 9 PPMVD @ 15% O2 CO 10 PPMVD @ 15% O2	Scr. & Steam Inj., 80% Eff. Mfg Guarantee on CO Emissions
Union Cogeneration	CA	Gas Turbine w/ Duct Burner	16 MW	Jan-86	NOx 25 PPMV @ 15% O2 CO 8 lb/hr 29.2 TPY	H2O Injection & Scrubber Oxidizing Catalyst, 80% Efficiency
Willamette Industries	CA	GE Gas Turbine	230 MMBTU/hr	Apr-85	NOx 15 PPMVD @ 15% O2	H2O Inj. w/ Selective Cat. Red. 92% Efficiency

Table 4-2. LAER/BACT Decisions (Page 4 of 5)

Company Name	State	Unit Description	Capacity (Size)	Date of Permit	Emission Limit	Emission Control
Witco Chemical Corp.	CA	Gas Turbine	350 MMBTU/hr	Dec-84	NOx 0.18 lb/MMBTU Oil 0.20 lb/MMBTU Gas	
		Duct Burner	111.6 MMBTU/hr		NOx 0.12 lb/MMBTU	Gas Firing Only
AES Placerita, Inc.	CA	Turbine & Recovery Boiler	519 MMBTU/hr	Mar-86	NOx 629 lb/d 7 PPMVD @ 15% O ₂ CO 103 lb/d 2 PPMVD @ 15% O ₂	H ₂ O Inj, Select. Cat. Red. 80% Efficiency
AES Placerita, Inc.	CA	Turbine & Recovery Boiler	530 MMBTU/hr	Jul-87	NOx 340 lb/D 9 PPMVD @ 15% O ₂	Steam Inj, Select. Cat. Red.
AES Placerita, Inc.	CA	Gas Turbine	530 MMBTU/hr	Jul-87	NOx 289 lb/D 9 PPMVD @ 15% O ₂	Steam Inj, Select. Cat. Red.
Alaska Electrical Generation	AK	Gas Turbine	80 MW	Mar-87	NOx 75 PPMVD @ 15% O ₂ CO 109 lb/SCF Fuel	H ₂ O Injection
Alaska Electrical Generation	AK	Gas Turbine	38 MW	Mar-85	NOx 75 PPM @ 15% O ₂	H ₂ O Injection
BAF Energy	CA	Turbine, Generator	887.2 MMBTU/hr	Jul-87	NOx 9 PPM @ 15% O ₂ 30.1 lb/hr	Steam Injection, Scrubber 80% Efficiency
BAF Energy	CA	Auxiliary Boiler	150 MMBTU/hr	Oct-87	NOx 17.4 lb/D 40 PPMVD @ 3% O ₂ CO 63.6 lb/D 0.018 lb/MMBTU	Flue Gas Recirculation Low NOx Burners Oxidation Catalyst
Champion International Corp.	TX	Gas Turbine	30.6 MW (1342 MMBTU/hr)	Mar-85	NOx 720.34 TPY CO 70.08 TPY	Low NOx Burners
Cogen Technologies	NJ	GE Gas Turbines	40 MW	Jun-87	NOx 9.6 PPMVD @ 15% O ₂ CO 50 PPMVD @ 15% O ₂	H ₂ O Inject. & SCR, 95% Efficiency

Table 4-2. LAER/BACT Decisions (Page 5 of 5)

Company Name	State	Unit Description	Capacity (Size)	Date of Permit	Emission Limit	Emission Control
Combined Energy Resources	CA	Gas Turbine	2 MW	Feb-88	NOx 199 lb/hr	H2O Inj. & Scrubber, 81% Efficiency
Formosa Plastic Corp.	TX	GE Gas Turbine	38.4 MW	May-86	NOx 640 TPY CO 32.4 TPY	Steam Injection
Midland Cogeneration Venture	MI	Turbine	984.2 MMBTU/hr	Feb-88	NOx 42 PPMV @ 15% O2 CO 26 lb/hr	Steam Injection Turbine Design
		Duct Burner	249 MMBTU/hr		NOx 0.1 lb/MMBTU	Burner Design
Pacific Gas Transmission	OR	Gas Turbine	14000 HP	May-87	NOx 154 PPM 50 lb/hr CO 6 lb/hr 25 TPY	Combustion Control
Power Development Co.	CA	Gas Turbine	49 MMBTU/H	Jun-87	NOx 36 lb/D 9 PPMVD @ 15% O2	Scrubber & H2O Injection
San Joaquin Cogen Limited	CA	Gas Turbine	48.6 MW	Jun-87	NOx 250 lb/D 6 PPMVD @ 15% O2 CO 1326 lb/d 55 PPMVD @ 15% O2	Scrubber & H2O Injection 76% Efficiency Combustion Controls
TBG/Grumman	NY	Gas Turbine	16 MW	Mar-88	NOx 75 PPM + NSPS Corr. 0.2 lb/MMBTU CO 0.181 lb/MMBTU	H2O Inj. & Combustion Controls CO Catalyst
Texas Gas Transmission Corp.	KY	Gas Turbine	14300 HP	Feb-88	NOx 0.015 % by Volume	
Orlando Utilities Commission	FL	Gas Turbine	4 x 445 MMBTU/H	Sept-88	NOx 42 PPMDV Gas 65 PPMDV Oil CO 10 PPMDV	Steam Injection Good Combustion
Anheuser-Busch	FL	Gas Turbine	95.7 MMBTU/hr	Apr-87	NOx 0.1 lb/MMBTU	

category of stationary source. This limitation, when applied to a modification, means the lowest achievable emissions rate for the new or modified emissions units within the stationary source. In no event shall the application of this term permit a proposed new modified stationary source to emit any pollutant in excess of the amount allowable under applicable new source standards of performance (40 CFR 51 Appendix S. II, A.18).

As noted from the discussion contained in Subsection 3.2.3, there is a regulatory distinction between LAER and BACT.

In Florida, the most recent permits have required wet injection for NO_x control. The emission limits were 42 ppm and 65 ppm (corrected to 15% O₂, dry conditions) respectively, for natural gas and fuel oil firing.

The hierarchy for NO_x control suggested by the existing and permitted facilities is as follows:

1. Selective Catalytic Reduction (SCR).
2. Wet Injection using standard or advanced combustor design.

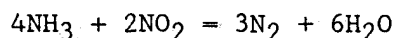
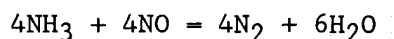
The selected control level of SCR used for the BACT analysis was 9 ppm NO_x corrected to 15% dry conditions using natural gas. This level of control assumes 80% removal of NO_x by the SCR equipment with an input concentration of 42 ppm. For fuel oil firing, a control level of 14 ppm was used to account for fuel bound nitrogen. These levels of control are the most stringent being established as BACT. For wet injection, the advanced combustor design can limit NO_x to 25 ppm when firing natural gas and 42 ppm when firing fuel oil while the standard combustor design can limit NO_x to 42 ppm when firing natural gas and 65 ppm when firing fuel oil.

4.3.1.2 Technology Description and Feasibility

SELECTIVE CATALYTIC REDUCTION (SCR)

SCR uses ammonia (NH₃) to react with NO_x in the gas stream under the presence of a catalyst. NH₃, which is diluted with air to about 5% by

volume, is introduced into the gas stream at reaction temperatures between 600°F and 700°F. The reactions are as follows:



SCR has mainly been installed at facilities located in nonattainment areas for NO₂ and mainly in California. While the operating experience has not been extensive, certain cost, technical and environmental considerations have surfaced. These considerations are summarized in Table 4-3.

The operating experience consists primarily of baseload natural gas fired installations either of cogeneration or combined cycle configuration; no simple cycle facilities have SCR. Exhaust gas temperatures of simple cycle combustion turbines are generally in the range of 1000°F, which exceeds the optimum range for SCR. While cooling could be accomplished through the introduction of ambient air, the increased volume of air would increase the catalyst size, and thus the cost, considerably. Water quenching is not feasible since the catalyst can be damaged and ammonium hydroxide, a corrosive, would be formed.

The use of fuel oil in SCR facilities has been limited since SCR catalysts are contaminated by sulfur containing fuels. For most fuel oil burning facilities, catalyst operation is discontinued, or the exhaust bypasses the SCR system. As presented in Table 4-3, ammonium bisulfate is formed by the reaction of NH₃ and SO₃. Experience at the United Airlines cogeneration facility using 0.05% fuel oil found catalyst contamination after 2,500 hours of operation. For this facility, the catalyst has been replaced three times and the recommended hours of operation by the manufacturer is now 500 hours.

Reported and permitted NO_x removal efficiencies of SCR range from 40 to 80%. Emission limiting standards with SCR are in the 9 ppm range for natural gas firing. However, two facilities have reported emission limits

Table 4-3. SCR Cost, Technical and Environmental Considerations for Combustion Turbines (Page 1 of 2)

Consideration	Description
COST:	
Catalyst Replacement	Catalyst life varies depending on the application. Cost ranges from 20 to 40% of total capital cost and is the dominate annual cost factor.
Ammonia	Ratio of at least 1:1 NO _x to NH ₃ generally needed to obtain high removal efficiencies. Special storage and handling equipment required.
Space Requirements	For new installations, space in the catalyst is needed for replacement layers. Additional space is also required for catalyst maintenance and replacement.
Backup Equipment	Reliability requirements necessitate redundant systems such as ammonia control and vaporization equipment.
Catalyst Back Pressure Heat Rate Pressure	Addition of catalyst creates back pressure on the turbine which reduces overall heat rate.
TECHNICAL:	
Ammonia Flow Distribution	NH ₃ must be uniformly distributed in the exhaust steam to assure optimum mixing with NO _x prior to reaching the catalyst.
Temperature	The narrow temperature range that SCR systems operate, i.e., about 100°F, must be maintained even during load changes. Operational problems could occur if this range is not maintained. HRSG duct firing requires careful monitoring.
Ammonia Control System	Quantity of NH ₃ introduced must be carefully controlled. With too little NH ₃ , the desired control efficiency is not reached; with too much NH ₃ , NH ₃ emissions occur.

Table 4-3. SCR Cost, Technical and Environmental Considerations for
Combustion Turbines (Page 2 of 2)

Consideration	Description
Flow Control	The velocity through the catalyst must be within a range to assure satisfactory residence time.
ENVIRONMENTAL:	
Ammonia Slip	NH ₃ slip, or NH ₃ that passes unreacted through the catalyst and into the atmosphere can occur if: 1) too much ammonia is added, 2) the flow distribution is not uniform, 3) the velocity is not within the optimum range, or the proper temperature is not maintained.
Ammonia Bisulfate and Chloride Salts	Ammonium bisulfate and chloride salts can lead to increased corrosion. These usually occur when firing fuel oil. These compounds are emitted as particulates.
N ₂ O and Nitro-soamines formation	The mechanism under which these compounds form is not totally understood. Secondary impacts can occur.

of about 4.5 ppm. These emission limits were clearly determined to be LAER on machines using water injection below 42 ppm. For fuel oil firing, permitted NO_x emissions with SCR has ranged from 14 ppm to 42 ppm.

The available information suggests that SCR is a technically feasible alternative for the project. However, the following technical limitations exist:

1. SCR is not technically applicable to the simple cycle portion of the combined cycle configuration, i.e., the combustion turbine by-pass stack exhaust, and
2. Continuous operation of SCR using distillate oil has not demonstrated; technical, economic and environmental uncertainties would result.

WET INJECTION

The injection of water or steam in the combustion zone of turbines reduces the flame temperature with a decrease of NO_x emissions. The amount of NO_x reduction possible depends on the combustor design and the water to fuel ratio used. An increase in the water to fuel ratio will cause a concomitant decrease in NO_x emissions until flame instability occurs. At this point, operation of the turbine becomes inefficient and unreliable, and significant increases in products of incomplete combustion will be emitted, i.e., CO and VOC.

With standard combustion chamber design, there is a point where the amount of water or steam injected into the turbine seriously degrades its reliability and operational life. This generally occurs at NO_x emissions levels of about 65 ppmvd (with no heat rate adjustment) on oil and 42 ppmvd on natural gas. These NO_x emission levels can be achieved with little additional cost and with limited impact on reliability or power output over those costs required to comply with the NSPS.

Since the combustion turbine NSPS was last revised in 1982, combustion turbines have improved their tolerance to the water or steam necessary to

control NO_x emissions below the NSPS requirement. Some manufactures have begun to market an improved low NO_x burner design. [These burners provide improved air/fuel mixing with water or steam injection result in reduced flame temperatures and concomitantly lower concentrations of NO_x as compared to a standard combustion chamber design (with water or steam injection).] These design improvements result in a NO_x emission rate of 25 ppmvd compared to 42 ppmvd with a standard combustor design. However there is the lack of operating experience with such designs and there is a significant increase in capital cost of the turbines. Also, approximately 25 gpm of additional demineralized water per turbine would be required for injection into the combustion chamber. The improved combustors would, however, increase CO concentrations relative to the standard combustor. Low NO_x burner designs are however, not available for several of the manufacturers being considered. Because of this and the lack of operating experience of those manufacturers with burners, low NO_x burner design are considered marginally feasible for the project.

Wet injection is a technically feasible alternative for the project. The application of this technology has the following limitations:

1. Wet injection can be accomplished until a condition of maximum moisturization occurs; this design condition depends on the combustor design but usually occurs at 42 ppm on natural gas and 65 ppm on fuel oil,
2. Wet injection will not substantially reduce NO_x formation due to fuel bound nitrogen, any emission limiting requirements must account for this effect, and
3. Wet injection will increase the emissions of CO and VOC depending on the water to fuel ratio.

For the BACT analysis, emissions with wet injection were considered to be 25 ppm and 42 ppm when firing natural gas and 42 ppm and 65 ppm when firing

fuel oil (both corrected to 15% O₂ dry conditions). These emission levels are the most stringent being established as BACT.

4.3.1.3 Impact Analysis

A BACT determination requires an analysis of the economic, environmental, and energy impacts of the proposed and alternative control technologies (see 40 CFR 52.21(b)(12) and 17-2.100(25) and 17-2.500(5)(c) FAC). The analysis must be specific to the project, i.e., case-by-case. The economic and environmental impacts of the control technologies evaluated for NO_x are summarized in Table 4-4. The specific analyses are discussed below.

ECONOMIC

The total annualized cost for alternative NO_x control technologies range from \$22,014,000 for SCR to \$2,490,000 for wet injection to meet NSPS (Table 4-5). Incremental cost effectiveness for SCR was estimated to range from \$8,250/ton NO_x removed for natural gas firing to \$4,641/ton NO_x removed for fuel oil firing. This incremental cost is about a factor of four higher than the improved combustor design. Indeed, the incremental cost effectiveness was estimated to be over 25 times that of the standard combustor. For the improved combustor design the incremental cost effectiveness ranged from \$1,626 to \$915/ton of NO_x removed, which was about seven times or more higher than the standard combustor design. These costs reflect increased CO emissions. Assuming CO controls the incremental cost effectiveness would be \$5,007/ton of NO_x removed when firing natural gas and \$2,817/ton of NO_x removed when firing fuel oil. The incremental cost effectiveness for the standard combustor ranged from \$176 to \$504/ton of NO_x removed.

ENVIRONMENTAL

The maximum predicted impacts of the alternative technologies are all considerably below the PSD increment (i.e., 25 ug/m³) and AAQS (i.e., 100 ug/m³). Additional controls beyond NSPS improve air quality to less than about 20% of the PSD increment and about 5% of the AAQS.

Table 4-4. Summary of BACT Analysis

Pollutant	Control Option		Emissions (TPY)	Economic Impact		Environmental Impacts	
	Description	Fuel		Annualized Cost (\$)	Incremental Cost Effectiveness (\$/ton)	Impacts for Controlled Pollutant	Other Impacts
NOx	Water Injection with SCR to 9 ppm	Natural Gas	1,018	22,014,000	8,250	0.6 (Max. Annual)	Ammonia @ 10ppm
	Water Injection with SCR to 14 ppm	Fuel Oil	1,810	22,014,000	4,641	1.0 (Max. Annual)	Ammonia @ 10ppm Ammonium Bisulfate
	Improved Combustor Design to 25 ppm	Natural Gas	3,058	5,210,000 (10,868,000)	1,626 (5,007)	1.7 (Max. Annual)	Increase in CO & VOC; water use
	Improved Combustor Design to 42 ppm	Fuel Oil	5,431	5,210,000 (10,868,000)	915 (2,817)	3.0 (Max. Annual)	Increase in CO & VOC; water use
	Standard Combustor Design to 42 ppm	Natural Gas	4,729	2,490,000	176*	2.6 (Max. Annual)	Water use
	Standard Combustor Design to 65 ppm	Fuel Oil	8,405	2,490,000	504*	4.6 (Max. Annual)	Water use
CO	Catalytic Oxidation to 10 ppm	Natural Gas	685	5,658,000	2,663	10 (Max. 8 hr)	
	Combustion Techniques to 41 ppm	Natural Gas	2,810	--	--	39 (Max. 8 hr)	
SO2	0.20 % Sulfur Fuel	Fuel Oil	6,433	21,009,000	NA	25 (Max. 24 hr)	
	0.50 % Sulfur Fuel	Fuel Oil	16,083	--	--	63 (Max. 24 hr)	

* Based on an NSPS Emission Level of 98 ppm and an estimated annualized cost of \$1,813,000.

Table 4-5. Annualized Cost Estimate for Alternative NOx Control Technology

Item	Basis	Standard Combustor & SCR	Improved Combustor	Standard Combustor
DIRECT COSTS (DC):				
Differential Turbine Costs		\$ 1,800,000	\$8,750,000	\$1,800,000
SCR Reactor		\$22,140,000	\$0	\$0
Ammonia Storage & Injection Equipment		\$5,530,000	\$0	\$0
Water Treatment, Storage & Injection		\$2,810,000	\$4,240,000	\$2,810,000
Balance of Plant		\$1,160,000	\$1,380,000	\$1,060,000
Subtotal:		\$33,440,000	\$14,370,000	\$5,670,000
CONTINGENCY:	10% of DC	\$3,344,000	\$1,437,000	\$567,000
TOTAL CAPITAL COSTS (TCC):		\$36,784,000	\$15,807,000	\$6,237,000
ESCALATION:		\$5,429,318	\$2,333,113	\$920,581
TOTAL ESCALATED COST (TEC):		\$42,213,318	\$18,140,113	\$7,157,581
SALES AND USE TAX:	6% of TEC	\$2,532,799	\$1,088,407	\$429,455
SUBTOTAL:		\$44,746,118	\$19,228,520	\$7,587,036
INDIRECT COSTS:	14.5% of Subtotal	\$6,488,187	\$2,788,135	\$1,100,120
INTEREST DURING CONSTRUCTION:	10.45%	\$5,353,985	\$2,300,740	\$907,808
INSTALLED COST:		\$56,588,289	\$24,317,396	\$9,594,964
OPERATING COSTS:				
Operating & Maintenance*		\$10,208,333	\$986,111	\$652,778
Ammonia		\$ 1,305,556	\$0	\$0
Energy		\$ 2,125,000	\$625,000	\$416,667
ANNUAL OPERATING COST:		\$13,638,889	\$1,611,111	\$1,069,444
FIXED CHARGES ON CAPITAL:	14.8% of Installed Cost	\$ 8,375,067	\$3,598,975	\$1,420,055
TOTAL LEVELIZED ANNUAL COST:		\$22,013,956	\$5,210,086	\$2,489,499

* Includes Catalyst Replacement

Additional air quality impacts would occur with the installation of SCR. Emissions of ammonia, ammonium sulfates, such as ammonium bisulfate, and chloride salts would occur. Ammonia would be emitted at a concentration of at least about 10 ppm based on previous experience; previous permit conditions have selected this level. For a 660 MW plant, ammonia emissions would be about 400 ton/year. However, ammonia emissions could be five times this level since actual operating experience has found ammonia slippage rates as high as 50 ppm.

The replacement of SCR catalyst will create additional economic and environmental impacts since such catalyst, e.g. vanadium pentoxide, are listed as hazardous chemical wastes under RCRA regulations (40 CFR 261).

ENERGY

Energy penalties will occur with all control alternatives evaluated. The most significant is with SCR would reduce the output of the combustion turbine by about 0.1% over wet injection. This would amount to about a 5,800,000 kw/hr loss in potential generation/year.

4.3.1.4 Proposed BACT and Rationale

The proposed BACT for the Hardee Power Station is wet injection using standard combustor design. The NO_x emissions levels using standard combustor with wet injection would be 42 ppm when firing natural gas and 65 ppm when firing fuel oil. This alternative control is proposed for the following reasons:

1. SCR was rejected based on technical economic and environmental grounds. Operation of SCR during simple cycle CT operation has not been demonstrated since the temperature range of the exhaust exceeds operational requirements for optimum catalytic reaction. Fuel oil firing when operating SCR would cause operating problems and result in catalyst poisoning. The estimated total and incremental costs exceed \$2,000 and \$5,000/tons of NO_x removed, respectively. These costs are over an order of magnitude more costly than the proposed BACT levels. Additional environmental

impacts would result from SCR operation including emissions of ammonia and ammonium bisulfates, and the generation of hazardous waste, i.e., spent catalyst replacement.

2. The improved combustor design is rejected based on technical economic and environmental reasons. Not all manufacturers offer improved combustor designs. For those who do, an economic penalty would result: the annualized cost of such systems is over twice that of the standard combustor design. In addition, these improved combustor designs have not been demonstrated to achieve the reliability and maintenance requirements as standard designs. Environmental impacts would also result including increases in CO and VOC emissions and water consumption. Control of CO and VOC emissions greatly increase the cost of the advanced combustor. The cost effectiveness would exceed \$2,500/ton of NO_x removed. Water use has been estimated to increase 25 gpm per turbine or about 130,000 gpd more than a standard combustor design.
3. The proposed BACT provides the least costly alternative and results in the maximum environmental impacts of less than 20% of the PSD increments and 5% of the AAQS. Wet injection at the proposed emissions levels has been adopted as BACT previously and manufacturers have guaranteed this level.

4.3.2 Carbon Monoxide (CO)

4.3.2.1 Emission Control Hierarchy

CO emissions are a result of incomplete or partial combustion of fossil fuel. Combustion design and catalytic oxidation are the control alternatives that are viable for the project.

Combustion design is the more prevalent control technique used in combustion turbines. Sufficient time, temperature and turbulence is required within the combustion zone to minimize the emissions of CO. As such, combustion

efficiency is dependent upon combustor design and, in NO_x control systems, the amount of water or steam injected in the combustion zone. For the combustion turbines being evaluated, CO emissions range from 10 ppm to 41 ppm, corrected to 15% O_2 dry conditions.

Catalytic oxidation is a post combustion control that has been installed where CO nonattainment regulations have required CO reduction due to increases caused by wet injection. These LAER installations typically have CO limits in the 10 ppm range (corrected to 15% O_2 and dry conditions).

4.3.2.2 Technology Description

Oxidation catalyst control CO emissions by allowing unburned CO to react with oxygen at the surface of a precious metal catalyst such as a platinum coated surface. Combustion of CO starts at about 300°F with efficiencies above 90% occurring at temperatures above 600°F. Catalytic oxidation occurs at temperatures 50% lower than that of thermal oxidation which reduces the amount of thermal energy required. For combustion turbine and HRSG combinations, the oxidation catalyst can be located directly after the turbine or in the HRSG. Catalyst size depends upon the exhaust flow, temperature and desired efficiency. The existing gas turbine applications have been limited to smaller cogeneration facilities burning natural gas. Controlled CO levels of 10 ppm have generally been established as BACT.

Oxidation catalysts have not been used on fuel oil fired combustion turbines or combined cycle facilities. The use of sulfur containing fuels in a system with oxidation catalyst would result in an increase of SO_3 emissions and concomitant corrosive effects to the back end of the HRSG and stack. In addition, trace metals in the fuel would result in catalyst poisoning during prolonged periods of operation.

Since the facility would likely require numerous start-ups, variations in exhaust conditions would influence catalyst life and performance. Very little technical data exist to demonstrate the effect of such cycling. The size and fuel requirements for the project would suggest rejection of

catalytic oxidation as a technically feasible alternative. However, continuous operation using natural gas is technically feasible and therefore evaluated as an alternative BACT technology.

Combustion design is dependent upon the manufacturer's operating specifications which include air to fuel ratio and the amount of water injected. All combustion turbines presently being considered have designs to optimize combustion efficiency and minimize CO emissions.

4.3.2.3 Impact Analysis

ECONOMIC

The estimated annualized cost of a CO oxidation catalyst is \$5,658,000 (Table 4-6) with a total cost effectiveness of \$2,663/ton of CO removed. The latter assumes that the "worst-case" emissions will be in the range of 41 ppm corrected to 15% O₂ dry conditions. At a CO emission of 25 ppm, the cost effectiveness would exceed \$5,000/ton of pollutant removed. No costs are associated with combustion techniques since they are inherent to the process.

ENVIRONMENTAL

The air quality impacts of both techniques are below the significant impact levels for CO. Therefore, no environmental benefit would be realized by the installation of a CO catalyst.

ENERGY

An energy penalty would result from the pressure drop across the catalyst bed. A pressure drop of about 1 1/2 to 2 1/2 water gauge would be expected. At a catalyst back pressure of about 2 in, an energy penalty of about 4,000,000 kw-hr/year would result.

4.3.2.4 Proposed BACT and Rationale

Combustion design is proposed as BACT due to the technical and economic consequences of installing catalytic oxidation. Catalytic oxidation is not

Table 4-6. Annualized Cost Estimate for CO Catalyst

Item	Basis	Cost
DIRECT COSTS (DC):		
Catalyst	Manufacturer	\$7,644,000
Installation	45% of Catalyst	\$3,439,800
Subtotal:		\$11,083,800
CONTINGENCY:	10% of DC	\$1,108,380
TOTAL CAPITAL COSTS (TCC):		\$2,032,030
ESCALATION:		\$1,799,568
TOTAL ESCALATED COST (TEC):		\$13,831,651
SALES AND USE TAX:	6% of TEC	\$839,504
SUBTOTAL:		\$14,831,253
INDIRECT COSTS:	14.5% of Subtotal	\$2,150,532
INTEREST DURING CONSTRUCTION:	10.45% of Subtotal	\$1,549,866
INSTALLED COST:		\$18,531,651
OPERATING COSTS:		
Labor	1 man-year	\$270,000
Catalyst Replacement*	Manufacturer	\$2,400,000
Miscellaneous Parts	1% of Installed Cost	\$185,316
Energy Penalty	Estimated	\$60,000
ANNUAL OPERATING COST:		\$2,915,316
FIXED CHARGES ON CAPITAL:	14.8% of Installed Cost	\$2,742,684
TOTAL LEVELIZED ANNUAL COST:		\$5,658,000

* 2-year replacement interval on fuel oil

considered feasible, not withstanding the lack of environmental benefit, for the following reasons:

1. Catalytic oxidation has not been demonstrated on cycling combustion turbines or those using fuel oil; and
2. The economic impacts are significant, i.e. annualized cost of \$5,658,000 with a likely cost effectiveness of over \$5,000/tons of pollutant removed.

4.3.3 Sulfur Dioxide (SO₂)

4.3.2.1 Emission control Hierarchy

Sulfur dioxide (SO₂) emissions are a result of the oxidation of sulfur in fossil fuel and can be minimized by reducing the sulfur content in fuel or through applying post combustion removed techniques. For combustion turbines, the use of low sulfur fuels is the only demonstrated control technology determined to be technically feasible. Post combustion techniques, such as flue gas desulfurization (FGD) have not been applied to combustion turbines.

FGD systems have been applied to oil and coal-fired steam electric power plants. However, the relative gas volume for such facilities is significantly less than that for combustion turbines (i.e., about 2 to 3 times) and the resultant SO₂ concentration is considerably more. While the former factor will influence the cost of FGD, the later poses significant technological constraints to removing SO₂.

The BACT/LAER clearinghouse documents (1985, 1986b, 1987c, 1988c) show fuel sulfur contents from 0.8% to less than 0.2%. The lowest sulfur containing fuels were required in California where LAER decisions dictate more stringent standards. Furthermore, such requirements generally limited fuel oil use for backup or emergency purposes only. For the Hardee Power Station the only technically feasible control technology for SO₂ is therefore low sulfur fuel use. The use of natural gas will clearly minimize SO₂ emission. SO₂ emissions from distillate fuel can be minimized by specification of a lower sulfur content fuel, or blending of a lower sulfur

content fuel, such as No. 1 fuel oil or kerosene, with No. 2 fuel oil. To reduce the uncertainties of supplier reliability, the blending of kerosene was selected as an alternative control technology of the project. A sulfur content of 0.2% was selected as the BACT level since it is near the lowest of sulfur contents contained in the BACT clearinghouse documents.

4.3.3.2 Technology Description

The sulfur content of No. 2 fuel oil will have a maximum sulfur content of 0.5% with a nominal average of 0.3%. For the purposes of the analysis the maximum sulfur content was assumed. Kerosene has a sulfur content of 0.05%.

To obtain an average sulfur content of 0.2%, No. 2 fuel oil and Kerosene would have to be blended in a ration of about 1 to 2. Blending would require a separate storage tank, transfer pumps, mixing tank and mixing equipment.

4.3.3.3 Impact Analysis

ECONOMIC

The total annualized cost for achieving a maximum 0.2% sulfur fuel was estimated at \$21,009,000 (Table 4-7). The incremental cost of \$2,177/ton of pollutant removed reflects the assumption that the No.2 fuel oil received would be 0.5%. At the more nominal sulfur content of 0.3% for No. 2 fuel oil the cost effectiveness would be \$6,531/ton of pollutant removed. In addition, the cost effectiveness would substantially increase as the percentage of fuel oil decreases. As discussed previously primary fuel for the project is natural gas.

ENVIRONMENTAL

Both alternatives are less than the PSD increment and AAQS. Substantial air quality benefits are not expected given the primary use of natural gas and the fact that the maximum SO₂ concentrations were predicted to occur at the property boundary.

Table 4-7. Annualized Cost Estimate for SO₂ Control

Item	Basis	Cost
DIRECT COSTS (DC):		
Oil Tank & Mixers	Estimate	\$5,000,000
Installation	45% of Equipment	\$2,250,000
Subtotal:		\$7,250,000
CONTINGENCY:	10% of DC	\$725,000
TOTAL CAPITAL COSTS (TCC):		\$7,975,000
ESCALATION:		\$1,177,110
TOTAL ESCALATED COST (TEC):		\$9,152,110
SALES AND USE TAX:	6% of TEC	\$549,127
SUBTOTAL:		\$9,701,237
INDIRECT COSTS:	14.5% of Subtotal	\$1,406,679
INTEREST DURING CONSTRUCTION:	10.45% of Subtotal	\$1,013,779
INSTALLED COST:		\$12,121,695
OPERATING COSTS:		
Labor	1 man-year	\$45,000
Fuel Cost	\$0.07/gallon differential	\$19,049,008
Miscellaneous Parts	1% of Installed Cost	\$121,217
ANNUAL OPERATING COST:		\$19,215,225
FIXED CHARGES ON CAPITAL:	14.8% of Installed Cost	\$1,794,011
TOTAL LEVELIZED ANNUAL COST:		\$21,009,236

* 2-year replacement interval on fuel oil

ENERGY

No substantial energy penalties were assumed to occur with the blending of kerosene with No. 2 fuel oil.

4.3.3.4 Proposed BACT and Rationale

The proposed BACT for the Hardee Power Station is the use of natural gas and No. 2 fuel oil with a maximum sulfur content 0.5%. The basis for this control alternative are:

1. The blending of Kerosene is not economically feasible. Indeed, it is uncertain if the quantities of kerosene required to be blended with No. 2 fuel oil could be obtained.
2. The primary fuel for the project is natural gas which would increase the relative cost effectiveness of blending kerosene with No. 2 fuel oil.

4.3.4 Particulate Emissions

The emission of particulates from the combustion turbine facility are a result of some incomplete combustion that may occur and of having some trace solids in the fuel, especially fuel oil. The design of the combustion turbines will insure that particulate emissions will be minimized by combustion controls and the use of clean fuels. A review of the USEPA's BACT/LAER Clearinghouse documents did not reveal any post combustion particulate control technologies being used on gas/oil fueled combustion turbines. The natural gas and distillate fuel oil to be used in the proposed combustion turbines will only contain trace quantities of particulate. Therefore, the fuel and combustion design will ensure maximum possible fuel combustion and are the proposed BACT for total suspended particulate, and particulate matter smaller than 10 microns (PM10). Indeed, the maximum particulate emissions will be of less concentration than that normally specified for fabric filter designs; i.e., the grain loading of the maximum particulate emissions (57 lbs/yr) is less than 0.01 grains/SCF which a typical design specification for a baghouse.

4.3.5 Other Criteria and Non-Regulated Pollutants Emissions

Emission estimates indicate that significance levels are exceeded for VOC, sulfuric acid mist, mercury beryllium and arsenic, requiring PSD review (including BACT) for these pollutants.

There are no technically feasible methods for controlling the emission of these pollutants from combustion turbines, other than complete combustion of the fuel, and the inherent quality of the fuel (see Section 4.3.3 and 4.3.4). Sulfuric acid mist emissions are a direct function of the sulfur content of the fuel. BACT regarding mercury beryllium, and arsenic is the inherent quality of the fuel.

For the non-regulated pollutants, none of the control technologies evaluated would reduce these concentrations. The air quality impacts of the pollutants are expected to be significantly below any levels that would cause health effects.

5.0 AIR QUALITY ANALYSIS

5.1 GENERAL MONITORING REQUIREMENTS

The CAA requires that an air quality analysis be conducted for each pollutant subject to regulation under the act before a major stationary source or major modification is constructed. This analysis may be performed through the use of modeling and/or monitoring the air quality. The use of monitoring data refers to either the use of representative air quality data from existing monitoring stations or establishing a monitoring network to monitor existing air quality. Monitoring must be conducted for a period up to 1 year prior to submission of a construction permit application. In addition to establishing existing air quality, the air quality data are useful for determining background concentrations (i.e., concentrations from sources not considered in the modeling). The background concentrations can be added to the concentrations predicted for the sources considered in the modeling to estimate total air quality impacts. These total concentrations are then evaluated to determine compliance with the AAQS.

For the criteria pollutants, continuous air quality monitoring data must be used to establish existing air quality concentrations in the vicinity of the proposed source or modification. However, preconstruction monitoring data will generally not be required if the ambient air quality concentration before construction is less than the de minimis impact monitoring concentrations, (refer to Table 3-3 for de minimis impact levels). Also, if the maximum predicted impact of the source or modification is less than the de minimis impact monitoring concentrations, the source generally would be exempt from preconstruction monitoring.

For noncriteria pollutants, USEPA recommends that an analysis based on the air quality modeling should generally be used instead of monitoring data. The permit-granting authority has discretion in requiring preconstruction monitoring data when:

1. The state has an air quality standard for the noncriteria pollutant and emissions from the source or modification pose a threat to the standard;

2. The reliability of emission data used as input to modeling existing sources is highly questionable; or
3. Air quality models have not been validated or may be suspect for certain situations, such as complex terrain or building downwash conditions.

However, before a permit granting authority requires preconstruction monitoring, USEPA recommends that an acceptable measurement method approved by USEPA should be available and the maximum concentrations due to the major source or major modification are predicted to be above the significant monitoring concentrations.

The USEPA "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (PSD) (USEPA, 1987a) sets forth guidelines for preconstruction monitoring. The guidelines allow the use of existing air quality data in lieu of additional air monitoring, if the existing data are "representative." The criteria used in determining the representativeness of data are: 1) monitor location, 2) quality of data, and 3) currentness of data.

For the first criteria, monitor location, the existing monitoring data should be representative of three types of areas: (1) the location(s) of maximum concentration increase from the proposed source or modification, (2) the location(s) of the maximum air pollutant concentration from existing sources, and (3) the location(s) of the maximum impact area, i.e., where the maximum pollutant concentration hypothetically would occur based on the combined effect of existing sources and the proposed new source or modification. The locations and size of the three types of areas are determined through the application of air quality models. The areas of maximum concentration or maximum combined impact vary in size and are influenced by factors such as the size and relative distribution of ground level and elevated sources, the averaging times of concern, and the distances between impact areas and contributing sources.

5.2 PROJECT MONITORING APPLICABILITY

As determined by the source applicability analysis described in Section 3.4, an ambient monitoring analysis is required by PSD regulations for SO₂, NO₂, PM, CO, VOC, sulfuric acid mist, Hg, Be and As. However, dispersion modeling analysis demonstrates that impacts due to the emissions from the proposed facility are less than the de minimis impact levels established for NO₂, PM, CO, Hg, and Be, but above the de minimis level for SO₂. The proposed emissions of VOC, sulfuric acid mist and arsenic are above the significant emission rates. However, for sulfuric acid mist and arsenic, no de minimis levels have been established for these pollutants because acceptable monitoring methods have not been developed. Therefore, monitoring is not required for sulfuric acid mist or arsenic.

For SO₂, the Florida DER 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, 1988) with FDER's recommendation for monitoring exemption in September 1988 (FDER, 1988). The exemption is appropriate because:

1. The site is not located near (i.e., within 10 km) any major sources of pollutant emissions;
2. Background concentrations are expected to be low and near the PSD monitoring de minimis impact levels; and
3. Data from existing monitors will provide conservative background concentrations because these sites are located in more industrial areas than the project site.

Because of the rural area and minimal amount of air pollution sources in Hardee County, the Florida DER does not operate any monitoring stations in the county. Existing air quality data were obtained from monitoring stations operated by the Florida DER in Polk County, which has monitoring stations closest to the proposed project site. The closest ambient air monitoring stations to the proposed project site that measure SO₂ concentrations are located in Nichols, about 25 km north-northwest of the site, and in Lakeland, about 50 km north of the site. Because these

monitors are located in urban areas, and/or in proximity (i.e., within 10 km) of major sources, the observed concentrations are considered to be higher than those expected to occur at the proposed facility. A more detailed discussion about the monitoring data collected at these stations is presented in Section 6.6 on background concentrations.

Preconstruction monitoring review is required for O_3 concentrations because the maximum potential VOC emissions from the proposed plant are greater than 100 TPY. The proposed facility is located in Hardee County which is an attainment area for O_3 concentrations. As discussed earlier, the proposed facility is located in a rural area with minimal industrial development (i.e., lack of major VOC emission sources) within 15 km of the site.

A summary of the nearest monitoring stations to the proposed facility that measure O_3 concentrations is presented in Table 5-1. These stations are operated by the FDER or are part of the Florida Acid Deposition Monitoring Program (FADMP) (ESE, 1988). These sites are located between 50 and 79 km in directions from the east clockwise through west from the site. Except for the FDER station in Hillsborough County, all stations have measured maximum 1-hour average O_3 concentrations that are less than 1-hour AAQS of 0.12 ppm. The Hillsborough County monitoring station has measured 1-hour concentration greater than the AAQS but this station is located in an urban area near and within the vicinity of major VOC emission sources. Data measured at this station are not considered representative of the proposed facility's site.

Therefore, based on the modeling results and the use of existing monitoring data, an exemption from preconstruction monitoring for all pollutants is appropriate.

Table 5-1. Ozone Concentration Measured in 1987 at FDER and FADMP Monitoring Sites Near the Proposed Hardee Power Station

County/Location	Identification Number	UTM Coordinate (km)*		Number of Observations	1-Hour Concentration (ppm)	
		East	North		First	Second
<u>FDER Sites</u>						
Manatee/Brandenton	0320-002-G002	340.0 (257 ⁰ , 66.6 km)	3041.9	7839	0.115	0.105
Sarasota/Sarasota	4080-002-G01	350.0 (236 ⁰ , 66.5 km)	3019.8	4907	0.094	0.090
Sarasota/Sarasota	4100-012-G01	371.7 (229 ⁰ , 43.7 km)	3028.9	8054	0.093	0.092
Hillsborough/ Hillsborough Bay	1800-081-G03	355.2 (283 ⁰ , 50.8 km)	3068.8	8593	0.171	0.151
<u>FADMP Site</u>						
Highlands/Archbold	1780-013-9A	465.2 (130 ⁰ , 79.0 km)	3006.5	7773	0.110	0.091

* Relative location from the proposed plant given in parentheses.

Source: FDER, 1988.
ESE, 1988.

6.0 AIR QUALITY MODELING APPROACH

6.1 GENERAL MODELING APPROACH

The general modeling approach followed USEPA and FDER 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 can be compared to the applicable standard when 5 years of meteorological data are 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 to reduce the computation time required to perform the modeling analysis. The basic difference between the two phases is the receptor grid used when predicting concentrations, the number of emission points, and the number of meteorological periods evaluated. In general, concentrations for the screening phase were predicted using a coarse receptor grid, limited number of major sources, and a 5-year meteorological record.

After a final list of highest, second-highest short-term concentrations was 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, second-highest concentration from the screening phase was produced. The air dispersion model was executed for the meteorological periods during which both the highest and second-highest concentrations were

predicted to occur at that receptor, based on the screening phase results. This approach was used to ensure that valid highest, second-highest concentrations were obtained. More detailed descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections.

6.2 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 USEPA 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 50 km of the proposed facility's site, the terrain has maximum elevations of 50 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 ISC dispersion model (USEPA, 1988a) was used to evaluate the pollutant emissions from proposed facility and existing major facilities. This model is contained in USEPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (USEPA, 1988b). The ISC model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

The ISC model consists of two sets of computer codes which are used to calculate short- and long-term ground level concentrations. The main differences between the two codes are the input format of the meteorological data and the method of estimating the plume's horizontal dispersion.

The first model code, the ISCST model, is an extended version of the single-source (CRSTER) model (USEPA, 1977). The ISCST model is designed to

calculate hourly concentrations based on hourly meteorological parameters (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). The hourly concentrations are processed into non-overlapping, short-term and annual averaging periods. For example, a 24-hour average concentration is based on twenty-four 1-hour averages calculated from midnight to midnight of each day. For each short-term averaging period selected, the highest and second-highest average concentrations are calculated for each receptor. As an option, a table of the 50 highest concentrations over the entire field of receptors can be produced.

The second model code of the ISC model is the ISC long-term (ISCLT) model, which is an extension of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The ISCLT model uses joint frequencies of wind direction, wind speed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. Because the input wind directions are for 16 sectors, with each sector defined as 22.5 degrees, the model calculates concentrations by assuming that the pollutant is uniformly distributed in the horizontal plane within a 22.5-degree sector.

In this analysis, the ISCST model was used to calculate both short-term and annual average concentrations because these concentrations are readily obtainable from the model output.

Major features of the ISCST model are presented in Table 6-1. Concentrations due to stack and volume sources are calculated by the ISCST model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISCST model is based on the equation for a continuous and finite crosswind line source. The ISC 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

Table 6-1. Major Features of the ISCST Model

ISCST Model Features

- o Polar or Cartesian coordinate systems for receptor locations
 - o Rural or one of three urban options which affect wind speed profile exponent, dispersion rates, and mixing height calculations
 - o Plume rise due to momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1972, and 1975)
 - o Procedures suggested by Huber and Snyder (1976); Huber (1977); and Schulmann and Hanna (1986) and Schulmann and Scire (1980) for evaluating building wake effects
 - o Procedures suggested by Briggs (1974) for evaluating stack-tip downwash
 - o Separation of multiple point sources
 - o Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
 - o Capability of simulating point, line, volume and area sources
 - o Capability to calculate dry deposition
 - o Variation with height of wind speed (wind speed-profile exponent law)
 - o Concentration estimates for 1-hour to annual average
 - o Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm
 - o Receptors located above local terrain, i.e., "flagpole" receptors
 - o Consideration of time-dependent exponential decay of pollutants
 - o The method of Pasquill (1976) to account for buoyancy-induced dispersion
 - o A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)
 - o Procedure for calm-wind processing
-

Source: USEPA, 1988a

surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50% 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.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by USEPA (1987a) and are referred to as the regulatory 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 or urban option,
5. Default vertical potential temperature gradients,
6. Calm wind processing, and
7. Reducing calculated SO₂ concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO₂ concentration emitted by 50% for every 4 hours of plume travel time).

In this analysis, the USEPA regulatory options were used to address maximum impacts. Based on a review of the land use around the facility and discussions with the FDER, the rural mode was selected because of the lack of residential, industrial and commercial development within 3 km the proposed facility site.

6.3 METEOROLOGICAL DATA

Meteorological data used in the ISCST 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. This station also has the most readily available and complete database which is representative of the plant site. In addition, FDER has requested the use of this meteorological data. The surface observations included wind direction, wind speed, temperature, cloud cover, and cloud ceiling. The wind speed, cloud cover, and cloud ceiling values were used in the ISCST meteorological preprocessor program to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at morning and afternoon, mixing heights were calculated with the radiosonde data at Ruskin using the Holzworth approach (1972). Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by USEPA (Holzworth, 1972). The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the observed hourly wind directions were classified into one of thirty-six 10-degree sectors, the wind directions were randomized within each sector using a USEPA preprocessing program to account for the expected variability in air flow.

6.4 EMISSION INVENTORY

Preliminary modeling indicated that the proposed facility's impacts could be above the significant impact levels for SO₂, NO₂ and PM at distances of approximately 50, 50, and 10 km, respectively, from the facility.

Therefore, the emission inventories for those pollutants were developed from available databases, such as FDER's Air Pollution Inventory System (APIS) and previous studies performed by KBN. The initial step involved requesting and receiving from FDER the listing of all facilities within 100 km square centered on the proposed site. From this listing, a total of 305 facilities were identified. Using current data from APIS for each facility within the 100 km square, there were 32 facilities that had maximum allowable SO₂ emissions greater than 100 TPY and were within 50 km of the proposed facility; 19 facilities that had maximum allowable NO₂ emissions greater than 100 TPY and were within 50 km of the proposed facility; there were no facilities that had maximum allowable PM emissions greater than 100 TPY

within 10 km of the proposed facility. However, within 50 km of the proposed facility, there were 42 facilities that had maximum allowable PM emissions greater than 100 TPY. Listings of the sources in the inventory with maximum allowable SO₂, NO₂, and PM emissions greater than 100 TPY and within 50 km of the proposed facility are presented in Tables 6-2 through 6-4, respectively.

Each facility was screened to determine the probability of interaction with the proposed facility. The screening technique is the "Screening Threshold" method, developed by the North Carolina Department of Natural Resources and Community Development, and approved for use by the USEPA and FDER. The method is designed to objectively eliminate from the emission inventory those sources which are not likely to have a significant interaction with the source undergoing evaluation. In general, sources that should be considered in the modeling analyses are those with emissions greater than Q (in TPY) which is calculated by the following criteria:

$$Q = 20 \times D$$

where D is the distance (km) from the source to the source undergoing review.

A listing of the emission sources and associated Q are presented in Tables 6-5 through 6-7. The sources with maximum allowable emissions which are below the calculated "screening threshold" emissions were eliminated from further consideration in the modeling analysis. A total of 22, 19, and 42 facilities (excluding the proposed facility) were included in the modeling analysis for SO₂, NO₂, and PM emissions.

In order to reduce the model computation time but effectively model sources that are most likely to interact with the proposed facility, modeling was performed in screening and refined phases. In the screening phase, only those sources with emissions above a certain threshold, based on the source's distance from the proposed facility, were modeled. The following

Table 6-2. SO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station.

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum SO2 * Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	1,173
Imperial Phosphate	404.8	3069.5	0.0	12.1	12.1	0	275
Agrico Chemical Co. (S. Pierce)	407.5	3071.5	2.7	14.1	14.4	11	4,557
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	569
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	44	2,933
Wachula City Power Plant	418.4	3047.0	13.6	-10.4	17.1	127	180
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	1,714
Agrico Chemical Co. (Pierce)	403.7	3079.0	-1.1	21.6	21.6	357	417
Mobil-Electrophosphate Division+	405.6	3080.0	0.8	22.6	22.6	2	1,428
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	3,692
IMC	396.7	3079.4	-8.1	22.0	23.4	340	10,251
IMC/Noralyn Mine Road	414.7	3080.3	9.9	22.9	24.9	23	505
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	8	8,443
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	385
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	198
Conserv. Chemicals	398.7	3084.2	-6.1	26.8	27.5	347	1,597
Royster Co.	406.8	3085.1	2.0	27.7	27.8	4	1,283
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	1,516
IMC/Praire	402.9	3087.0	-1.9	29.6	29.7	356	137
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	8,186
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	1,575
FPL Manatee	367.2	3054.1	-37.6	-3.3	37.7	265	85,305
Tricil Recovery Services	422.7	3091.9	17.9	34.5	38.9	27	240
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	3,302
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	371,733
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	597
Columbus Company	361.9	3077.8	-42.9	20.4	47.5	295	167
Gardinier	362.9	3082.2	-41.9	24.8	48.7	301	5,181
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	4,014
Lakeland City Power	409.2	3106.2	4.4	48.8	49.0	5	30,176
Adams Packing	421.7	3104.2	16.9	46.8	49.8	20	172

Total							551,901

* Maximum facility emissions from APIS, or other available information on facility.

Table 6-3. NO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum NO2 * Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	176
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	139
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	156
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	131
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	610
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	226
IMC	396.7	3079.4	-8.1	22.0	23.4	340	322
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	100
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	134
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	528
FPL Manatee	367.2	3054.1	-37.6	-3.3	37.7	265	22,734
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	534
Sherex Polymers	410.7	3098.9	5.9	41.5	41.9	352	617
Juice Bowl Products	409.4	3099.9	4.6	42.5	42.7	354	109
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	391
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	82,624
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	1,382
Gardinier	362.9	3082.2	-41.9	24.8	48.7	301	466
Lakeland City Power	409.2	3106.2	4.4	48.8	49.0	5	5,028

* Maximum facility emissions from APIS, or other available information on facility.

Table 6-4. PM Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km) To Proposed Site		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum PM * Emissions (TPY)
	East	North	X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	132
Imperial Phosphates	404.8	3069.5	0.0	12.1	12.1	0	162
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	1,705
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	263
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	871
Biochemical Energy, LTD	418.3	3048.0	13.5	-9.4	16.5	125	281
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	679
IMC	398.2	3075.7	-6.6	18.3	19.5	340	168
Agrico Chemical	403.7	3079.0	-1.1	21.6	21.6	357	631
C&M Products	405.5	3079.1	0.7	21.7	21.7	358	162
Mobil-Electrophos Division	405.6	3080.0	0.8	22.6	22.6	358	555
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	977
IMC	396.7	3079.4	-8.1	22.0	23.4	340	162
IMC	414.7	3080.3	9.9	22.9	24.9	337	973
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	352	788
IMC/ Uranium Recovery	408.4	3082.8	3.6	25.4	25.7	8	831
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	180
Conserv Chemical	398.7	3084.2	-6.1	26.8	27.5	13	1,620
Royster	406.8	3085.1	2.0	27.7	27.8	4	210
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	433
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	636
Ridge Pallets	418.6	3084.1	13.8	26.7	30.1	27	180
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	182
Allsun Products	413.5	3093.8	8.7	36.4	37.4	13	317
FPL Manatee	367.2	3054.1	-37.6	-3.3	37.7	265	7,578
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	740
Pavers, Inc.	414.0	3098.2	9.2	40.8	41.8	347	114
Rinker Cencon Corp.	412.4	3099.0	7.6	41.6	42.3	350	159
Quikrete	412.8	3099.0	8.0	41.6	42.4	349	253
Landia Chemical	403.7	3101.8	-1.1	44.4	44.4	1	2,313
Kraft Citrus	399.0	3101.8	-5.8	44.4	44.8	353	108
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	102
Jahna Concrete, Inc.	450.0	3052.2	45.2	-5.2	45.5	97	139
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	7,699
Agrico Chemical Co.	362.1	3076.1	-42.7	18.7	46.6	66	184
Macasphalt	451.1	3050.0	46.3	-7.4	46.9	99	165
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	166
FPL Avon Park	451.4	3050.5	46.6	-6.9	47.1	98	212
Gardinier	362.9	3082.2	-41.9	24.8	48.7	301	863
Lakeland City Power	409.2	3106.2	4.4	48.8	49.0	5	14,705
Coca Cola Citrus	421.6	3103.7	16.8	46.3	49.3	20	334
Adams Packing Association	421.7	3104.2	16.9	46.8	49.8	20	129

* Maximum facility emissions from APIS, or other available information on facility.

Table 6-2. SO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum SO2 Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	1,173
Imperial Phosphate	404.8	3069.5	0.0	12.1	12.1	0	275
Agrico Chemical Co. (S. Pierce)	407.5	3071.5	2.7	14.1	14.4	11	4,557
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	569
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	44	2,933
Wachula City Power Plant	418.4	3047.0	13.6	-10.4	17.1	127	180
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	1,714
Agrico Chemical Co. (Pierce)	403.7	3079.0	-1.1	21.6	21.6	357	417
Mobil-Electrophosphate Division+	405.6	3079.4	0.8	22.0	22.0	2	1,428
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	3,692
IMC	396.7	3079.4	-8.1	22.0	23.4	340	10,251
IMC/Noralyn Mine Road	414.7	3080.3	9.9	22.9	24.9	23	505
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	8	8,443
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	385
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	198
Conserv. Chemicals	398.7	3084.2	-6.1	26.8	27.5	347	1,597
Royster Co.	406.8	3085.1	2.0	27.7	27.8	4	1,283
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	1,516
IMC/Praire	402.9	3087.0	-1.9	29.6	29.7	356	137
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	8,186
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	1,575
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	85,305
Tricil Recovery Services	422.7	3091.9	17.9	34.5	38.9	27	240
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	3,302
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	371,733
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	597
Columbus Company	361.9	3077.8	-42.9	20.4	47.5	295	167
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	5,181
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	4,014
Lakeland City Power	409.2	3106.2	4.4	48.8	49.0	5	30,176
Adams Packing	421.7	3104.2	16.9	46.8	49.8	20	172
Total							551,901

* Maximum facility emissions from APIS, or other available information on facility.

Table 6-3. NO2 Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum NO2 Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	176
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	139
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	156
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	131
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	610
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	226
IMC	396.7	3079.4	-8.1	22.0	23.4	340	322
Kaplan Industries	418.3	3079.3	13.5	21.9	25.7	32	100
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	134
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	528
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	22,734
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	534
Sherex Polymers	410.7	3098.9	5.9	41.5	41.9	352	617
Juice Bowl Products	409.4	3099.9	4.6	42.5	42.7	354	109
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	391
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	82,624
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	1,382
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	466
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	5,028
Total							116,407

* Maximum facility emissions from APIS, or other available information on facility.

Table 6-4. PM Sources (>100 TPY) Within 50 km of Proposed Hardee Power Station

Facility	UTM Coordinates (km)		Relative Location (km)		Distance From Proposed Site (km)	Direction From Proposed Site (degree)	Maximum PM * Emissions (TPY)
	East	North	To Proposed Site				
			X	Y			
Gardinier	415.3	3063.3	10.5	5.9	12.0	61	132
Imperial Phosphates	404.8	3069.5	0.0	12.1	12.1	0	162
Agrico Chemical	407.5	3071.5	2.7	14.1	14.4	11	1,705
Mobil Oil Big Four Mine	394.7	3069.6	-10.1	12.2	15.8	320	263
U.S. Agri-Chemicals	416.0	3069.0	11.2	11.6	16.1	316	871
Biochemical Energy, LTD	418.3	3048.0	13.5	-9.4	16.5	125	281
IMC Fort Lonesome	389.5	3067.9	-15.3	10.5	18.6	304	679
IMC	398.2	3075.7	-6.6	18.3	19.5	340	168
Agrico Chemical	403.7	3079.0	-1.1	21.6	21.6	357	631
C&M Products	405.5	3079.1	0.7	21.7	21.7	358	162
Mobil-Electrophos Division	405.6	3079.4	0.8	22.0	22.0	358	555
Farmland Industries	409.5	3080.1	4.7	22.7	23.2	12	977
IMC	396.7	3079.4	-8.1	22.0	23.4	340	162
IMC	414.7	3080.3	9.9	22.9	24.9	337	973
C.F. Industries	408.4	3082.4	3.6	25.0	25.3	352	788
IMC/ Uranium Recovery	408.4	3082.8	3.6	25.4	25.7	8	831
American Orange Corp.	429.8	3047.3	25.0	-10.1	27.0	112	180
Conserv Chemical	398.7	3084.2	-6.1	26.8	27.5	13	1,620
Royster	406.8	3085.1	2.0	27.7	27.8	4	210
Mobil Chemical Co./Nichols	398.4	3085.3	-6.4	27.9	28.6	347	433
W.R. Grace & Co.	409.8	3086.7	5.0	29.3	29.7	10	636
Ridge Pallets	418.6	3084.1	13.8	26.7	30.1	27	180
U.S. Agri-Chemicals	413.2	3086.3	8.4	28.9	30.1	16	182
Allsun Products	413.5	3093.8	8.7	36.4	37.4	13	317
FPL Manatee	367.3	3054.2	-37.5	-3.2	37.6	265	7,578
Consolidated Minerals	393.8	3096.3	-11.0	38.9	40.4	344	740
Pavers, Inc.	414.0	3098.2	9.2	40.8	41.8	347	114
Rinker Cencon Corp.	412.4	3099.0	7.6	41.6	42.3	350	159
Quikrete	412.8	3099.0	8.0	41.6	42.4	349	253
Landia Chemical	403.7	3101.8	-1.1	44.4	44.4	1	2,313
Kraft Citrus	399.0	3101.8	-5.8	44.4	44.8	353	108
Owens-Illinois	406.0	3102.3	1.2	44.9	44.9	358	102
Jahna Concrete, Inc.	450.0	3052.2	45.2	-5.2	45.5	97	139
Teco Big Bend	361.9	3075.0	-42.9	17.6	46.4	292	7,699
Agrico Chemical Co.	362.1	3076.1	-42.7	18.7	46.6	66	184
Macasphalt	451.1	3050.0	46.3	-7.4	46.9	99	165
Citrus World	441.0	3087.3	36.2	29.9	47.0	50	166
FPL Avon Park	451.4	3050.5	46.6	-6.9	47.1	98	212
Gardinier	363.4	3082.4	-41.4	25.0	48.4	301	863
Lakeland City Power	409.0	3106.2	4.2	48.8	49.0	5	14,705
Coca Cola Citrus	421.6	3103.7	16.8	46.3	49.3	20	334
Adams Packing Association	421.7	3104.2	16.9	46.8	49.8	20	129
Total							49,061

Table 6-5. Summary of SO2 Emission Sources Considered in the Modeling Analysis for the Hardee Power Station

Facility*	Location from Proposed Facility		Maximum SO2 Emissions (TPY)	Emission Threshold, Q (TPY)	Included in Modeling	Modeled Sources in Analyses:	
	Distance (km)	Direction (degrees)				Screen.	Refined
Gardinier	12.0	61	1,173	241	YES	YES	YES
Imperial Phosphate	12.1	0	275	242	YES	NO	YES
Agrico Chemical Co. (S. Pierce)	14.4	11	4,557	287	YES	YES	YES
Mobil Oil Big Four Mine	15.8	320	569	317	YES	NO	YES
U.S. Agri-Chemicals	16.1	44	2,933	322	YES	YES	YES
Wachula City Power Plant	17.1	127	180	342	NO	--	--
IMC Fort Lonesome	18.6	304	1,714	371	YES	YES	YES
Agrico Chemical Co. (Pierce)	21.6	357	417	433	NO	--	--
Mobil-Electrophosphate Division	22.0	2	1,428	440	YES	NO	YES
Farmland Industries	23.2	12	3,692	464	YES	YES	YES
IMC	23.4	340	10,251	469	YES	YES	YES
IMC/Noralyn Mine Road	24.9	23	505	499	YES	NO	YES
C.F. Industries	25.3	8	8,443	505	YES	YES	YES
Kaplan Industries	25.7	32	385	515	NO	--	--
American Orangr Corp.	27.0	112	198	539	NO	--	--
Conserv. Chemicals	27.5	347	1,597	550	YES	NO	YES
Royster Co.	27.8	4	1,283	555	YES	NO	YES
Mobil Chemical Co./Nichols	28.6	347	1,516	572	YES	NO	YES
IMC/Prairie	29.7	356	137	593	NO	--	--
W.R. Grace & Co.	29.7	10	8,186	594	YES	YES	YES
U.S. Agri-Chemicals	30.1	16	1,575	602	YES	NO	YES
FPL Manatee	37.6	265	85,305	753	YES	YES	YES
Tricil Recovery Services	38.9	27	240	777	NO	--	--
Consolidated Minerals	40.4	344	3,302	809	YES	YES	YES
Teco Big Bend	46.4	292	371,733	927	YES	YES	YES
Citrus World	47.0	50	597	939	NO	--	--
Columbus Company	47.5	295	167	950	NO	--	--
Gardinier	48.4	301	5,181	967	YES	YES	YES
Lakeland City Power	49.0	5	4,014	980	YES	YES	YES
Lakeland City Power	49.0	5	30,176	980	YES	YES	YES
Adams Packing	49.8	20	172	995	NO	--	--

			551,901				

* Refer to Table 6-2 for facility UTM coordinates (East, North) and relative locations (x, y) to proposed site.

Table 6-6. Summary of NO2 Emission Sources Considered in the Modeling Analysis for the Hardee Power Station

Facility*	Location From Proposed Facility		Maximum NO2 Emissions (TPY)	Emission Threshold, Q (TPY)	Included in Modeling	Modeled Sources in Analyses:	
	Distance (km)	Direction (degrees)				Screen.	Refined
Gardinier	12.0	61	176	241	NO	--	--
Agrico Chemical	14.4	11	139	287	NO	--	--
Mobil Oil Big Four Mine	15.8	320	156	317	NO	--	--
U.S. Agri-Chemicals	16.1	316	131	322	NO	--	--
IMC Fort Lonesome	18.6	304	610	371	YES	NO	YES
Farmland Industries	23.2	12	226	464	NO	--	--
IMC	23.4	340	322	469	NO	--	--
Kaplan Industries	25.7	32	100	515	NO	--	--
Mobil Chemical Co./Nichols	28.6	347	134	572	NO	--	--
W.R. Grace & Co.	29.7	10	528	594	NO	--	--
FPL Manatee	37.6	265	22,734	753	YES	YES	YES
Consolidated Minerals	40.4	344	534	809	NO	--	--
Sherex Polymers	41.9	352	617	838	NO	--	--
Juice Bowl Products	42.7	354	109	855	NO	--	--
Owens-Illinois	44.9	358	391	898	NO	--	--
Teco Big Bend	46.4	292	82,624	927	YES	YES	YES
Citrus World	47.0	50	1,382	939	YES	NO	YES
Gardinier	48.4	301	466	967	NO	--	--
Lakeland City Power	49.0	5	5,028	980	YES	YES	YES
Total			116,407				

* Refer to Table 6-3 for facility UTM coordinates (East, North) and relative locations (x, y) to proposed site.

Table 6-7. Summary of PM Emission Sources Considered in the Modeling Analysis for the Hardee Power Station

Facility*	Location from Proposed Facility		Maximum PM Emissions (TPY)	Emission Threshold, Q (TPY)	Included in Modeling	Modeled Sources in Analyses:	
	Distance (km)	Direction (degrees)				Screen.	Refined
Gardinier	12.0	61	132	241	NO	--	--
Imperial Phosphates	12.1	0	162	242	NO	--	--
Agrico Chemical	14.4	11	1,705	287	YES	YES	YES
Mobil Oil Big Four Mine	15.8	320	263	317	NO	--	--
U.S. Agri-Chemicals	16.1	316	871	322	YES	NO	YES
Biochemical Energy, LTD	16.5	125	281	329	NO	--	--
IMC Fort Lonesome	18.6	304	679	371	YES	NO	YES
IMC	19.5	340	168	389	NO	--	--
Agrico Chemical	21.6	357	631	433	YES	NO	YES
C&M Products	21.7	358	162	434	NO	--	--
Mobil-Electrophos Division	22.0	358	555	440	YES	NO	YES
Farmland Industries	23.2	12	977	464	YES	NO	YES
IMC	23.4	340	162	469	NO	--	--
IMC	24.9	337	973	499	YES	NO	YES
C.F. Industries	25.3	352	788	505	YES	NO	YES
IMC/ Uranium Recovery	25.7	8	831	513	YES	NO	YES
American Orange Corp.	27.0	112	180	539	NO	--	--
Conserv Chemical	27.5	13	1,620	550	YES	NO	YES
Royster	27.8	4	210	555	NO	--	--
Mobil Chemical Co./Nichols	28.6	347	433	572	NO	--	--
W.R. Grace & Co.	29.7	10	636	594	YES	NO	YES
Ridge Pallets	30.1	27	180	601	NO	--	--
U.S. Agri-Chemicals	30.1	16	182	602	NO	--	--
Allsun Products	37.4	13	317	749	NO	--	--
FPL Manatee	37.6	265	7,578	753	YES	YES	YES
Consolidated Minerals	40.4	344	740	809	NO	--	--
Pavers, Inc.	41.8	347	114	836	NO	--	--
Rinker Cencon Corp.	42.3	350	159	846	NO	--	--
Quikrete	42.4	349	253	847	NO	--	--
Landia Chemical	44.4	1	2,313	888	YES	NO	YES
Kraft Citrus	44.8	353	108	896	NO	--	--
Owens-Illinois	44.9	358	102	898	NO	--	--
Jahna Concrete, Inc.	45.5	97	139	910	NO	--	--
Teco Big Bend	46.4	292	7,699	927	YES	YES	YES
Agrico Chemical Co.	46.6	66	184	932	NO	--	--
Macasphalt	46.9	99	165	938	NO	--	--
Citrus World	47.0	50	166	939	NO	--	--
FPL Avon Park	47.1	98	212	942	NO	--	--
Gardinier	48.4	301	863	967	NO	--	--
Lakeland City Power	49.0	5	14,705	980	YES	YES	YES
Coca Cola Citrus	49.3	20	334	985	NO	--	--
Adams Packing Association	49.8	20	129	995	NO	--	--
Total			49,061				

* Refer to Table 6-4 for facility UTM coordinates (East, North) and relative location (x, y) to proposed site.

criteria was used to determine the sources to be modeled in the screening analysis:

<u>Distance (km)</u>	<u>Emission Threshold (TPY)</u>
0 - 15	500
15 - 20	1000
20 - 25	1500
25 - 30	2000
30 - 50	3000

Facilities considered in the screening and refined analyses are presented in Tables 6-5 through 6-7. Summaries of the amount of modeled emissions in the screening phase compared to the refined phase by distance categories from the proposed facility are given in Tables 6-8 through 6-10. For the SO₂ modeling analysis, approximately 98% of the SO₂ emissions in the refined phase were modeled in the screening phase. As indicated, most of the emissions occur beyond 30 km from the proposed facility.

For the NO₂ modeling analysis, approximately 98% of the NO₂ emissions in the refined analysis were modeled in the screening phase. Similar to the SO₂ emission sources, most of the NO₂ emissions occur beyond 30 km from the proposed facility.

For the PM modeling analysis, approximately 75% of the PM emissions were modeled in the screening phase. As indicated in Tables 6-7 and 6-10, there were no emission sources within 10 km of the proposed facility (the significant impact distance) with most emissions occurring beyond 30 km from the proposed facility.

6.5 RECEPTOR LOCATIONS

As discussed in Section 6.1, 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

Table 6-8. Summary of Modeled SO2 Emissions Used for Screening and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		----- Emissions (TPY)	----- Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	6,005	5,730	95.4
15 - 20	> 1000	5,216	4,647	89.1
20 - 25	> 1500	15,876	13,943	87.8
25 - 30	> 2000	21,025	16,629	79.1
30 - 50	> 3000	501,286	499,711	99.7
0 - 50		549,408	540,660	98.4

Table 6-9. Summary of Modeled NO2 Emissions Used for Screening and
and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		Emissions (TPY)	Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	0	0	--
15 - 20	> 1000	610	0	0.0
20 - 25	> 1500	0	0	--
25 - 30	> 2000	0	0	--
30 - 50	> 3000	111,768	110,386	98.8
0 - 50		112,378	110,386	98.2

Table 6-10. Summary of Modeled PM Emissions Used for Screening and Refined Analyses for the Hardee Power Station

Distance From Proposed Site (km)	Threshold Emissions (TPY)	Refined Analysis	Screening Analysis	
		----- Emissions (TPY)	----- Emissions (TPY)	Percent Modeled of Refined Analysis
0 - 15	> 500	1,705	1,705	100.0
15 - 20	> 1000	1,550	0	0.0
20 - 25	> 1500	3,136	0	0.0
25 - 30	> 2000	3,875	0	0.0
30 - 50	> 3000	32,295	29,982	92.8
0 - 50		42,561	31,687	74.5

locations of the receptors were based on identifying the areas in which maximum concentrations would be expected due to the proposed unit.

A description of the receptor locations for determining compliance with PSD Class II increments and AAQS is as follows:

1. 344 receptors located in a radial grid centered on the proposed facility. These receptors were classified into two main groups: (1) plant property receptors and (2) near-field receptors.
2. The grid for the plant property receptors consisted of 36 receptors, presented in Table 6-11.
3. The grid for the near-field receptors consisted of 308 receptors located at distances of 600, 900, 1,250, 1,750, 2,250, 2,750, 3,500, 4,500, and 6,000 m along 36 radials with each radial spaced at 10 degree increments. For directions of 10 through 160 degrees, receptors at a downwind distance of 600 m from the proposed facility were not included in the analysis because these receptors are on plant property.

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 9 radials, at 2 degree increments, centered on the radial which the maximum concentration was produced. For example, if the maximum concentration was produced along the 90 degree radial at a distance of 1.75 km, the refined receptor grid would consist of receptors at the following locations:

Table 6-11. Plant Property Receptors Used in the Screening Analysis for the Hardee Power Station

Direction (degrees)	Distance (km)	Direction (degrees)	Distance (km)
10	1.050	190	0.450
20	1.100	200	0.420
30	1.160	210	0.390
40	0.960	220	0.380
50	0.820	230	0.360
60	0.760	240	0.420
70	0.710	250	0.490
80	0.830	260	0.410
90	1.060	270	0.360
100	0.700	280	0.330
110	0.700	290	0.320
120	0.740	300	0.300
130	0.820	310	0.300
140	0.890	320	0.300
150	0.790	330	0.320
160	0.760	340	0.350
170	0.540	350	0.400
180	0.500	360	0.450

<u>Directions (degrees)</u>	<u>Distance (km)</u>
82, 84, 86, 88, 90, 92, 94,	1.35, 1.45, 1.55, 1.65, 1.75,
96, 98	1.85, 1.95, 2.05, and 2.15
	per direction

To ensure that a valid highest, second-highest concentration was calculated, concentrations were predicted for the refined grid for the periods that produced both the highest and second-highest concentration from the screening receptor grid.

Refined modeling analysis was performed for the annual average period but used a different approach than that used for short-term average periods. Because the spatial distributions of annual average concentrations are not expected to vary significantly from those produced from the screening analysis, concentrations were calculated at the receptor which produced the highest annual concentration in the screening analysis. For this analysis, concentrations were calculated for the entire year using the refined emission inventory.

6.6 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 not located near any major sources of SO₂, PM, and NO_x emissions, background concentrations are expected to be low. As a result, existing monitoring data were used to estimate background concentrations. A summary of the maximum concentrations measured at the closest monitors to the proposed facility is presented in Table 6-12. 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 SO₂ concentrations, data collected at the monitoring stations in Nichols and Lakeland were reviewed and used in estimating background concentrations. The nearest station to the proposed site is located in Nichols,

Table 6-12. Summary of maximum SO₂, TSP, and NO₂ Concentrations Measured at the Closest Monitoring State on to the Proposed Hardee Power Station

Pollutant	Location	Site Number	UTM Coordinates (km)*		Year	Observations ⁺		Concentration (ug/m ³)					
			East	North		Number	%	3-Hour		24-Hour		Annual	
								1st	2nd	1st	2nd		
SO ₂	Lakeland	2160-001-F01	407.5	3107.5	1987	8444	96.4	200	162	86	55	10	
			(3 ⁰ , 50 km)		1986	6520	74.4	267	178	81	71	13	
	Nichols	3680-010-F02	399.5	3081.3	1987	8571	97.8	697	267	115	51	11	
			(348 ⁰ , 24.5 km)		1986	4994	57.0	203	162	38	35	7	
TSP	Lakeland	2160-001-F01	407.5	3107.5	1987	58	95.1	-	-	87	86	50	
			(3 ⁰ , 50 km)		1986	58	95.1	-	-	109	87	47	
	Nichols	3680-010-F02	399.5	3081.3	1987	58	95.1	-	-	73	73	38	
			(348 ⁰ , 24.5 km)		1986	58	95.1	-	-	119	81	38	
	Bartow	0180-010-F01	418.4	3084.15	1987	42	68.9	-	-	74	71	40	
			(27 ⁰ , 29.9 km)		1986	57	93.4	-	-	70	70	37	
	Mulberry	2860-003-F02	405.0	3085.5	1987	42	68.9	-	-	75	75	43	
			(360 ⁰ , 28 km)		1986	54	88.5	-	-	74	74	38	
Bradley	3680-011-F02	403.1	3074.8	1987	61	100.0	-	-	110	91	45		
		(354 ⁰ , 17.5 km)		1986	60	98.4	-	-	94	80	41		
NO ₂	Ybor City	4360-052-601	358.4	3093.5	1987	6005	68.6	-	-	-	-	45	
			(308 ⁰ , 59.8 km)		1986	7808	89.1	-	-	-	-	39	

* Direction and distance from the site listed in parentheses.

⁺ For TSP, based on observations every 6 days (61 per year).

Source: FDER, 1987/88

approximately 24.5 km to the north-northwest. During 1987, the second highest 3- and 24-hour and annual average concentrations were 267, 51, and 11 $\mu\text{g}/\text{m}^3$, respectively. These concentrations were assumed to represent background concentrations.

TSP concentration data collected at the monitoring station in Bradley were used in estimating background PM_{10} concentrations. These values were the second highest 24-hour and annual average concentrations of 91 and 45 $\mu\text{g}/\text{m}^3$, respectively. The data from this station were selected because this is the closest station to the project site with TSP concentrations. It should be noted that the AAQS for particulate matter is based on PM with a nominal diameter of 10 μ or less. TSP concentrations include particles with diameters up to approximately (PM₁₀) 30 μ . Therefore, the use of TSP concentrations to estimate PM₁₀ background concentrations will provide an additional conservative factor in determining compliance with AAQS.

There are no stations within 50 km of the proposed site location that measure NO_2 concentrations. The nearest station to the proposed site is located in Ybor City, Hillsborough County, approximately 60 km to the west-northwest. This station is in a highly urbanized area and has a significant impact from vehicular traffic. During 1987, this station measured an annual average concentration of 45 $\mu\text{g}/\text{m}^3$, based on 69% data capture. This concentration was used to represent a conservative estimate of the background concentration.

6.7 BUILDING DOWNWASH EFFECTS

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 must be 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 are input to the model which are used to modify

the dispersion parameters. For short stacks (i.e., physical stack height is less than $h_b + 0.5 L_b$, where h_b is the building height and L_b is the lesser of the building height or projected width), the Schulman and Scire method is used. If this method is used, then direction-specific building dimensions are input for h_b and L_b for the 36 directions, with each direction representing a 10 degree sector. The features of the Schulman and Scire method are: 1) reduced plume rise due to initial plume dilution, 2) enhanced plume spread as a linear function of the effective plume height, and 3) specification of building dimensions as a function of wind direction.

For cases where the physical stack is greater than $h_b + 0.5 L_b$ but less than GEP, the Huber-Snyder method is used. For this method, the ISCST model calculates the area of the building using the length and width, assumes the area is representative of a circle, and then calculates a building width by determining the diameter of the circle. If a specific width is to be modeled, then the value input to the model must be adjusted according to the following formula:

$$M_w = \sqrt{\left(\frac{H_w}{2}\right)^2}$$

$$M_w = 0.8886 H_w$$

where M_w is input to the model to produce a building width of H_w used in the dispersion calculation.

H_w is the actual building width for which dispersion calculations are performed.

The building dimensions considered for the proposed facility are presented in Table 6-13. In these analyses, building downwash conditions were assumed to occur for all directions around each stack although these conditions may not occur for certain directions. Based on sensitivity analyses performed for the proposed facility, higher concentrations were produced with the

Table 6-13. Structure Dimensions and GEP Stack Height Calculations for the Hardee Power Station

Structure	Building Dimensions (ft)			Maximum Projected Width	GEP Stack Height
	Height	Length	Width		
HRSG*	45	50	25	56	113
Combustion Turbine Enclosure**	40	1175	75	1178	100

Note: These structure dimensions produced the worst case impacts for a HRSG stack height of 75 feet.

* Used in modeling analyses.

** Based on a single structure that encloses all the combustion turbines associated with a 660 MW plant.

building dimension using a height of 45 ft which also produced the highest GEP height. Therefore, the building dimensions associated with this height were used in performing subsequent model calculations.

7.0 AIR QUALITY MODELING RESULTS

7.1 PROPOSED FACILITY ONLY

For the screening analysis, a summary of the maximum SO₂, NO₂, PM, CO, and Be concentrations due to the proposed facility is presented in Table 7-1. Model results were calculated for a range of operating conditions for which maximum impacts could occur (see Section 2.0 for the operating data and rationale for modeling these conditions). These operating conditions, which were based on either maximum emissions or minimum flow rate for the units, were as follows (Refer to Table 2-7 for Stack parameters and SO₂ emission):

1. Case 1: Maximum emissions at 32°F;
2. Case 2: Maximum emissions at 95°F;
3. Case 3: Minimum flow rate at 32°F; and
4. Case 4: Minimum flow rate at 95°F.

As indicated in Table 7-1, the maximum concentrations are predicted for the operating conditions with minimum flow rates (Cases 3 and 4). It should be noted that the modeled SO₂ emissions were specific for each case because the maximum predicted SO₂ concentrations were relatively high when compared to PSD Class II increments. For the other pollutants, the emissions from Case 1, which had the highest emissions among the cases, were modeled using the stack parameters for Cases 2, 3, and 4; therefore, the maximum impacts predicted for cases 2 through 4 are conservative (lower impacts would be predicted if the emissions associated with each case were modeled). See Section 2.0 for a more detailed discussion about the emission data and associated operating parameters used in the modeling.

The maximum predicted 3-, 24-hour and annual SO₂ concentrations are 424, 62.5 and 6.7 ug/m³, 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 5.0, existing monitoring data collected by the FDER are being used in this application to satisfy preconstruction monitoring requirements and to establish background concentrations.

Table 7-1. Maximum Concentrations Predicted for the Combined Cycle Plant (660 MW)
for 4 Operating Designs

Pollutant	Averaging Period	Maximum Concentrations (ug/m3)				Air Quality Requirements (ug/m3)	
		Maximum Emissions		Minimum Flow Rate		Deminimis Levels	PSD Class II Increment
		32 oF	95 oF	32 oF	95 oF		
		Case 1	Case 2	Case 3	Case 4		
SO2	3-hour	196	281	359	424	NA	512
	24-hour	54.7	53.8	62.5	60.0	13	91
	Annual	5.8	5.7	6.7	6.5	NA	20
PM(TSP)	24-hour	5.1	5.9	6.4	7.5	10	37
	Annual	0.54	0.63	0.68	0.82	NA	19
PM(PM10)	24-hour	5.1	5.9	6.4	7.5	10	NA
	Annual	0.54	0.63	0.68	0.82	NA	NA
NO2	Annual	3.0	3.5	3.8	4.6	14	25
CO	1-hour	99.0	112.0	130.3	178.5	NA	NA
	8-hour	21.4	24.2	26.1	38.0	575	NA
Be	24-hour	0.0002	0.0003	0.0003	0.0004	0.001	NA
Hg	24-hour	0.0011	0.0012	0.0013	0.0016	0.25	NA

NA = Not applicable

* Modeled as 3 stacks, each separated by 100 m.

Hardee Power Station
Site Certification Application and Environmental Assessment

Clarification No. 2

Date: August 7, 1989

Affected Sections: 11.1.4 Prevention of Significant Deterioration
(Section 7.1)

Question: The PSD analyses in Appendix 11.1.4 provides insufficient detail in analyses ... on visibility impacts (re: FDER letter: Owen to Conn, July 17, 1989, Item No. 7).

Response: The Clean Air Act Amendments provide for implementation of guidelines to prevent visibility impairment in mandatory PSD Class I areas. For sources undergoing PSD review, a visibility impairment analysis must be performed for any source locating within 100 km of a Class I area. The nearest Class I area to the proposed facility is the Chassahowitzka National Wilderness Area located about 125 km to the northwest of the proposed facility. Although the proposed facility is more than 100 km from the Class I area, a visibility analysis was performed to determine if any impairment would occur as a result of the proposed facility's emissions.

The procedures used to quantify potential visibility impairment are based on USEPA recommendations presented in Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-05, September, 1988. A Level-1 screening analysis was performed using the USEPA program, VISCREEN, which is designed to provide a conservative estimate of plume visual impacts (i.e., impacts that would be larger than those calculated with more realistic input and modeling assumptions). The VISCREEN model assumes worst-case meteorological conditions of extremely stable atmospheric conditions and wind speed of 1 m/s persisting for 12 hours toward the Class I area.

The model inputs and results of the modeling for the proposed facility are presented in the following table. As shown in the results section of the table, the proposed facility's visual impacts do not exceed the USEPA screening criteria either inside or outside the Class I area. Based on these results, the proposed facility's emissions are highly unlikely to cause visibility impairment in the Class I area.

Visual Effects Screening Analysis for

Source: HARDEE POWER STATION

Class I Area: CHAS. NWR

*** Level-1 Screening ***

Input Emissions for

Particulates 1500.00 TON/YR
NOx (as NO2) 8405.00 TON/YR
Primary NO2 .00 TON/YR
Soot .00 TON/YR
Primary SO4 .00 TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone: .04 ppm
Background Visual Range: 25.00 km
Source-Observer Distance: 125.00 km
Min. Source-Class I Distance: 125.00 km
Max. Source-Class I Distance: 140.00 km
Plume-Source-Observer Angle: 11.25 degrees
Stability: 6
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area

Screening Criteria ARE NOT Exceeded

						Delta E		Contrast	
						=====		=====	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume	
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
SKY	10.	84.	125.0	84.	2.00	.118	.05	.000	
SKY	140.	84.	125.0	84.	2.00	.028	.05	-.001	
TERRAIN	10.	84.	125.0	84.	2.00	.005	.05	.000	
TERRAIN	140.	84.	125.0	84.	2.00	.001	.05	.000	

Maximum Visual Impacts OUTSIDE Class I Area

Screening Criteria ARE NOT Exceeded

						Delta E		Contrast	
						=====		=====	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume	
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
SKY	10.	75.	121.0	94.	2.00	.123	.05	.000	
SKY	140.	75.	121.0	94.	2.00	.029	.05	-.002	
TERRAIN	10.	65.	116.6	104.	2.00	.008	.05	.000	
TERRAIN	140.	65.	116.6	104.	2.00	.002	.05	.000	

Hardee Power Station
Site Certification Application and Environmental Assessment

Clarification No. 3

Date: August 7, 1989

Affected Sections: 11.1.4 Prevention of Significant Deterioration
(Section 7.1)

Question: Please clarify the description of modeling outputs that deal with Part II or provide the computer printouts (re: Conversation with Max Lin, FDER 8/2/89).

Response: Air dispersion modeling was performed for SO₂, NO₂, and PM concentrations as part of the screening analysis to address compliance with PSD increments and AAQS (see Part II of the Index to Computer Printouts). The initial analyses were performed for Cases 1 and 4 in the same run to demonstrate the range of impacts associated with the operating and emission data used for these cases. (Cases refer to various combinations of emissions and flow rates for combustion turbines.) The results from these cases should produce the highest and lowest impacts expected from the range of flow rates and emissions from the four configurations considered because Case 1 and Case 4 represent the maximum emissions and the lowest flow rate, respectively. As discussed in Section 7.0 of the PSD Application, the maximum impacts for the proposed facility were predicted for either Case 3 or Case 4. Because the results were already calculated for Case 4, additional modeling was performed for Case 3 to determine compliance with PSD increments and AAQS. The configuration of operating and emission data for Case 2 is expected to produce lower impacts than the results for Cases 3 and 4 and, therefore, was not explicitly modeled in the analysis.

The maximum predicted 24-hour and annual average PM concentrations are 7.5 and 0.82 $\mu\text{g}/\text{m}^3$, respectively. Because the maximum 24-hour concentration is below the de minimis monitoring level, preconstruction is not required for the permit application.

The maximum predicted annual NO_2 concentration is 4.6 $\mu\text{g}/\text{m}^3$, which is below the de minimis monitoring level. Similar to the PM concentrations, preconstruction monitoring requirements is not required for the permit application.

The maximum predicted 1- and 8-hour average CO concentrations are 17.9 and 38.0 $\mu\text{g}/\text{m}^3$, respectively, which 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 Be and Hg concentrations are 0.0004 and 0.0016 $\mu\text{g}/\text{m}^3$, respectively, which are less than the de minimis monitoring levels. Therefore, preconstruction monitoring is not required for these pollutants.

7.2 PSD CLASS II INCREMENT ANALYSIS

Summaries of the maximum SO_2 , PM, and NO_2 concentrations predicted in the screening analysis for comparison to the PSD Class II increments are presented in Tables 7-2 through 7-4, respectively. These results show that maximum concentrations due to all PSD sources are less than the maximum allowable PSD Class II increments for all averaging periods and pollutants.

The refined analysis was based on modeling the meteorological periods during which the overall highest, second-highest and associated highest 3- and 24-hour SO_2 and 24-hour PM concentrations were predicted in the screening analysis. The refined analysis for the annual average concentrations was based on modeling the receptor and year which produced

Table 7-2. Maximum Predicted SO₂ Concentrations in the Screening Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (ug/m ³)	Receptor Location		Period		
		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
3-Hour*	194 ⁺	110	2.25	214	12	1982
	195 ⁺	310	1.75	211	12	1983
	198 ⁺	130	2.75	59	6	1984
	424 ^{**}	360	0.45	243	12	1985
	203 ⁺	90	0.90	194	15	1986
24-Hour*	62.6 ⁺	240	2.25	241	24	1982
	58.2 ⁺	240	3.50	289	24	1883
	58.5 ^{**}	120	0.74	59	24	1984
	61.4 ⁺	90	2.75	118	24	1985
	60.5 ⁺	90	2.25	201	24	1986
Annual	8.0 ⁺⁺	240	3.50	-	-	1982
	6.5 ^{**}	240	3.50	-	-	1983
	8.1 ^{**}	240	3.50	-	-	1984
	7.4 ⁺⁺	250	3.50	-	-	1985
	8.0 ^{**}	90	1.75	-	-	1986

* Highest, second-highest concentrations predicted for this averaging period.

+ Based on Operating Case 3.

** Based on Operating Case 4.

++ Based on Operating Cases 3 and 4.

Table 7-3. Maximum Predicted PM Concentrations in the Screening Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (ug/m ³)	Receptor Location		Period		
		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
24-Hour*	7.5	240	1.75	123	24	1982
	6.9	240	3.50	289	24	1883
	6.0	240	4.50	313	24	1984
	7.2	90	2.25	118	24	1985
	6.5	90	1.75	201	24	1986
Annual	0.8	240	3.50	-	-	1982
	0.6	240	3.50	-	-	1983
	0.8	240	3.50	-	-	1984
	0.7	250	3.50, 4.50	-	-	1985
	0.8	90	1.75	-	-	1986

* Highest, second-highest concentrations predicted for this averaging period.

Table 7-4. Maximum Predicted NO₂ Concentrations in the Screening Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (ug/m ³)	Receptor Location		Period		
		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
Annual	4.6	240	3.50	-	-	1982
	3.3	240	3.50	-	-	1983
	4.4	240	3.50	-	-	1984
	4.0	240	4.50	-	-	1985
	4.5	90	1.75	-	-	1986

the highest annual concentration using the refined emission inventory. A summary of the maximum SO₂, PM, and NO₂ concentrations predicted in the refined analysis is presented in Table 7-5.

The maximum 3-hour average SO₂ PSD increment consumption from the refined analysis is predicted to be 424 ug/m³, which is 83% of the maximum allowable PSD Class II increment of 512 ug/m³, not to be exceeded more than once per year. The proposed facility contributed 100% to this maximum 3-hour average concentration.

The maximum 24-hour average SO₂ PSD increment consumption is predicted to be 66.0 ug/m³, which is 73% of the maximum allowable PSD Class II increment of 91 ug/m³, not to be exceeded more than once per year. Approximately 99% of this concentration is due to the proposed facility.

The maximum annual average SO₂ PSD increment consumption is predicted to be 8.1 ug/m³, which is 41% of the maximum allowable PSD Class II increment of 20 ug/m³. Approximately 77% of this concentration is due to the proposed facility.

The maximum 24-hour average TSP PSD increment consumption is predicted to be 8.0 ug/m³, which is 22% of the maximum allowable PSD Class II increment of 37 ug/m³, not to be exceeded more than once per year. Approximately 99% of this concentration is due to the proposed source.

The maximum annual average TSP PSD increment consumption from the refined analysis is predicted to be 0.9 ug/m³, which is 6% of the maximum allowable PSD Class II increment of 19 ug/m³. Approximately 89% of this concentration is due to the proposed facility.

The maximum annual average NO₂ PSD increment consumption from the refined analysis is predicted to be 4.6 ug/m³, which is 17% of the maximum allowable PSD Class II increment of 25 ug/m³. This concentration is entirely due to the proposed facility.

Table 7-5. Maximum Predicted SO₂, PM, and NO₂ Concentrations in the Refined Analysis for Comparison to PSD Class II Increments

Averaging Period	Maximum Concentration (ug/m ³)	<u>Receptor Location</u>		<u>Period</u>		
		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
<u>SO₂ Concentrations</u>						
3-Hour*	424	360	0.45	243	12	1985
24-Hour*	66.0	242	2.05	241	24	1982
Annual	8.1	240	3.5	--	--	1984
<u>PM (TSP) Concentrations</u>						
24-Hour*	8.0	242	1.95	123	24	1982
Annual	0.9	240	3.5	--	--	1982
<u>NO₂ Concentrations</u>						
Annual	4.6	240	3.5	--	--	1982

* Highest, second-highest concentrations predicted for this averaging period.

7.3 AAQS ANALYSIS

A summary of the maximum 3-hour, 24-hour, and annual average total SO₂ concentrations predicted in the screening analysis is presented in Table 7-6. Summaries of the maximum 24-hour and annual total PM and annual NO₂ concentrations are given in Tables 7-7 and 7-8, respectively. The total concentrations are determined from the impacts of the modeled sources added to the background concentration determined from monitoring data. These results show that the maximum SO₂, PM, and NO₂ concentrations due to all sources are below the AAQS for all averaging periods.

Similar to the PSD Class II increment analysis, the refined analysis was based on modeling the meteorological periods during which the overall highest, second-highest and associated highest 3- and 24-hour concentrations were predicted in the screening analysis. A summary of the maximum SO₂ and PM concentrations predicted in the refined analysis is presented in Table 7-9.

The maximum 3-hour average SO₂ concentration due to all sources from the refined analysis is predicted to be 691 ug/m³, which is 53% of the AAQS of 1300 ug/m³, not to be exceeded more than once per year. The proposed facility contributed 61% to this maximum 3-hour average concentration.

The maximum 24-hour average SO₂ concentration due to all sources is predicted to be 169 ug/m³, which is 65% of the AAQS of 260 ug/m³, not to be exceeded more than once per year. The proposed facility contributed 29% to this maximum 24-hour average concentration.

The maximum annual average SO₂ concentration due to all sources is predicted to be 30.3 ug/m³, which is 51% of the AAQS of 60 ug/m³. The proposed facility contributed 20% to the maximum concentration.

The maximum 24-hour PM concentration due to all sources is predicted to be 112 ug/m³, which is 75% of the AAQS of 150 ug/m³. The proposed facility did not contribute to this maximum concentration.

Table 7-6. Maximum Predicted Total SO₂ Concentrations in the Screening Analysis for Comparison to AAQS

Averaging Period	Concentration (ug/m ³)		Receptor Location		Period			
	Total	Total Due To		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
		Modeled Sources	Background					
3-hour *	607	340 ⁺	267	110	1.75	214	12	1982
	634	367 ⁺⁺	267	30	2.75	151	9	1983
	589	322 ⁺	267	110	1.25	226	12	1984
	691	424 ^{**}	267	360	0.45	243	12	1985
	579	312 ^{**}	267	10	6.00	230	9	1986
24-hour *	163	112 ^{**}	51	120	1.75	234	24	1982
	152	101 ^{**}	51	190	2.75	299	24	1983
	149	97.9 ^{**}	51	120	2.75	96	24	1984
	152	101 ^{**}	51	90	2.25	153	24	1985
	146	94.9 ^{**}	51	110	2.25	106	24	1986
Annual	27.4	16.4 ^{**}	11	240	3.50	-	-	1982
	28.5	17.5 ^{**}	11	270	4.50	-	-	1983
	29.4	18.4 ^{**}	11	50	6.00	-	-	1984
	29.2	18.2 ^{**}	11	70	2.75	-	-	1985
	29.5	18.5 ^{**}	11	80	1.75	-	-	1986

* Highest, second-highest concentrations predicted for this averaging period.

+ Based on Operating Case 3.

** Based on Operating Case 4.

++ Based on Operating Cases 3 and 4.

Table 7-7. Maximum Predicted Total PM Concentrations in the Screening Analysis for Comparison to AAQS

Averaging Period	Concentration (ug/m ³)			Receptor Location		Period		
	Total	Total Due To		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
		Modeled Sources	Background					
24-hour*	101	9.7	91	20	6.00	38	24	1982
	104	12.5	91	20	6.00	297	24	1983
	100	10.3	91	30	6.00	317	24	1984
	104	12.9	91	30	6.00	350	24	1985
	101	9.8	91	360	6.00	303	24	1986
Annual	46.4	1.4	45	240	2.75	-	-	1982
	46.3	1.3	45	300	6.00	-	-	1983
	46.4	1.4	45	240	3.50	-	-	1984
	46.4	1.4	45	80	2.25	-	-	1985
	46.4	1.4	45	90	1.75	-	-	1986

* Highest, second-highest concentrations predicted for this averaging period.

Table 7-8. Maximum Predicted Total NO₂ Concentrations in the Screening Analysis for Comparison to AAQS

Averaging Period	Concentration (ug/m ³)			Receptor Location		Period		
	Total	Total Due To		Direction (°)	Distance (km)	Julian Day	Hour Ending	Year
		Modeled Sources	Background					
Annual	50.7	5.7	45	240	3.50	-	-	1982
	49.7	4.7	45	240	3.50	-	-	1983
	50.8	5.8	45	240	4.50	-	-	1984
	50.5	5.5	45	240	4.50	-	-	1985
	50.8	5.8	45	90	1.75	-	-	1986

Table 7-9. Maximum Predicted SO₂, PM and NO₂ Concentrations in the Refined Analysis for Comparison to AAQS.

Average Period	Concentration (ug/m ³)			Receptor Location		Period		
	Total due to			Direction (o)	Distance (km)	Julian Day	Hour Ending	Year
	Total	Modeled Sources	Background					
<u>SO₂ Concentrations</u>								
3-Hour*	691	424	267	360	0.45	243	12	1985
24-Hour*	169	118	51	116	2.15	234	24	1982
Annual	30.3	19.3	11	80	1.75	---	---	1986
<u>PM (TSP) Concentrations</u>								
24-Hour*	112	21.2	91	28	6.2	13	24	1985
Annual	48.6	3.6	45	240	3.5	---	---	1984
<u>NO₂ Concentration</u>								
Annual	50.9	5.9	45	90	1.75	---	---	1986

* Highest, second-highest concentrations predicted for this averaging period.

The maximum annual average concentration due to all sources is predicted to be 48.6 ug/m^3 , which is 97% of the AAQS of 50 ug/m^3 . The proposed facility contributed less than 2% to the maximum concentration.

The maximum annual average NO_2 concentrations of 50.9 ug/m^3 due to all sources is below the AAQS of 100 ug/m^3 . The proposed facility contributed approximately 8% to the maximum concentration.

7.4 NONATTAINMENT ANALYSIS

As discussed in Section 3.4.2, the proposed facility is located approximately 40 km from that portion of Hillsborough County designated as nonattainment for TSP concentrations. Because the proposed facility is located within the area of influence of a nonattainment area (i.e., 50 km), nonattainment review requirements may apply to the facility except if the proposed facility's impacts are less than the significant impact levels. As presented in Table 3-1, the 24-hour and annual average significant impact levels for TSP concentrations are 5 and 1 ug/m^3 , respectively. Based on the modeling performed for the proposed facility, the furthest distances from the site at which the proposed facility's impacts are less than the significant impact levels for any direction are as follows:

Year	<u>Distance (km) of Significant Impact</u>	
	24-hour	Annual
1982	7.5-10	Not significant
1983	7.5-10	Not significant
1984	7.5-10	Not significant
1985	7.5-10	Not significant
1986	7.5-10	Not significant

From this analysis, the proposed plant's impact is significant out to approximately 10 km from the site, based on the 24-hour average concentration. The proposed plant's impacts are not significant on an annual average basis. Because the proposed plant's predicted impacts are

not significant at the TSP nonattainment area (i.e., 40 km), nonattainment review for TSP emissions is not required for this project.

8.0 IMPACTS ON AIR QUALITY RELATED VALUES, VEGETATION, AND SOILS

8.1 IMPACTS ON VEGETATION

The response of vegetation to atmospheric pollutants is influenced by the concentration of the pollutant, duration of the exposure and the 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 they will be from the short-term higher doses. A dose is the product of the concentration of the pollutant and the duration of the exposure. The impact of the Hardee Power Station on regional vegetation was assessed by comparing pollutant doses that are predicted from modeling with threshold doses reported from the scientific literature which could adversely affect plant species typical of those present in the region.

SULFUR DIOXIDE

The maximum total 3-hour average SO_2 concentration predicted in the Hardee Power Station region is 691 ug/m^3 . This concentration is predicted to occur about 0.5 km (0.24 mile) north of the stacks and represents the concentration that would occur during the worst-case meteorological conditions of the past five years (see Section 7.0). The maximum 3-hour average ground-level concentration predicted for the other four years ranged from 579 to 634 ug/m^3 . These concentrations would occur between 1 (0.6 mile) and 6 km (3.7 miles) from the stacks with directions ranging from north to east-southeast. Concentrations decrease with distance beyond the location of the maximum concentration.

The maximum total predicted 24-hour average SO_2 concentration is 169 ug/m^3 and is located approximately 2 km (1.24 miles) east-southeast of the stacks. The maximum total predicated annual SO_2 concentration is 30.3 ug/m^3 . This

concentration is predicted to occur 1.75 km (1.1 miles) to the east of the stacks.

These concentrations and averaging times can be compared with SO₂ doses known to adversely affect plant species that are presented in Table 8-1. The expected doses from operation of the Hardee Power Station combined with background sources are much lower than doses known to cause a detrimental effect on vegetation.

NITROGEN OXIDES

The maximum predicted 3-hour, 24-hour and annual average NO₂ concentrations due to the Hardee Power Station are predicted to be 297, 42 and 4.6 ug/m³, respectively. The maximum total predicted annual average concentrations due to all sources is 50.9 ug/m³ which includes a background concentration of 45 ug/m³ derived from monitoring data in Bartow. The NO₂ doses known to adversely affect some plant species that have been tested are shown in Table 8-1. The predicted doses of NO₂ due to the proposed facility are far lower than the doses reported to injure vegetation; therefore, the proposed facility's NO₂ emissions are not expected to have an adverse affect on vegetation.

TOTAL SUSPENDED PARTICULATES

The maximum total 24-hour and annual average concentrations are predicted to be 112 and 48.6 ug/m³, respectively. These concentrations are predicted to occur between 1.75 to 6 km from the stacks. High deposition of particulates on plant leaves can reduce photosynthesis through shading and impede diffusion of gases. However, at least 5 g/m² 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 Hardee Power Station.

Table 8-1. SO₂ and NO₂ Doses Reported to Affect Plant Species Similar to Vegetation in the Region of the Hardee Power Plant

<u>Pollutant</u>	<u>Species</u>	<u>Dose and Effect</u>	<u>Reference</u>
SO ₂	Strawberry	1,040 ug/m ³ for 6 hours per day for 3 days had no affect on growth	Rajput, <u>et al.</u> , 1977
SO ₂	Citrus	2,080 ug/m ³ for 23 days with 10 day interruption reduced leaf area	Matsushima and Brewer 1972
SO ₂	Ryegrass	42 ug/m ³ for 26 weeks or 367 ug/m ³ for 131 days reduced dry weight	Bell, <u>et al.</u> , 1979 Ayazaloo and Bell, 1981
SO ₂	Tomato	1,258 ug/m ³ for 5 hours per day, for 57 days, reduced growth	Kohut, <u>et al.</u> , 1983
SO ₂	Duckweed	390 ug/m ³ for 6 weeks reduced growth	Fankhauser, <u>et al.</u> , 1976
SO ₂	Lichens (<u>Parmotrema</u> and <u>Ramalina</u> spp.)	400 ug/m ³ 6 hours per week for 10 weeks reduced CO ₂ uptake and biomass gain of <u>Ramalina</u> , not <u>Parmotrema</u>	Hart, <u>et al.</u> , 1988
SO ₂	Bald Cypress	1,300 and 2,600 ug/m ³ for 48 hours. Only 2600 ug/m ³ reduced leaf area.	Shanklin and Kozlowski, 1985
SO ₂	Green Ash	210 ug/m ³ for 4 hours per day, 5 days per week for 6 weeks reduced growth	Chappelka, <u>et al.</u> , 1988
NO ₂	Ryegrass	39.5 ug/m ³ for 6 minutes had no affect on shoot weight	Lane and Bell, 1984
NO ₂	Citrus	470 ug/m ³ for 290 days injured trees	Thompson, <u>et al.</u> , 1970
NO ₂	Sphagnum	11.7 ug/m ³ averaged over 18 months compared with control of 4.8 ug/m ³ (exceeded 15 ug/m ³ 4 times) reduced growth	Press, <u>et al.</u> , 1986

CARBON MONOXIDE

The maximum predicted 1-hour and 8-hour average CO concentrations due to the facility are 179 and 38.0 ug/m³, respectively. 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. No adverse impacts to vegetation are expected from CO emissions from the Hardee Power Station.

BERYLLIUM

The maximum 24-hour average Be concentration due to the proposed facility is predicted to be 0.0004 ug/m³. Levels of Be greater than 2 ug/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.

MERCURY

The maximum 24-hour average Hg concentration due to the proposed facility is predicted to be 0.0016 ug/m³. Siegel, et al., (1984) reported that 7 days of exposure to 50 ug/m³ 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 Plant. Therefore, the predicted Hg concentrations due to the proposed facility are not expected to adversely affect vegetation.

8.2 IMPACTS TO SOILS

Soils in the site region have been disrupted 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 formed in unconsolidated loamy textured sediment influenced by calcareous material (Robbins, et al., 1984). They are coarse-loamy siliceous, hyperthermic Typic Ochraqualfs.

SO₂ and NO₂ 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 affect 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 SO₂ and NO₂ from stack emissions are not expected to have a significant adverse affect on soils in the vicinity because (1) the predicted concentrations of both gases are low, (2) Payne Creek floodplain and other wetland soils contain organic matter and/or calcium carbonate nodules that buffer changes in acidity, and (3) ground limestone will be applied to lands being reclaimed for pasture and citrus. Therefore, the facility is not expected to have a significant adverse impact on regional vegetation or soils.

8.3 IMPACTS DUE TO ADDITIONAL GROWTH

A limited number of additional personnel will be added to the work force due to the proposed facility. These additional personnel are expected to have an insignificant effect on the residential, commercial, and industrial growth of Hardee and Polk counties.

Fuel oil will be delivered by truck every week to the facility. Based on a truck capacity of 9,200 gallons, approximately 129 trucks per week trucks or 18 trucks per day will deliver oil to the site. These additional trucks are not expected to adversely affect existing traffic patterns or air quality in the vicinity of the plant.

Therefore, no air quality related impacts associated with residential, commercial and industrial growth are anticipated.

PSD REFERENCES

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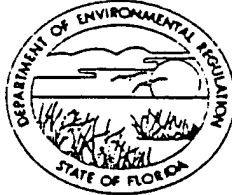
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11.1.5 APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

*This application has been prepared for information purposes
only as required by FDER Form 17-1.211(1).
Refer to Applicant Information in the SCA.*

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION



This application is being completed for information purposes as required by Section 3.4.1 of DERFORM 17-1.211 (1); Power Plant Site Certification Application (SCA).

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Combustion Turbine ☒ New¹ ☐ Existing¹

APPLICATION TYPE: ☐ Construction ☐ Operation ☐ Modification

COMPANY NAME: Refer to Applicant Information in the SCA COUNTY: Hardee

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) By-Pass and HRSG Stack

SOURCE LOCATION: Street _____ City _____

UTM: East 404.8 km North 3057.4 km

Latitude _____° _____' _____"N Longitude _____° _____' _____"W

APPLICANT NAME AND TITLE: Refer to Applicant Information in the SCA

APPLICANT ADDRESS: Refer to Applicant Information in the SCA

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT N/A

I am the undersigned owner or authorized representative* of _____

I certify that the statements made in this application for a permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: _____

Name and Title (Please Type)

Date: _____ Telephone No. _____

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

N/A

This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

¹ See Florida Administrative Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed _____

Name (Please Type)

Company Name (Please Type)

Mailing Address (Please Type)

Florida Registration No. _____ Date: _____ Telephone No. _____

SECTION II: GENERAL PROJECT INFORMATION

- A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Refer to Section 2.0 of the PSD Application

- B. Schedule of project covered in this application (Construction Permit Application Only)

Refer to Chapter 1 of the SCA.

Start of Construction _____ Completion of Construction _____

- C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Refer to Section 4.0 of the PSD Application: Table 4-4

- D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

No previous permits have been issued.

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52; if power plant, hrs/yr 8760; if seasonal, describe: _____

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? No
 - a. If yes, has "offset" been applied? N/A
 - b. If yes, has "Lowest Achievable Emission Rate" been applied? N/A
 - c. If yes, list non-attainment pollutants. N/A
 2. Does best available control technology (BACT) apply to this source? Yes
If yes, see Section VI.
 3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. Yes
 4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? Yes
 5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No
- H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No
- a. If yes, for what pollutants? N/A

- b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted. N/A

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

Refer to the following sections in the PSD Application:

PSD Applicability - Subsection 3.4.1
Non-Attainment Applicability - Subsection 3.4.2
BACT Applicability - Section 4.1
NSPS Applicability - Section 4.2

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Not Applicable

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		

B. Process Rate, if applicable: (See Section V, Item 1) Not Applicable

1. Total Process Input Rate (lbs/hr): _____

2. Product Weight (lbs/hr): _____

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Refer to Tables 2-2 through 2-4 of the PSD Application

Name of Contaminant	Emission ¹		Allowed ² Emission Rate per Rule 17-2	Allowable ³ Emission lbs/hr	Potential ⁴ Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/yr hr	T/yr	
TSP/PM10	57	250	--	--	57	250	Refer To
SO ₂	734	3,217	0.5% sulfur fuel	1174	734	3,217	Figure 2-1 in PSD
NO _x	384	1,681	65 ppm corrected	> 440	384	1,681	Applica- tion
CO	128	562	--		128	562	
VOC	21	90	--		21	90	

¹See Section V, Item 2. Above information is maximum emissions for each CT.

²Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

³Calculated from operating rate and applicable standard.

⁴Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Refer to Section 4.0 in the PSD Application				

E. Fuels Refer to Table 3-3 in SCA and Table 2-1 in PSD Application

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Natural Gas	--	1251.4 MCF/hr	
No. 2 Fuel Oil	--	73,437 lb/hr	1312.3

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis: Refer to Tables 2-5 and 2-6 in the PSD Application

Percent Sulfur: _____ Percent Ash: _____

Density: _____ lbs/gal Typical Percent Nitrogen: _____

Heat Capacity: _____ BTU/lb _____ BTU/gal

Other Fuel Contaminants (which may cause air pollution): _____

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average _____ Maximum _____

G. Indicate liquid or solid wastes generated and method of disposal.

Refer to Section 3.6 in the SCA

Refer to Table 2-7 in the PSD Application

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: _____ ft. Stack Diameter: _____ ft.

Gas Flow Rate: _____ ACFM _____ DSCFM Gas Exit Temperature: _____ °F.

Water Vapor Content: _____ % Velocity: _____ FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____

Manufacturer _____

Date Constructed _____ Model No. _____

	Volume (ft) ³	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diameter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices: ☐ Cyclone ☐ Wet Scrubber ☐ Afterburner

☐ Other (specify) _____

Brief description of operating characteristics of control devices: _____

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
See Table 2-1 in the PSD Application
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made. Refer to Tables 2-2 through 2-4 in the PSD Application
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
Refer to Tables 2-2 through 2-4 in the PSD Application
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.) Refer to Section 4.0 in the PSD Application
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency). Refer to Section 4.0 in the PSD Application
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained. See Figure 2-1 in the PSD Application
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).
See Figures 3.2-1 and 3.2-2 in the SCA
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
See Figures 3.2-1 and 3.2-2 in the SCA

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
Not Applicable
10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

- A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

☒ Yes ☐ No 40 CFR Part 60 Subpart GG

Contaminant

Rate or Concentration

See Table 4-1 in PSD Application

- B. Has EPA declared the best available control technology for this class of sources (if yes, attach copy)

☒ Yes ☐ No

Contaminant

Rate or Concentration

Refer to Section 4.3 in the PSD Application

- C. What emission levels do you propose as best available control technology?

Contaminant

Rate or Concentration

Refer to Tables 2-2 and 2-5 in the PSD Application

- D. Describe the existing control and treatment technology (if any). Not Applicable

1. Control Device/System:

2. Operating Principles:

3. Efficiency:*

4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant

Rate or Concentration

10. Stack Parameters

a. Height:

ft.

b. Diameter:

ft.

c. Flow Rate:

ACFM

d. Temperature:

°F.

e. Velocity:

FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary). Refer to Section 4.3 in the PSD Application

1.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected: Refer to Section 4.3 in the PSD Application

1. Control Device:

2. Efficiency:¹

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:²

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:¹

Contaminant

Rate or Concentration

_____	_____
_____	_____
_____	_____

(8) Process Rate:¹

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:¹

Contaminant

Rate or Concentration

_____	_____
_____	_____
_____	_____

(8) Process Rate:¹

10. Reason for selection and description of systems:

¹Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data Refer to Section 5.0 in the PSD Application

1. _____ no. sites _____ TSP _____ () SO₂* _____ Wind spd/dir

Period of Monitoring _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

- a. Was instrumentation EPA referenced or its equivalent? ☐ Yes ☐ No
- b. Was instrumentation calibrated in accordance with Department procedures?
☐ Yes ☐ No ☐ Unknown

B. Meteorological Data Used for Air Quality Modeling Refer to Section 6.3 in the PSD

1. _____ Year(s) of data from _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

2. Surface data obtained from (location) _____

3. Upper air (mixing height) data obtained from (location) _____

4. Stability wind rose (STAR) data obtained from (location) _____

C. Computer Models Used

1. _____ Modified? If yes, attach description.
2. _____ Modified? If yes, attach description.
3. _____ Modified? If yes, attach description.
4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data Refer to Table 2-1 in PSD Application

Pollutant	Emission Rate
ISP	_____ grams/sec
SO ₂	_____ grams/sec

E. Emission Data Used in Modeling Refer to Table 2-7 in the PSD Application

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review. Refer to PSD Application

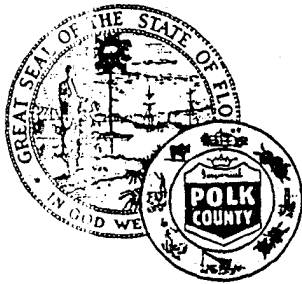
G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources. Refer to Section 4.0 of the

PSD Application

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology. Refer to Section 4.0 of the PSD

Application

11.2 ZONING CONSISTENCY



REC'D
JAN 27 1989
FILE COPY

IMPERIAL P O L K C O U N T Y

DEPARTMENT OF DEVELOPMENT COORDINATION

ZONING DIVISION

January 24, 1989

GERALD C. MARTIN
Zoning Administrator

MERLE H. BISHOP
Director

Mr. Mike Opalinski
Environmental Affairs
Seminole Electric Cooperative, Incorporated
P. O. Box 272000
Tampa, Florida 33688-2000

RE: Combined Cycle Power Plant - Consistency and Compliance with
applicable Comprehensive Plan and Zoning Ordinance

Dear Mr. Opalinski:

As per your request, the Planning Division and I have reviewed the proposal of Seminole Electric Cooperative, Inc. to construct a combined cycle power plant on a site located in Hardee County. It is our understanding that some directly associated plant facilities will be located in Polk County. These directly associated facilities include: (1) a portion of a 570 acre cooling reservoir (2) a 230 KV transmission line to the Pebbledale Substation located 4 miles southwest of Mulberry and (3) a natural gas pipeline connecting the plant to Florida Gas Transmission's main gas line northeast of Lake Hancock.

These facilities are defined in the Polk County Zoning Ordinance (Ord. No. 83-2, as amended) as essential services. Specifically, transmission lines and gas pipelines are Class I essential services; and the power plant's cooling reservoir is a Class II essential service. Class I essential services are permitted in all zoning districts. The site of the proposed cooling reservoir in Polk County is zoned Rural Conservation (RC) which permits Class II essential services. Therefore, these proposed facilities are in compliance with the Polk County Zoning Ordinance. Also, attached is a memorandum from the Planning Division of Polk County which indicates consistency with the current Comprehensive Plan.

I trust this information will assist you.

Sincerely,

Gerald C. Martin
Gerald C. Martin
Zoning Administrator

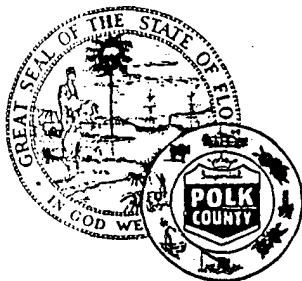
Mr. Mike Opalinski
Combined Cycle Power Plant
January 24, 1989
page 2

GCM/mlh

cc: Robert D. Anders, Planning Director
Ron Borchers, Chief of Current Planning

enc.

RECEIVED



BOARD OF COUNTY COMMISSIONERS

JAN 20 1989

IMPERIAL

POLK COUNTY
ZONING DEPARTMENT

P O L K C O U N T Y

DEPARTMENT OF DEVELOPMENT COORDINATION

PLANNING DIVISION

Robert D. Anders, AICP
Planning Director

MERLE H. BISHOP
Director

January 20, 1989

MEMORANDUM

TO: Gerald Martin, Zoning Administrator

VIA: *RA* Robert D. Anders, Planning Director

FROM: *RS* Ron Borchers, Chief of Current Planning

SUBJECT: Seminole Electric Cooperative, Inc. Proposed Power Plant
and Associated Facilities

Seminole Electric Cooperative, Inc. is proposing a power plant location in Hardee County. The following associated facilities will be located in Polk County: a portion of a 570 acre cooling reservoir, a 230 KV transmission line to the Pebbledale Substation located four (4) miles southwest of Mulberry and a natural gas pipeline connecting the plant to Florida Gas Transmission's main gas line northeast of Lake Hancock. These facilities, considered as essential services, would be in compliance with the Polk County Comprehensive Plan as adopted by the Board of County Commissioners on June 26, 1979.

RB:el

11.3 FLORIDA DIVISION OF HISTORIC RESOURCES OPINION



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building
Tallahassee, Florida 32399-0250
(904) 488-1480

April 4, 1989

Dr. J. Raymond Williams
Department of Anthropology
University of South Florida
Tampa, Florida 33620-8177

In Reply Refer To:
Laura A. Kammerer
Historic Sites Specialist
(904) 487-2333
Project File No. 890750

RE: Cultural Resource Assessment Request
Seminole Electric Cooperative, Inc.
Preliminary Transmission Line Corridors
Polk, Hardee, DeSoto, Charlotte and Lee Counties, Florida

Dear Dr. Williams:

We have compared the plotting of the proposed transmission line corridors provided by Seminole Electric with Mark Hurd aerial photographs in the Florida Master Site File. It is the opinion of this agency that the majority of the proposed corridor siting study areas have a low likelihood to contain significant archaeological or historical sites. We have plotted in red hatching on the USGS quadrangle maps, those portions of the study corridors that appear to be archaeologically sensitive. However, we cannot identify all potential locations using this method because some potential site locales are simply not visible on the USGS quadrangle maps or the Mark Hurd aeriels.

Since potentially significant archaeological and historic sites may be present, it is our recommendation that, once the final corridor selection has been made, those areas of the corridor hatched in red on the maps be subjected to a professional archaeological and historical survey prior to any project related land clearing or ground disturbing activities within the project area. The purpose of this survey will be to locate and assess the significance of cultural resources present. The resultant survey report must be forwarded to this agency in order to complete the process of reviewing the impact of this project on archaeological and historic resources.

Please note that it is ultimately the survey archaeologist who is responsible for locating and assessing the cultural resources within these areas, regardless of this agency's recommendations. However, this agency is willing to work with the survey archaeologist in determining appropriate field methodology.

Dr. J. Raymond Williams
April 4, 1989
Page 2

Finally, if sites determined to be potentially eligible for listing in the National Register of Historic Places are encountered within the corridor siting by the archaeologist, it will be the recommendation of this office that those sites be avoided during the construction of the transmission line, and subsequently during all line maintenance activities to insure preservation. If avoidance is not feasible, it will be our recommendation that project impacts be mitigated through archaeological salvage excavation, conducted by a professional archaeologist. The resulting mitigative salvage excavation report should be submitted to this agency in order to complete the process of reviewing the impact of this of this project on archaeological and historical resources.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,

GWP/lak
xc: Joseph M. Norton

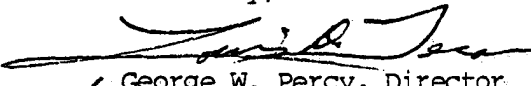

for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building

500 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

Telecopier Number (FAX)

(904) 488-1480

(904) 488-3353

April 14, 1989

Dr. J. Raymond Williams
Department of Anthropology
University of South Florida
Tampa, Florida 33620-8177

In Reply Refer To:
Laura A. Kammerer
Historic Sites Specialist
(904) 487-2333
Project File No. 890751

RE: Cultural Resource Assessment Request
Seminole Electric Cooperative, Inc.
Gas Pipeline Corridor
Polk County, Florida

Dear Dr. Williams:

We have compared the plotting of the proposed gasline corridor provided by Seminole Electric, with USGS quadrangle maps in the Florida Master Site File. It is the opinion of this agency that the majority of the proposed corridor siting study areas have a low likelihood to contain significant archaeological or historical sites. We have plotted in red hatching on USGS quadrangle maps, those portions of the study corridor that appear to be archaeologically sensitive. However, we cannot identify all potential locations using this method because some potential site locales are simply not visible on the USGS quadrangle maps.

Since potentially significant archaeological and historic sites may be present, it is our recommendation that those areas of the corridor hatched in red on the maps be subjected to a professional archaeological and historical survey prior to any project related land clearing or ground disturbing activities within the project area. The purpose of this survey will be to locate and assess the significance of cultural resources present. The resultant survey report must be forwarded to this agency in order to complete the process of reviewing the impact of this project on archaeological and historic resources.

Please note that it is ultimately the survey archaeologist who is responsible for locating and assessing the cultural resources within these areas, regardless of this agency's recommendations. However, this agency is willing to work with the survey archaeologist in determining appropriate field methodology.

Finally, if sites determined to be potentially eligible for listing in the National Register of Historic Places are encountered within the corridor siting by the archaeologist, it will be the recommendation of this office that those sites be avoided during the construction of the transmission line, and subsequently during all line maintenance activities to insure preservation. If avoidance is not feasible, it will be our recommendation that project impacts be

Archaeological Research
(904) 487-2299

Florida Folklife Programs
(904) 397-2192

Historic Preservation
(904) 487-2333

Museum of Florida History
(904) 488-1484

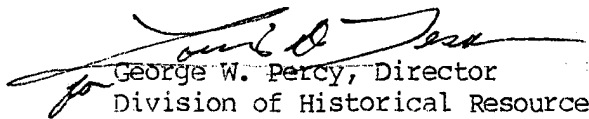
Dr. J. Raymond Williams
April 14, 1989
Page 2

mitigated through archaeological salvage excavation, conducted by a professional archaeologist. The resulting mitigative salvage excavation report should be submitted to this agency in order to complete the process of reviewing the impact of this of this project on archaeological and historical resources.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,

GWP/lak
xc: Joseph M. Norton



George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer



FLORIDA DEPARTMENT OF STATE

Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES

R.A. Gray Building
500 South Bronough

Tallahassee, Florida 32399-0250

Director's Office

Telecopier Number (FAX)

(904) 488-1480

(904) 488-3353

June 22, 1989

Mr. Roy Zwolak
Hunter Services, Inc.
1715 N. Westshore Blvd., Suite 500
Tampa, Florida 33607-3999

In Reply Refer To:
Laura A. Kammerer
Historic Sites Specialist
(904) 487-2333
Project File No. 891460

RE: Cultural Resource Assessment Request
Liquid Fuel Pipeline Corridor
Hardee, Hillsborough, Manatee and Polk Counties

Dear Roy Zwolak:

We have compared the plotting of the proposed liquid fuel line corridor provided by Hunter Services, Inc. with USGS quadrangle maps in the Florida Master Site File. It is the opinion of this agency that the majority of the proposed corridor siting study areas have a low likelihood to contain significant archaeological or historical sites. We have plotted in black hatching on your aerial maps, those portions of the study corridor that appear to be archaeologically sensitive. However, we cannot identify all potential locations using this method because some potential site locales are simply not visible on the aerials or the USGS quadrangle maps. However, because of environmental change, the unpredictability of special use sites such as burial mounds, cemeteries, quarries and other site types, it is possible that sites may be found in unidentified locales which are not indicated in the black hatched areas, but which the survey archaeologist may investigate at his or her own discretion. This agency is willing to work with the survey archaeologist in determining appropriate field methodology.

Since potentially significant archaeological and historic sites may be present, it is our recommendation that those areas of the corridor hatched in black on the maps be subjected to a professional archaeological and historical survey prior to any project related land clearing or ground disturbing activities within the project area. The purpose of this survey will be to locate and assess the significance of cultural resources present. The resultant survey report must be forwarded to this agency in order to complete the process of reviewing the impact of this project on archaeological and historic resources.

Finally, if sites determined to be potentially eligible for listing in the National Register of Historic Places are encountered within the corridor siting by the archaeologist, it will be the recommendation of this office that those sites be avoided during the construction of the liquid fuel line, and subsequently during all line maintenance activities to insure preservation. If avoidance is not feasible, it will be our recommendation that project impacts be

Mr. Roy Zwolak
June 22, 1989
Page 2

mitigated through archaeological salvage excavation, conducted by a professional archaeologist. The resulting mitigative salvage excavation report should be submitted to this agency in order to complete the process of reviewing the impact of this of this project on archaeological and historical resources.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,

GWP/lak



for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

11.4 SUPPORTING GEOHYDROLOGICAL INFORMATION

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES N 1200 E 750			ELEVATION (DATUM) 122.3		TOTAL DEPTH 100.3		DATE START 11/4/88			
SURFACE CONDITIONS Level, grass							INSPECTOR P. L. Nelson			DATE FINISH 11/7/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	1	1	1	2	3	1.3	1			SAND; dark grey grading to light grey; loose; poorly graded; fine grained; rounded; moist; trace of silt	Boring advanced by continuous driving of SPT to 6.5'.			
SPT	2	3	4	9	13	1.5	2			Grading to brown				
SPT	3	8	10	10	20	1.5	3			Clayey SAND; greenish-white; medium dense; well graded; fine grained; rounded; moist				
TW	4					2.0	4							
SPT	5	8	10	12	22	1.5	5			Grading coarser sand	At 6.5' boring advanced by rotary wash w/3 7/8" wing bit and bentonite as drilling fluid. Water encountered at 7.5'. Pushed w/750 psi.			
TW	6					2.0	6			SAND; white; medium dense; poorly graded; fine grained; rounded; moist; trace of clay				
SPT	7	1	1	2	3	1.1	7							
TW	8					1.7	8							
							9				Lost circulation at 21'-25' Switched to 2 7/8" roller bit at 25'. Tube sunk first foot by rod weight. Harder at 26.5'. Pushed 4" casing to 29'.			
							10							
							11							
							12							
							13				6" cemented zone (bent tube at 27')			
							14							
							15							
							16							
							17							
							18							
							19							
							20							
							21							
							22							
							23							
							24							
							25							
							26							
							27							
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							29							
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							31							
							32							

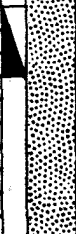
CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES N 1200 E 750			ELEVATION (DATUM) 122.3		TOTAL DEPTH 100.3		DATE START 11/4/88			
SURFACE CONDITIONS Level, grass							INSPECTOR P. L. Nelson			DATE FINISH 11/7/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	6	7	50 5.5"	57+	1.4	1			Clayey SAND; light grey w/mottled tan; medium dense; poorly graded; fine grained; rounded; wet	Chattering 31'-32.5'			
SPT	10	6	11	13	24	1.5	35			Grading finer sand				
SPT	11	8	11	16	27	1.5	40				Stopped at 40' on 11/4/88			
							1				Water observed at 2.3' on 11/7/88 a.m.			
SPT	12	10	50 4"		50+	0.8	45			Silty SAND; light grey w/black specs; medium dense; poorly graded; fine grained; rounded; moderate cementation; wet	Hard drilling 45.5'-47.5'			
SPT	13	14	13	12	25	1.5	50			Grading no cementation				
SPT	14	11	10	10	20	1.5	55							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES N 1200 E 750			ELEVATION (DATUM) 122.3		TOTAL DEPTH 100.3		DATE START 11/4/88			
SURFACE CONDITIONS Level, grass							INSPECTOR P. L. Nelson			DATE FINISH 11/7/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	4	5	10	15	1.5	1							
							2							
							3							
							4							
							5							
							6							
SPT	16	50			50+	0.2	65							
		5"					6							
							7							
							8							
							9							
							10							
SPT	17	4	5	48	53	1.5	70							
							1							
							2							
							3							
							4							
							5							
SPT	18	15	15	37	52	0.8	75							
							6							
							7							
							8							
							9							
							10							
SPT	19	9	11	32	43	1.5	80							
							1							
							2							
							3							
							4							
							5							
SPT	20	35	50		50+	0.3	85							
			4.5"				6							
							7							
							8							
							9							
							10							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES N 1200 E 750			ELEVATION (DATUM) 122.3		TOTAL DEPTH 100.3		DATE START 11/4/88	
SURFACE CONDITIONS Level, grass							INSPECTOR P. L. Nelson			DATE FINISH 11/7/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE	CLASSIFICATION OF MATERIAL		REMARKS	
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD		GRAPHICS LOG				
SPT	21	50 4"			50+	0.3	1		Chert nodule in sample			
							2					
							3					
							4					
							95					
SPT	22	19	50 3"		50+	0.7	6				Drilling easier 96-97.5'.	
							7					
							8					
							9					
							100					
SPT	23	50 4"			50+	0	1				Bottom of boring at 100.3'.	
							2					
							3					
							4					
							105				Backfilled w/cement grout.	
							6					
							7					
							8					
							9					
							110					
							1					
							2					
							3					
							4					
							115					
							6					
							7					
							8					
							9					
							120					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 535 W 185			ELEVATION (DATUM) 114.2		TOTAL DEPTH 101.5		DATE START 11/2/88	
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/2/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE	CLASSIFICATION OF MATERIAL		REMARKS	
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD		GRAPHICS LOG				
SPT	1	1	0	2	3	1.4	1		Silty <u>SAND</u> ; dark grey grading light grey; very loose; poorly graded; fine grained; rounded; dry; trace of organics		Boring advanced to 6.5' by continuous driving and cleaning out of split spoon.	
SPT	2	4	6	4	10	1.5	2		Grading brown, no organics		At 6.5' switched to rotary wash w/3 7/8" roller bit, using bentonite as drilling fluid.	
SPT	3	2	2	4	6	1.5	3		Clayey <u>SAND</u> ; tan; loose; poorly graded; fine grained; rounded; moist		Water encountered at 5'.	
SPT	4	3	3	6	9	1.0	4		Grading finer			
TW	5					1.25	5					
TW	6					2.0	15		Clayey <u>SAND</u> ; tan; dense; poorly graded; fine grained; rounded; moist			
SPT	7	20	50 3"		50+	0.7	6		Sandy <u>CLAY</u> ; light brown; hard; plastic; moist; moderate cementation; trace of coarse sand and gravel		Chattering 20.5'-24' in 3"-6" increments.	
							7				Drilling easier.	
SPT	8	16	8	9	17	0.7	8		Clayey <u>SAND</u> ; light brown; dense; well graded; medium to coarse grained; angular; moist; weak cementation; some gravel			
							9					
							30					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 535 W 185			ELEVATION (DATUM) 114.2		TOTAL DEPTH 101.5		DATE START 11/2/88			
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/2/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	9	17	23	40	1.5	1				Silty <u>SAND</u> ; brown mottled tan; dense; poorly graded; fine grained; moist; trace clay			
							2							
							3							
							4							
TW	10					0.75	35						Drilling easier at 33'.	
							6				Sandy <u>CLAY</u> ; grey mottled brown; high plasticity; moist; trace silt			
							7							
							8							
							9						Chattering, 39'-40'	
SPT	11	28	12	8	20	1.5	40							
							1				Clayey <u>SAND</u> ; grey mottled brown; medium dense; poorly graded; fine grained; moist; trace silt			
							2							
							3							
							4							
SPT	12	3	6	50	56	1.5	45						Switched to 2 7/8" roller bit at 45'	
							6				Clayey <u>SAND</u> ; dark grey; very dense; poorly graded; fine grained; moist; trace of silt			
							7							
							8							
							9							
SPT	13	50 2.5"			50+	0	50						Chattering 50'-52.5'	
							1							
							2							
							3							
							4							
SPT	14	37	18	21	39	1.5	55							
							6				Sandy <u>CLAY</u> ; light grey w/black specs; high plasticity; wet; trace of silt			
							7							
							8							
							9						Drilling easier 58.5'-59.7'.	
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 535 W 185			ELEVATION (DATUM) 114.2		TOTAL DEPTH 101.5		DATE START 11/2/88	
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/2/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	50 1"			50+	0	1		SAND; black; medium dense; poorly graded; rounded; fine grained; moist; trace of silt		Chattering 59.7'-62.0'	
						2						
						3						
						4						
						65						
SPT	16	7	8	16	24	1.5	6					
						7						
						8						
						9						
						70						
SPT	17	14	8	19	27	1.5	1				Chattering 72'-72.5'	
						2						
						3						
						4						
						75						
SPT	18	12	6	5	11	1.5	6		Intermittent 2"-4" sandy clay layers		Drilling hard 77.5'-83'	
						7						
						8						
						9						
						80						
SPT	19	10	18	16	34	1.5	1		Sandy CLAY; tan w/black specs; hard; high plasticity; wet; weak cementation; trace of silt		Drilling hard w/chattering 83'-93'	
						2						
						3						
						4						
						85						
SPT	20	50 1"			50+	0	6					
						7						
						8						
						9						
						90						

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 535 W 185			ELEVATION (DATUM) 114.2		TOTAL DEPTH 101.5		DATE START 11/2/88	
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/2/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL		REMARKS	
SPT	21	50 2"			50+	0	1				Intermittent hard drilling 93'-95'.	
						2						
						3						
						4						
SPT	22	50 0.2'			50+	0.2	95		Clayey SAND; light grey w/black specs; very dense; well graded; fine grained; round; moist; weak cementation		Drilling easier 95.5'-100'.	
						6						
						7						
						8						
SPT	23	14	18	37	55	1.5	100		Sandy SILT; light grey w/black specs; hard; plastic; moist; trace clay			
						1						
						2						
						3						
							4		Bottom of boring at 101.5'. Water level not recorded. Backfilled hole to surface with cement grout.			
						105						
						6						
						7						
						8						
						9						
						110						
						1						
						2						
						3						
						4						
						115						
						6						
						7						
						8						
						9						
						120						

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 900 E 1800			ELEVATION (DATUM) 121.7		TOTAL DEPTH 100.7		DATE START 10/31/88				
SURFACE CONDITIONS Flat, heavy surface vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/1/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	1	1	1	2	3	1.0	1			Silty SAND; grey; very loose; poorly graded; fine grained; dry; trace of topsoil; w/organics	Boring advanced to 5' by continuous driving and cleaning out of split spoon. Boring then advanced with 3 7/8" wing bit, using bentonite as drilling fluid.			
SPT	2	3	4	4	8	1.5	2			SAND; light grey; very loose; poorly graded; fine grained; dry				
SPT	3	17	21	31	52	1.5	3			Silty SAND; dark brown; loose to very dense; poorly graded; fine grained; dry; w/iron nodules				
SPT	4	7	10	15	25	1.4	4			SAND; light tan; very dense; poorly graded; very fine grained; dry; trace silt				
SPT	5	20	18	16	34	1.2	5			Clayey SAND; light grey; medium dense; poorly graded; fine grained; slight cementation; moist; w/iron staining				
							6			Grading coarser	At 10' attempted TW			
TW	6					2.0	6			Sandy CLAY; light gray; very stiff; high plasticity; moist				
							7							
							8							
							9							
TW	7					2.0	20			CLAY; light gray; stiff; plastic; moist; trace sand	At 20' 600 psi down pressure required to push TW			
							1							
							2							
							3							
							4							
SPT	8	3	4	5	9	1.5	25			Becoming varved w/sand stringers				
							6							
							7							
							8							
							9							
							30							

CLIENT Seminole Electric Cooperative Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 900 E 1800			ELEVATION (DATUM) 121.7		TOTAL DEPTH 100.7		DATE START 10/31/88			
SURFACE CONDITIONS Flat, heavy surface vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/1/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
TW	9					1.7	1		Encountered fragments of cemented material	Too stiff to push below 31.8'. Cemented layer determined from hard drilling. At 33' began drilling with a 2 7/8" tricone roller bit.				
							2							
							3							
							4		Cemented stringer					
SPT	10	21	9	11	20	1.0	35							
							6		SAND; light brown; dense; well graded; medium-fine grained; wet; w/phosphate nodules and some silt	Terminated drill on 10/31/88 at 36.5'				
							7							
							8							
							9							
SPT	11	10	41	50 3"	+91	1.3	40							
							1		Sandy CLAY; light grey mottled brown; hard; plastic; weak cementation; moist; w/phosphate nodules and trace of silt					
							2							
							3							
							4		At 44'-45.5' signs of cementation					
SPT	12	16	9	10	19	1.2	45							
							6		Clayey SAND; grey; medium dense; poorly graded; fine grained; rounded; moist					
							7							
							8							
							9							
SPT	13	50 0			+50	0	50							
							1							
							2							
							3							
							4							
SPT	14	5	4	6	10	1.5	55							
							6		Clayey SAND; grey to light grey; medium dense; poorly graded; fine grained; moist; w/clayey silt seams					
							7							
							8							
							9							
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 900 E 1800			ELEVATION (DATUM) 121.7		TOTAL DEPTH 100.7		DATE START 10/31/88			
SURFACE CONDITIONS Flat, heavy surface vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/1/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	5	6	6	12	1.0	1				Silty <u>SAND</u> ; grey to dark grey; medium dense; poorly graded; fine grained; wet			
							2							
							3							
							4							
							65							
TW	16					1.3	6				Sandy <u>CLAY</u> ; dark brown; stiff; high plasticity; moist; w/trace peat at 67'			
							7							
							8							
							9							
							70							
SPT	17	10	7	7	14	1.5	1				<u>SAND</u> ; light grey; medium dense; poorly graded; fine grained; wet; w/some clay			
							2				Grading grey at 70.5'			
							3							
							4							
							75							
SPT	18	10	32	15	47	1.4	6				Grading coarser			
							7				Cemented seam at 75.9'			
							8							
							9							
							80							
SPT	19	8	8	28	36	1.5	1				Sandy <u>SILT</u> ; light grey; stiff; high plasticity; moist; w/cemented pieces			
							2							
							3							
							4							
							85							
SPT	20	50 1"	-	-	+50	0.1	6							
							7							
							8							
							9							
							90							

Drilling became
harder from
73'-75'Drilling became
hard at 81.5' to
84.0'

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 900 E 1800			ELEVATION (DATUM) 121.7		TOTAL DEPTH 100.7		DATE START 10/31/88	
SURFACE CONDITIONS Flat, heavy surface vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/1/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL			REMARKS
SPT	21	50 3"	-	-	+50	0.3	1		Clayey SAND; gray to light grey; very dense; poorly graded; fine grained; rounded; moist			Drilling showed interbedding layers of hard and soft material
						2						
						3						
						4						
SPT	22	50 4"	-	-	+50	0	95		Sandy SILT; light grey; hard; plastic; moist; moderate cementation			
						6						
						7						
						8						
						9						
SPT	23	50 4"	-	-	+50	0.7	100					Bottom of boring at 100.7 Water level not recorded Boring backfilled to surface with cement grout
						1						
						2						
						3						
						4						
						105						
						6						
						7						
						8						
						9						
						110						
						1						
						2						
						3						
						4						
						115						
						6						
						7						
						8						
						9						
						120						

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 80 E 570			ELEVATION (DATUM) 120.5		TOTAL DEPTH 101.5		DATE START 11/3/88				
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/4/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	1	2	1	2	3	1.5	1				SAND; dark grey grading to light grey; very loose; uniform; fine grained; rounded; dry; trace silt; little organics	Boring advanced to 6.5' by continuous driving and cleaning out of split spoon. Boring then advanced with 4" wing bit using bentonite as drilling fluid. Water encountered at 5'		
SPT	2	3	4	3	7	0.8	2				Grading to dark brown			
							3							
							4							
							5				Grading to light grey			
SPT	3	6	7	8	15	1.5	6							
SPT	4	3	3	4	7	1.1	7				Grading finer			
							8							
							9							
TW	5					2.0	10				Clayey SAND; light tan; medium dense; well graded; fine grained; rounded; moist	Pushed TW w/500 psi.		
							1							
							2							
							3							
							4							
TW	6					2.0	15				Sandy CLAY; greenish-tan; stiff; high plasticity; moist	Pushed w/400 psi.		
							6							
							7							
							8							
							9							
SPT	7	1	0	1	1	0	20							
							1						First blow 1', next blow 1.7'. Lost mud after driving spoon. Spoon showed traces of coarse sand at 21'.	
							2				SAND; greenish-white; very loose; poorly graded; medium grained; rounded; wet			
SPT	8	1	2	8	10	1.5	3				Sandy CLAY; tan; stiff; plastic; moist; weakly cemented; trace gravel and coarse sand		Set 4" casing to 24.5'.	
							4							
							25							
							6							
							7						Harder at 27.5'.	
							8							
							9				Cemented stringer		Lost mud at 29'.	
							9				Gravelly SAND; tan; medium dense; poorly graded; angular; wet; trace of clay			
							30							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 80 E 570			ELEVATION (DATUM) 120.5		TOTAL DEPTH 101.5		DATE START 11/3/88			
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/4/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	26	6	9	15	1.5	1		Clayey <u>SAND</u> ; grey mottled tan; medium dense; poorly graded; medium-fine grained; rounded; moist; trace gravel		Installed 5' more casing to 29.5'. Drilling easier 30'-35'.			
						2								
						3								
						4								
SPT	10	6	32	25	57	1.5	35		Silty <u>CLAY</u> ; dark grey; hard; dry; low plastic; trace fine sand					
						6								
						7								
						8								
SPT	11	50 3"			50+	0.25	40		Sandy <u>SILT</u> ; light grey w/black specs; hard; plasticity; moist; trace clay		Drilling harder 40'-41'.			
						1								
						2								
						3								
SPT	12	10	31	15	46	1.5	45		Weakly cemented					
						6								
						7								
						8								
SPT	13	38	9	13	22	1.5	50							
						1								
						2								
						3								
SPT	14	36	9	16	25	1.5	55		Clayey <u>SAND</u> ; black; medium dense; poorly graded; rounded; fine grained; moist					
						6								
						7								
						8								
							9							
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 80 E 570				ELEVATION (DATUM) 120.5		TOTAL DEPTH 101.5		DATE START 11/3/88			
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/4/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	4	4	5	9	1.5	1		Sandy CLAY; black grey mottled; stiff; plastic; moist		Chattering 64'-64.5'.			
						2								
						3								
						4								
SPT	16	21	19	21	40	1.5	65		SAND; black; medium dense; poorly graded; fine grained; rounded; moist; trace clay					
						6								
						7								
						8								
							9							
SPT	17	7	7	21	28	1.5	70							
						1								
						2								
						3								
							4							
SPT	18	8	9	10	19	1.5	75		Grading clayier		Chattering 76.5'-79'.			
						6								
						7								
						8								
							9				Drilling easier 79'-82'.			
SPT	19	5	7	22	29	1.5	80		Silty SAND; light grey w/dark grey marl; medium dense; well graded; coarse to fine grained; rounded; moist; trace gravel		Drilling harder 82'-86'.			
						1								
						2								
						3								
							4							
SPT	20	22	50 5.5"		50+	0.9	85		Grading coarser, weakly cemented					
						6								
						7								
						8								
							9							
							90							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 80 E 570			ELEVATION (DATUM) 120.5		TOTAL DEPTH 101.5		DATE START 11/3/88	
SURFACE CONDITIONS 8" long grass, level							INSPECTOR P. L. Nelson			DATE FINISH 11/4/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE	CLASSIFICATION OF MATERIAL		REMARKS	
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	GRAPHICS LOG					
SPT	21	26	50		50+	0.6	1	Grading clayier			Firm drilling 86'-100'.	
							2					
							3					
							4					
							95					
SPT	22	16	50 3"		50+	0.7	6					
							7					
							8					
							9					
							100					
SPT	23	14	14	29	43	1.0	1				Bottom of boring at 101.5'. Water level not recorded. Boring backfilled to surface with cement grout.	
							2					
							3					
							4					
							105					
							6					
							7					
							8					
							9					
							110					
							1					
							2					
							3					
							4					
							115					
							6					
							7					
							8					
							9					
							120					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845																		
PROJECT LOCATION Agrico South				COORDINATES S 530 E 385			ELEVATION (DATUM) 119.1'		TOTAL DEPTH 101.5'		DATE START 11/02/88																	
SURFACE CONDITIONS Flat (next to spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/02/88																		
<table border="1"> <tr> <th colspan="7">SAMPLING</th> </tr> <tr> <th>SAMP TYPE</th> <th>SAMP NO.</th> <th>SET 6"</th> <th>2ND 6"</th> <th>3RD 6"</th> <th>N VAL</th> <th>SAMP RECV</th> </tr> </table>							SAMPLING							SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV	CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
SAMPLING																												
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV																						
<table border="1"> <tr> <th colspan="7">CORING</th> </tr> <tr> <th>CORE SIZE</th> <th>RUN NO.</th> <th>RUN LENG</th> <th>RUN RECV</th> <th>RQD RECV</th> <th>% RECV</th> <th>RQD</th> </tr> </table>							CORING							CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD	DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
CORING																												
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD																						
SPT	1	1	1	3	4	1.2	1		TOPSOIL; black; w/organics		Boring advanced w/3 7/8" diameter wing bit; using bentonite as drilling fluid.																	
							2		SAND; grey; very loose; poorly graded; fine grained; moist																			
SPT	2	4	4	4	8	1.0	3		Silty SAND; greyish-brown; loose; poorly graded; fine grained; moist																			
SPT	3	4	4	7	11	1.4	4		Clayey SAND; light grey; medium dense; poorly graded; fine grained; rounded; moist																			
							5																					
							6																					
TW	4					2.0	7		Lens w/increasing sand content																			
SPT	5	5	5	7	12	1.3	8																					
							9																					
							10		Sandy CLAY; light grey; stiff; high plasticity; moist																			
TW	6					2.0	15																					
							6																					
							7		Clayey SAND; light grey mottled tan; medium dense; poorly graded; fine grained; rounded; moist																			
SPT	7	3	5	12	17	1.5	20		Light grey sand lense; 0.5' thick																			
							1																					
							2		Trace of gravel																			
SPT	8	50 4"	-	-	50+	0.3	25																					
							6																					
							7		Hard drilling at 27.5'.																			
							8																					
							9																					
							30																					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 530 E 385			ELEVATION (DATUM) 119.1'		TOTAL DEPTH 101.5'		DATE START 11/02/88			
SURFACE CONDITIONS Flat (next to spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/02/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	50 6"	-	-	50+	0.0	1							
							2							
							3							
							4							
SPT	10	50 5"	-	-	50+	0.4	35							
							6							
							7							
							8							
							9							
SPT	11	5	6	30	36	1.5	40							
							1							
							2							
							3							
							4							
SPT	12	8	14	50	64	1.4	45							
							6							
							7							
							8							
							9							
SPT	13	6	7	11	18	1.5	50							
							1							
							2							
							3							
							4							
SPT	14	50 5"	-	-	50+	0.4	55							
							6							
							7							
							8							
							9							
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 530 E 385			ELEVATION (DATUM) 119.1'		TOTAL DEPTH 101.5'		DATE START 11/02/88	
SURFACE CONDITIONS Flat (next to spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/02/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	50	-	-	50+	0.5	1		Increasing sand content			
							2					
							3					
							4					
SPT	16	21	11	50 4"	50+	1.4	65					
							6					
							7					
							8					
SPT	17	5	50 2"	-	50+	0.0	70					
							1					
							2					
							3					
SPT	18	50 5"	-	-	50+	0.4	75		Silty SAND; grey; very dense; poorly graded; fine grained; moist; w/seams of strong cementation; trace clay			
							6					
							7					
							8					
SPT	19	50 1"	-	-	50+	0.0	80					
							1					
							2					
							3					
SPT	20	38	17	12	29	1.5	85		Silty SAND; light grey; medium dense; poorly graded; fine grained; rounded; moist; trace clay			
							6					
							7					
							8					
							9					
							90					

CLIENT Seminole Electric Cooperative							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 530 E 385			ELEVATION (DATUM) 119.1'		TOTAL DEPTH 101.5'		DATE START 11/02/88			
SURFACE CONDITIONS Flat (next to spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/02/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	21	50 3"			50+	0.3	1			Fragments of strongly cemented material	91' to 92' strongly cemented layer.			
							2							
							3							
							4							
SPT	22	50 2"			50+	0.2	95			Minor cementation				
							6							
							7							
							8							
SPT	23	6	10	12	22	0.4	100			Sandy <u>SILT</u> ; light grey; very stiff; plastic; moist				
							1							
							2							
							3							
							4				Bottom of boring at 101.5'. Water level not recorded. Boring backfilled w/cement grout to surface.			
							105							
							6							
							7							
							8							
							9							
							110							
							1							
							2							
							3							
							4							
							115							
							6							
							7							
							8							
							9							
							120							

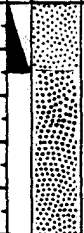
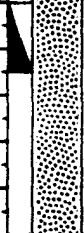
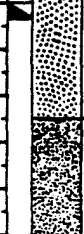
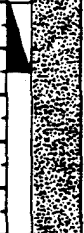
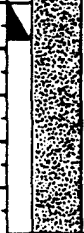
CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 1100 E 350			ELEVATION (DATUM) 115.05		TOTAL DEPTH 41.0'		DATE START 10/31/88			
SURFACE CONDITIONS Level w/8" grass and 5' woody bushes							INSPECTOR P. L. Nelson			DATE FINISH 11/1/88				
SAMPLING SAMP TYPE SAMP NO. SET 6" 2ND 6" 3RD 6" N VAL SAMP RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE SIZE RUN NO. RUN LENG RUN RECV RQD RECV % RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT 1 2 3 5 8 1.2							1		SAND; dark grey grading to light grey; loose; well graded; fine grained; rounded; dry; trace silt		Boring advanced with 3 7/8" wing bit, using bentonite as drilling fluid.			
SPT 2 8 9 8 17 1.0							2							
SPT 3 2 1 4 5 1.5							3							
SPT 4 6 8 9 17 1.4							4				Water encountered at 5'.			
SPT 5 7 6 5 11 1.5							5		Silty SAND; brown; loose; well graded; fine grained; rounded; wet					
SPT 6 1 1 2 3 1.5							6		Clayey SAND; grey; medium dense; poorly graded; fine grained; rounded; moist					
SPT 7 8 5 5 10 1.5							7							
SPT 8 4 5 8 13 1.5							8							
							9							
							10							
							11							
							12							
							13							
							14							
							15							
							16							
							17							
							18							
							19							
							20							
							21							
							22							
							23							
							24							
							25							
							26							
							27							
							28							
							29							
							30							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South			COORDINATES S 1100 E 350			ELEVATION (DATUM) 115.05		TOTAL DEPTH 41.0'		DATE START 10/31/88		
SURFACE CONDITIONS Level w/8" grass and 5' woody bushes							INSPECTOR P. L. Nelson			DATE FINISH 11/1/88		
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS		
1 5 8"	1	2.5	1.4	0.5	56	20	1		LIMESTONE; argillaceous; tannish-white; medium bedded; fine grained; partially consolidated (limerock)	Stopped at 32.5' on 10/31. Resumed drilling on 11/1/88.		
SPT	9	8	12	15	27	1.5	35					
							6				Clayey SAND; light grey mottled brown; medium dense; well graded; fine grained; rounded; wet	Pulled casing and finished boring w/2 7/8" roller bit.
							7					
							8					
							9					
							40			Bottom of boring at 41.0'.		
TW	10					1.0	1					
							2				Water level not recorded at conclusion of boring.	
							3					
							4					
							45		Backfilled boring to surface with cement grout.			
							6					
							7					
							8					
							9					
							50					
							1					
							2					
							3					
							4					
							55					
							6					
							7					
							8					
							9					
							60					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South			COORDINATES S 150 E 850			ELEVATION (DATUM) 118.5		TOTAL DEPTH 51.5'		DATE START 11/7/88		
SURFACE CONDITIONS Grass, small bushes							INSPECTOR P. L. Nelson			DATE FINISH 11/8/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE	CLASSIFICATION OF MATERIAL			REMARKS
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD		GRAPHICS LOG				
SPT	1	1	2	3	5	1.5	1		SAND; dark grey grading to light brown; loose; poorly graded; fine; rounded; moist; trace silt; little organics			Boring advanced to 6.5' by continuous driving and cleaning out of split spoon.
SPT	2	4	4	3	7	1.5	2		Grading to dark brown			
SPT	3	8	9	10	19	1.5	3					
TW	4					2.0	4					
SPT	3	8	9	10	19	1.5	5		Clayey SAND; grey; medium dense; well graded; fine; rounded; moist; trace of silt			Boring advanced with 3 7/8" wing bit using bentonite as drilling fluid. Pushed w/500 psi.
TW	4					2.0	6					
SPT	5	2	2	2	4	1.5	7					
TW	6					2.0	8					
SPT	5	2	2	2	4	1.5	9		Sandy CLAY; greenish-white; high plasticity; moist; trace of silt			Pushed w/500 psi.
TW	6					2.0	10					
SPT	7	3	4	5	9	1.5	15					
TW	6					2.0	16					
SPT	7	3	4	5	9	1.5	20		Grading tan			Stiff drilling at 21.5'. Switched to 2 7/8" roller bit at 25'. TW bent at 25', no recovery.
SPT	8	25	22	16	38	1.1	1					
TW	6					2.0	2					
SPT	8	25	22	16	38	1.1	3					
SPT	8	25	22	16	38	1.1	6		Sandy CLAY; tan mottled light grey; hard; high plasticity; moist; trace silt			Chattering 28'-31'.
TW	6					2.0	7					
SPT	8	25	22	16	38	1.1	8					
TW	6					2.0	9					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 150 E 850			ELEVATION (DATUM) 118.5		TOTAL DEPTH 51.5'		DATE START 11/7/88				
SURFACE CONDITIONS Grass, small bushes							INSPECTOR P. L. Nelson			DATE FINISH 11/8/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	50 2"			50+	0	1						Drilling easier 31'-32.5'.	
							2							
							3							
							4							
SPT	10	50 5"			50+	0.4	35							
							6							
							7							
							8							
							9							
SPT	11	50 5"			50+	0.4	40							
							1						Chattering 40.5'-41.5'.	
							2						Drilling easier 41.5'-42.5'.	
							3						Drilling harder 42.5'-46'.	
							4							
SPT	12	23 4"			50+	0.7	45							
							6						Drilling easier 46'-47'.	
							7						Drilling harder 47'-47.5'.	
							8							
							9							
SPT	13	2	5	13	18	1.5	50							
							1						Bottom of boring at 51.5'.	
							2							
							3							
							4						Water level not recorded at conclusion of boring.	
							55							
							6						Backfilled boring to surface with cement grout.	
							7							
							8							
							9							
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 525 E 1420			ELEVATION (DATUM) 121.4		TOTAL DEPTH 100.0		DATE START 11/2/88	
SURFACE CONDITIONS Flat (next to spoil pile) heavy vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/7/88		
SAMPLING							CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh			
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE LOG	CLASSIFICATION OF MATERIAL		REMARKS	
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD						
SPT	1	1	3	4	7	1.5	1		Silty SAND; light grey; loose; well graded; fine grained; dry; w/organics		Boring advanced by continuous driving of SPT to 11.5'.	
SPT	2	10	8	10	18	1.2	2					
							3					
							4					
SPT	3	6	6	6	12	1.4	5		SAND; light brown; medium dense; poorly graded; fine grained; dry; trace of silt			
							6					
							7					
SPT	4	5	3	6	9	1.5	8		Grading lighter brown			
							9					
SPT	5	25	13	10	23	1.5	10		Clayey SAND; light tan; medium dense; poorly graded; fine grained; occasional cementation; moist; at 11' very cemented lens .2' thick.		N value at 10' may not be exactly accurate. On 11/4/88 boring advanced to 15' w/3 7/8" wing bit and water as drilling fluid. On 11/7/88 water level reported at 10'. Boring advanced from 15' w/3 7/8" wing bit and bentonite as drilling fluid.	
							1					
							2					
							3					
SPT	6	5	9	9	18	1.5	15		Clayey SAND; light grey; medium dense; poorly graded; fine grained; occasional cementation; moist			
							6					
							7					
TW	7					0.3	20		Sandy CLAY; light grey; stiff; high plasticity; moist; at 20.5' sand lens			
							1					
							2					
							3					
TW	8					2.0	25		With cemented light grey clayey silt; and phosphate nodules			
							6					
							7					
							8					
							9					
							30					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 525 E 1420			ELEVATION (DATUM) 121.4		TOTAL DEPTH 100.0		DATE START 11/2/88	
SURFACE CONDITIONS Flat (next to spoil pile) heavy vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/7/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL			REMARKS
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD						
SPT	9	22	28	21	49	1.5	1		SAND; greyish-brown mottled tan; dense; poorly graded; fine grained; weak cementation; moist; w/some silt			
						2						
						3						
						4						
TW	10					1.7	35		Increasing grey clayey silt, w/high plasticity			Hard drilling between 37' to 38.5' (cemented layer)
						6						
						7						
						8						
SPT	11	22	11	8	19	0.0	40		Hard drilling at 42'.			
						1						
						2						
						3						
SPT	12	50 1"	-	-	50+	0.1	45		Strongly cemented, greyish tan			Switched to 2 7/8" tricone roller bit at 45'.
						6						
						7						
						8						
SPT	13	50	18	14	32	0.5	50		Silty SAND; grey w/brown sand; dense; well graded; coarse to fine grained; round; moist; cemented nodules			
						1						
						2						
						3						
SPT	14	7	50 2"	-	50+	0.7	55		Weak cementation, grading finer sand			Hard drilling at 56'.
						6						
						7						
						8						
							9					
							60					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 525 E 1420			ELEVATION (DATUM) 121.4		TOTAL DEPTH 100.0		DATE START 11/2/88	
SURFACE CONDITIONS Flat (next to spoil pile) heavy vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/7/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL			REMARKS
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD						
SPT	15	17	32	20	52	1.4	1		SAND; dark grey; very dense; poorly graded; fine grained; moist; w/cemented clayey silt layers (strongly cemented at 61')			
							2					
							3					
							4					
							65					
SPT	16	22	42	43	85	1.2	6		Strongly cemented clayey silt lens (~0.1' thick)			
							7					
							8					
							9					
							70					
SPT	17	10	13	50 2"	50+	1.1	1		Increasing moisture Strongly cemented clayey silt lens			
							2					
							3					
							4					
							75					
SPT	18	22	32	50 4"	50+	0.0	6					
							7					
							8					
							9					
							80					
SPT	19	13	30	50 3"	50+	1.2	1		Sandy <u>SILT</u> ; light grey; very dense; weak cementation; plastic; moist; trace of clay			Circulation lost at 80'. Intermittent hard drilling from 80' to 90'.
							2					
							3					
							4					
							85		Very cemented w/chert			
SPT	20	50 1"	-	-	50+	0.1	6					
							7					
							8					
							9					
							90					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845		
PROJECT LOCATION Agrico South				COORDINATES S 525 E 1420			ELEVATION (DATUM) 121.4		TOTAL DEPTH 100.0		DATE START 11/2/88	
SURFACE CONDITIONS Flat (next to spoil pile) heavy vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/7/88		
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh		
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV						
CORING							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL	REMARKS		
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	1 RECV	RQD						
SPT	21	50 2"	-	-	50+	0.1	1	Strongly cemented		Drilling easier at 90'. Drilled to 100' boring collapsed at 70' unable to obtain a sample at 100'.		
							2					
							3					
							4					
SPT	22	50 2"	-	-	50	0.1	95			Bottom of boring at 100'. Water level not recorded at conclusion of boring. Grout induced at 45' depth and boring grouted to surface.		
							6					
							7					
							8					
							9					
							100					
							1					
							2					
							3					
							4					
							105					
							6					
							7					
							8					
							9					
							110					
							1					
							2					
							3					
							4					
							115					
							6					
							7					
							8					
							9					
							120					

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845																
PROJECT LOCATION Agrico South				COORDINATES S 550 E 2050			ELEVATION (DATUM) 123.4		TOTAL DEPTH 100.2		DATE START 11/3/88															
SURFACE CONDITIONS Flat (~40' south of spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/4/88																
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh																
SAMP TYPE							SAMP NO.			SET 6"		2ND 6"		3RD 6"		N VAL		SAMP RECV								
CORE SIZE							RUN NO.		RUN LENG		RUN RECV		RQD RECV		% RECV		RQD		DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT		1		1		0		1		1		0.4		1		0.4		1		1		Silty <u>SAND</u> ; gray; loose; fine grained; dry; w/organics		Boring advanced w/3 7/8" wing bit using bentonite as drilling fluid.		
SPT		2		1		4		8		12		1.2		3		1.2		3		Silty <u>SAND</u> ; brown to dark brown; medium dense; poorly graded; fine grained; weakly cemented; moist						
SPT		3		25		35		50 4"		50+		1.1		5		1.1		5		At 5' grading to dark brown; very dense						
SPT		4		50 5"		-		-		50+		0.5		6		0.5		6		At 7.5' grading brown; slightly coarser						
SPT		5		21		32		33		65		1.2		7		1.2		7		At 7.5' grading brown; slightly coarser						
SPT		6		21		32		33		65		1.2		8		1.2		8		Clayey <u>SAND</u> ; light tan; very dense; fine grained; occasional cementation; moist		Easier drilling at ~12.5'.				
TW		6		21		32		33		65		1.2		9		1.2		9								
TW		6		21		32		33		65		1.2		10		1.2		10		Clayey <u>SAND</u> ; light tan; very dense; fine grained; occasional cementation; moist						
TW		6		21		32		33		65		1.2		11		1.2		11								
TW		6		21		32		33		65		1.2		12		1.2		12								
TW		6		21		32		33		65		1.2		13		1.2		13		Sandy <u>CLAY</u> ; light grey; stiff; high plasticity; moist; trace of silt						
TW		6		21		32		33		65		1.2		14		1.2		14								
TW		6		21		32		33		65		1.2		15		1.2		15								
TW		6		21		32		33		65		1.2		16		1.2		16								
TW		6		21		32		33		65		1.2		17		1.2		17								
SPT		7		3		2		3		5		1.5		18		1.5		18		Sandy <u>CLAY</u> ; light grey; stiff; high plasticity; moist; trace of silt						
SPT		7		3		2		3		5		1.5		19		1.5		19								
SPT		7		3		2		3		5		1.5		20		1.5		20								
SPT		7		3		2		3		5		1.5		21		1.5		21								
SPT		7		3		2		3		5		1.5		22		1.5		22								
TW		8		3		2		3		5		1.5		23		1.5		23		Reduction in sand content						
TW		8		3		2		3		5		1.5		24		1.5		24								
TW		8		3		2		3		5		1.5		25		1.5		25								
TW		8		3		2		3		5		1.5		26		1.5		26								
TW		8		3		2		3		5		1.5		27		1.5		27								
TW		8		3		2		3		5		1.5		28		1.5		28								
TW		8		3		2		3		5		1.5		29		1.5		29								
TW		8		3		2		3		5		1.5		30		1.5		30								

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 550 E 2050			ELEVATION (DATUM) 123.4		TOTAL DEPTH 100.2		DATE START 11/3/88				
SURFACE CONDITIONS Flat (~40' south of spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/4/88				
SAMPLING SAMP TYPE SAMP NO. SET 6" 2ND 6" 3RD 6" N VAL SAMP RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE SIZE RUN NO. RUN LENG RUN RECV RQD RECV % RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	9	4	5	6	11	1.5	1		Becoming mottled w/tan clay		Switched to 2 7/8" tricone roller bit at 35'.			
TW	10					2.0	35							
							6							
							7							
							8	Grading grey						
							9							
SPT	11	12	12	10	22	1.0	40							
							1							
							2							
							3							
							4							
SPT	12	7	7	10	17	0.8	45		Becoming mottled w/tan clay; increasing plasticity		Hard drilling at 47' (cemented layer). Lost circulation at 48.5'.			
							6							
							7							
							8							
							9							
SPT	13	50 0"			+50	0.1	50		Limestone fragments		Drilling easier at 52' reamed boring with 3 7/8" tricone roller bit.			
							1							
							2							
							3							
							4							
SPT	14	8	9	11	20	1.5	55		Sandy CLAY; light gray mottled brown (sand); stiff; plastic; moist; trace of silt		At 55' discontinued drill on 11/3/88. Resumed drilling on 11/4/88. Set casing to 57'.			
							6							
							7							
							8							
							9							
							60							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES S 550 E 2050			ELEVATION (DATUM) 123.4		TOTAL DEPTH 100.2		DATE START 11/3/88			
SURFACE CONDITIONS Flat (~40' south of spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/4/88				
SAMPLING SAMP TYPE SAMP NO. SET 6" 2ND 6" 3RD 6" N VAL SAMP RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE SIZE RUN NO. RUN LENG RUN RECV RQD RECV % RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT 15 5 6 50 5" 50+ 1.5							1		▲		SAND; brownish-grey; very dense; well graded; medium to fine grained; wet; w/cementation at 61.4'			
							2							
							3							
							4							
SPT 16 50 3" - - 50+ 0.3							65		▲		Increasing cemented fragments			
							6							
							7							
							8							
							9							
SPT 17 50 50 4" - 50+ 0.8							70		▲		Sandy SILT; light grey w/black specs; hard; low plasticity; strong cementation; moist; marled w/light grey clayey silt			
							1							
							2							
							3							
							4							
SPT 18 50 0" - - 50+ 0.2							75		▲		At 75' strongly cemented			
							6							
							7							
							8							
							9							
SPT 19 50 1" - - 50+ 0.1							80		▲				Hard drilling ~80.5' - ~82.0'	
							1							
							2							
							3							
							4							
SPT 20 34 17 16 33 1.5							85		▲		SAND; dark grey; medium dense; poorly graded; medium to fine grained; moist; some silt; w/cemented clayey silt seam at 86' ~0.2' thick			
							6						Hard drilling 87' - 88'.	
							7							
							8							
							9							
							90							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South			COORDINATES S 550 E 2050			ELEVATION (DATUM) 123.4		TOTAL DEPTH 100.2		DATE START 11/3/88				
SURFACE CONDITIONS Flat (~40' south of spoil pile) grass vegetation							INSPECTOR M. R. Osbourn			DATE FINISH 11/4/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	21	50	-	-	50+	0.0	1			Marled w/cemented clayey silt	Hard drilling ~92.0' - ~93.0'			
						2								
						3								
						4								
						95								
SPT	22	26	42	35	77	1.5	6				Hard drilling at 94'.			
							7							
							8							
							9							
SPT	23	50 0"	-	-	50+	0.2	100				Bottom of boring at 100.2'.			
							1				Water level not recorded at conclusion of boring.			
							2							
							3							
							4							
							105				Boring backfilled to surface w/cement grout.			
							6							
							7							
							8							
							9							
							110							
							1							
							2							
							3							
							4							
							115							
							6							
							7							
							8							
							9							
							120							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES N 2110 E 4575			ELEVATION (DATUM) 127.4		TOTAL DEPTH 100.1		DATE START 11/8/88			
SURFACE CONDITIONS Flat minor vegetation (reclaimed area)							INSPECTOR M. R. Osbourn			DATE FINISH 11/8/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	1	2	3	3	6	1.5	1	2	3	4	SAND; light grey; loose; poorly graded; fine grained; moist; some silt, w/topsoil and organics (fill)		Boring advanced w/3 7/8" wing bit using bentonite as drilling fluid.	
SPT	2	4	3	5	8	0.5	3	4	5	6	TAILINGS; composed of sand; light grey; loose; poorly graded; fine grained; wet (reclaimed fill)			
SPT	3	7	8	8	16	1.5	5	6	7	8	Grading medium dense			
SPT	4	6	5	6	11	1.5	7	8	9	10				
SPT	5	8	9	11	20	1.5	1	2	3	4				
SPT	6	8	3	4	7	0.5	5	6	7	8	Grading loose			
SPT	7	2	3	5	8	1.5	9	10	11	12				
SPT	8	5	3	5	8	1.5	13	14	15	16				
							17	18	19	20				
							21	22	23	24				
							25	26	27	28				
							29	30	31	32				
							33	34	35	36				
							37	38	39	40				
							41	42	43	44				
							45	46	47	48				
							49	50	51	52				
							53	54	55	56				
							57	58	59	60				
							61	62	63	64				
							65	66	67	68				
							69	70	71	72				
							73	74	75	76				
							77	78	79	80				
							81	82	83	84				
							85	86	87	88				
							89	90	91	92				
							93	94	95	96				
							97	98	99	100				
							101	102	103	104				
							105	106	107	108				
							109	110	111	112				
							113	114	115	116				
							117	118	119	120				
							121	122	123	124				
							125	126	127	128				
							129	130	131	132				
							133	134	135	136				
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							265	266	267	268				
							269	270	271	272				
							273	274	275	276				
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							293	294	295	296				
							297	298	299	300				
							301	302	303	304				
							305	306	307	308				
							309	310	311	312				
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							473	474	475	476				
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							497	498	499	500				
							501	502	503	504				
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							509	510	511	512				
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							521	522	523	524				
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							529	530	531	532				
							533	534	535	536				
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							541	542	543	544				
							545	546	547	548				
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							557	558	559	560				
							561	562	563	564				
							565	566	567	568				
							569	570	571	572				
							573	574	575	576				
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							581	582	583	584				
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							593	594	595	596				
							597	598	599	600				
							601	602	603	604				
							605	606	607	608				
							609	610	611	612				
							613	614	615	616				
							617	618	619	620				
							621	622	623	624				
							625	626	627	628				
							629	630	631	632				
							633	634	635	636				
							637	638	639	640				
							641	642	643	644				

CLIENT Seminole Electric Cooperative, Inc.										PROJECT Combined Cycle				PROJECT NO. 14845	
PROJECT LOCATION Agrico South					COORDINATES N 2110 E 4575					ELEVATION (DATUM) 127.4		TOTAL DEPTH 100.1		DATE START 11/8/88	
SURFACE CONDITIONS Flat minor vegetation (reclaimed area)										INSPECTOR M. R. Osbourn				DATE FINISH 11/8/88	
SAMPLING							CHECKED BY M. R. Osbourn				APPROVED BY L. J. Almaleh				
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV									
CORING							DEPTH IN FEET	SAMPLE TYPE		CLASSIFICATION OF MATERIAL			REMARKS		
CORE SIZE	RUN NO.	RUN LENG	RUN RECV	RQD RECV	% RECV	RQD		GRAPHICS LOG							
SPT	9	19	13	46	59	1.1	1			Grading light tan w/occasional cementation			At 30' switched to 2 7/8" tricone roller bit. At 32' drilling became harder.		
							2								
							3								
							4								
SPT	10	3	6	9	15	0.5	35			Clayey <u>SAND</u> ; tannish-grey; medium dense; well graded; medium to fine grained; weak cementation; moist; mottled w/brown sand; w/phosphate nodules					
							6								
							7								
							8								
							9								
SPT	11	9	12	31	43	1.3	40			SAND; greyish-brown; dense; poorly graded; fine grained; moist; marled w/some grey silty clay					
							1								
							2			Sandy <u>SILT</u> ; tannish-grey; very dense; weak cementation; w/occasional strongly cemented lens; moist					
							3								
							4								
SPT	12	50 5"	-	-	50+	0.5	45								
							6								
							7								
							8								
							9								
SPT	13	14	50 2"	-	50+	0.6	50								
							1								
							2								
							3								
							4								
SPT	14	25	50 5"	-	50+	0.0	55								
							6								
							7								
							8								
							9						Drilling easier at 59'.		
							60								

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845				
PROJECT LOCATION Agrico South				COORDINATES N 2110 E 4575			ELEVATION (DATUM) 127.4		TOTAL DEPTH 100.1		DATE START 11/8/88			
SURFACE CONDITIONS Flat minor vegetation (reclaimed area)							INSPECTOR M. R. Osbourn			DATE FINISH 11/8/88				
SAMPLING SAMP SAMP SET 2ND 3RD N SAMP TYPE NO. 6" 6" 6" VAL RECV							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh				
CORING CORE RUN RUN RUN RQD % SIZE NO. LENG RECV RECV RECV RQD							DEPTH IN FEET		SAMPLE TYPE GRAPHICS LOG		CLASSIFICATION OF MATERIAL		REMARKS	
SPT	15	9	8	11	19	0.6	1				Sandy <u>SILT</u> ; grey; very stiff; high plasticity; moist; w/traces of light grey clay			
							2							
							3							
							4							
SPT	16	50 5"	-	-	50+	0.5	65				Becoming cemented; no plasticity; w/increasing sand content; and traces of peat			
							6							
							7							
							8							
							9							
SPT	17	7	6	5	11	0.0	70							
							1					Hard drilling at 71.5'.		
							2							
							3					Hard drilling at 73.5'.		
							4							
SPT	18	50 5"	-	-	50+	0.5	75				Silty <u>SAND</u> ; dark grey; very dense; poorly graded; fine grained; moist; mottled w/light grey cemented clayey silt		Hard drilling at 76'.	
							6							
							7							
							8					Hard drilling at 78'.		
							9							
							80					Hard drilling at 79.5'.		
SPT	19	26	17	22	39	1.5	1				Sandy <u>CLAY</u> ; light grey; very dense; strongly cemented; moist; trace of silt			
							2							
							3							
							4							
							85							
SPT	20	50 0"	-	-	50+	0.1	6							
							7							
							8							
							9							
							90							

CLIENT Seminole Electric Cooperative, Inc.							PROJECT Combined Cycle			PROJECT NO. 14845	
PROJECT LOCATION Agrico South			COORDINATES N 2110 E 4575			ELEVATION (DATUM) 127.4		TOTAL DEPTH 100.1		DATE START 11/8/88	
SURFACE CONDITIONS Flat minor vegetation (reclaimed area)							INSPECTOR M. R. Osbourn			DATE FINISH 11/8/88	
SAMPLING							CHECKED BY M. R. Osbourn			APPROVED BY L. J. Almaleh	
SAMP TYPE	SAMP NO.	SET 6"	2ND 6"	3RD 6"	N VAL	SAMP RECV					
							DEPTH IN FEET	SAMPLE TYPE GRAPHICS LOG	CLASSIFICATION OF MATERIAL		REMARKS
SPT	21	50 4"	-	-	50+	0.3	1		Lens w/greater sand content Strongly cemented lens		
						2					
						3					
						4					
						95					
SPT	22	6	12	50 3"	50+	1.3	6				
							7				
							8				
							9				
SPT	23	50 1"	-	-	50+	0.1	100			Bottom of boring at 100.1'.	
							1			Water level not recorded at conclusion of boring.	
							2				
							3				
							4				
							105			Boring backfilled to surface w/cement grout.	
							6				
							7				
							8				
							9				
							110				
							1				
							2				
							3				
							4				
							115				
							6				
							7				
							8				
							9				
							120				

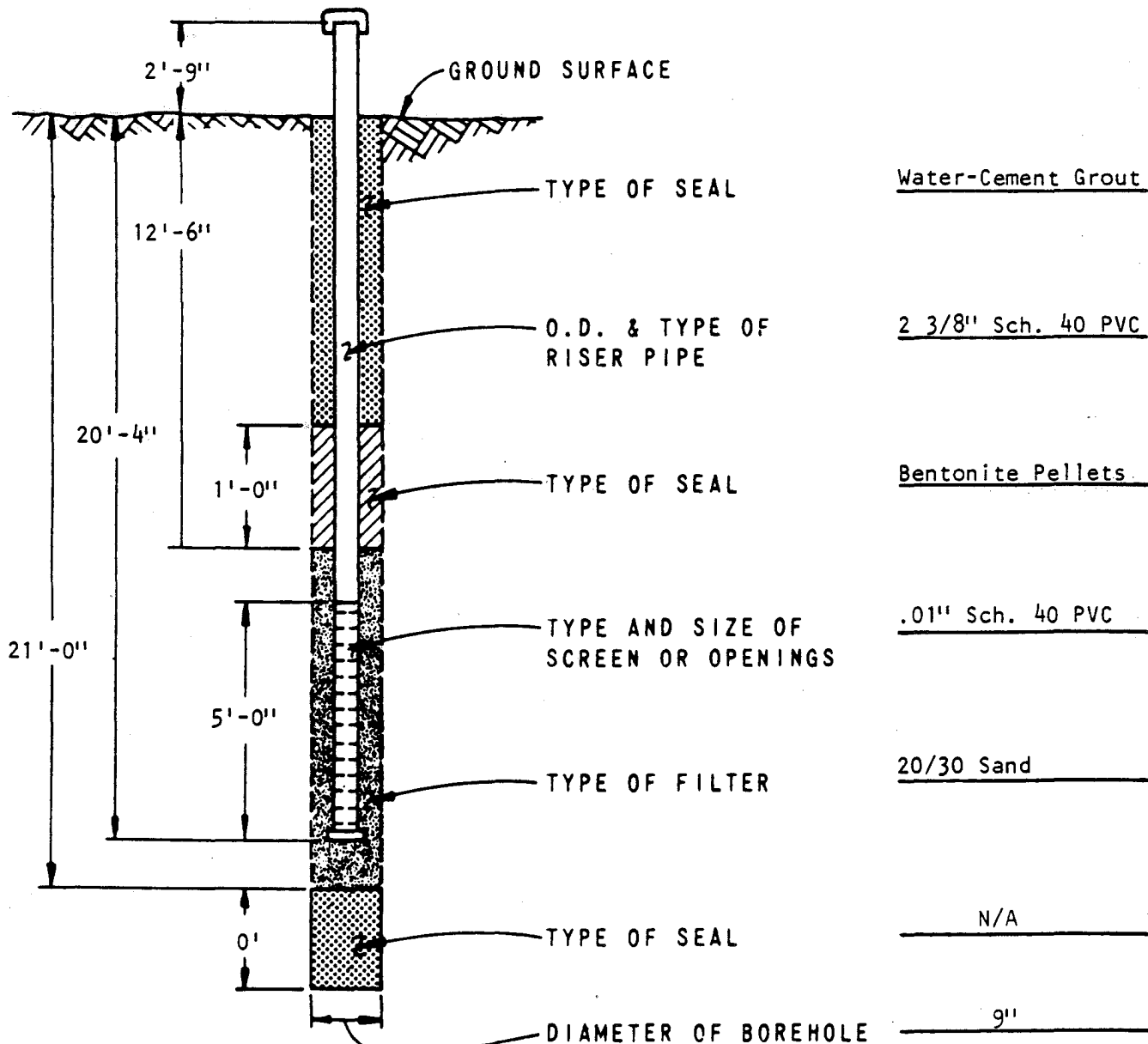


BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. P-1

CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle		PROJECT NO 14845
PROJECT LOCATION Agrico South	COORDINATES N 1200 E 750		GROUND ELEVATION 122.3	DATE 11/8/88
STRATUM MONITORED Upper Sands			INSPECTOR P. L. Nelson	
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh		



METHOD OF INSTALLATION:

Bored to 21' w/6" ID HSA, cleaned bottom 3' w/4 3/4" roller bit, placed 8" sand, installed piezometer, alternated placing sand and pulling augers, placed pellets, waited 15 minutes and installed grout.

REMARKS:

Grouted to 4.5' below ground surface, as protective casing not on job site. Water level at 6'-11" below ground surface after installation.

P-ST-021B

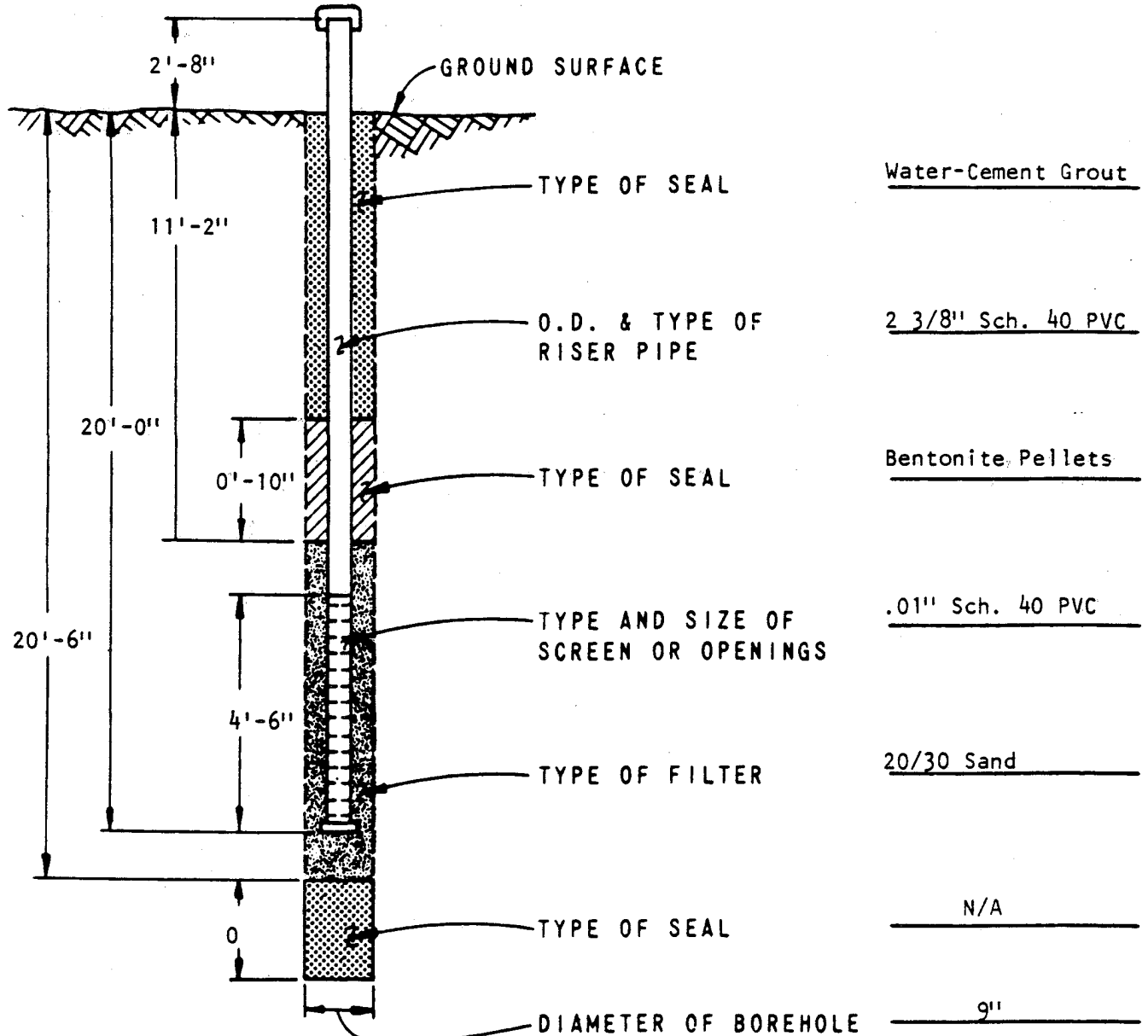


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PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. P-2

CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle		PROJECT NO 14845
PROJECT LOCATION Agrico South	COORDINATES S 535 W 185	GROUND ELEVATION 114.2		DATE 11/9/88
STRATUM MONITORED Upper Sands		INSPECTOR P. L. Nelson		
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh		



METHOD OF INSTALLATION:

Augered to 21' w/6" ID HSA, cleaned hole to 20'-6" w/4 3/4" roller bit, placed 6" of sand, installed piezometer, alternated sand and pulling augers, placed pellets, waited 10 minutes, placed grout and pulled augers completely.

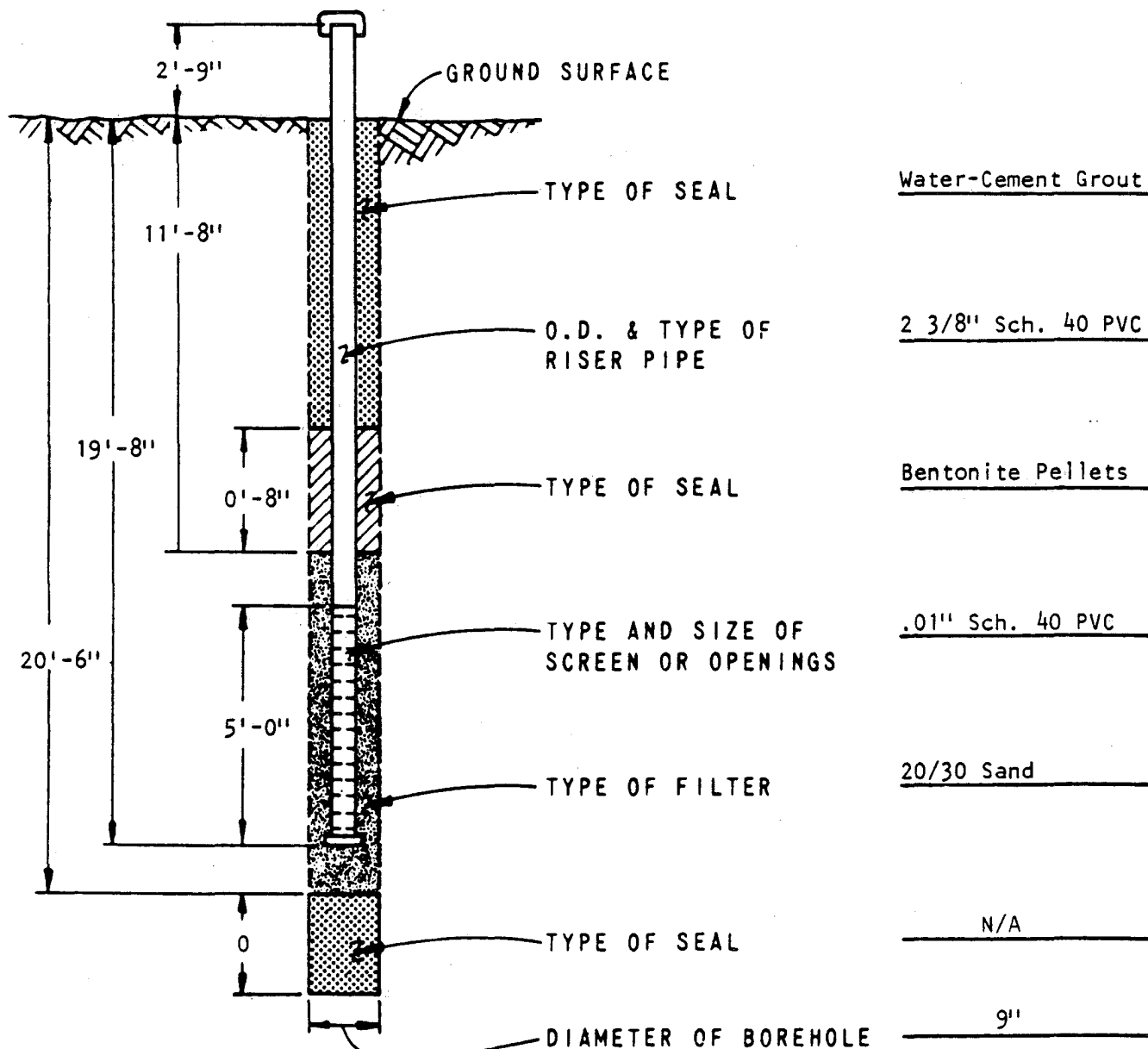
REMARKS

Grouted to 2'-0" below ground surface. Protective casing to be installed at a later date.
Water level at 3'-10" below ground surface after completing installation.

P-ST-021B



CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle		PROJECT NO 14845
PROJECT LOCATION Agrico South		COORDINATES S 900 E 1800	GROUND ELEVATION 121.7	DATE 11/10/88
STRATUM MONITORED Upper Sands			INSPECTOR P. L. Nelson	
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh		



METHOD OF INSTALLATION:
Augered to 20' w/6" ID HSA, cleaned hole w/4 3/4" roller bit to 20.5', installed 10" of sand, placed piezometer, alternated sand and pulling augers, placed bentonite, placed grout.

REMARKS:
Grouted to 1'-1" from ground surface. Protective casing to be installed at a later date.
Water level at 7'-11" below ground surface after piezometer installation.

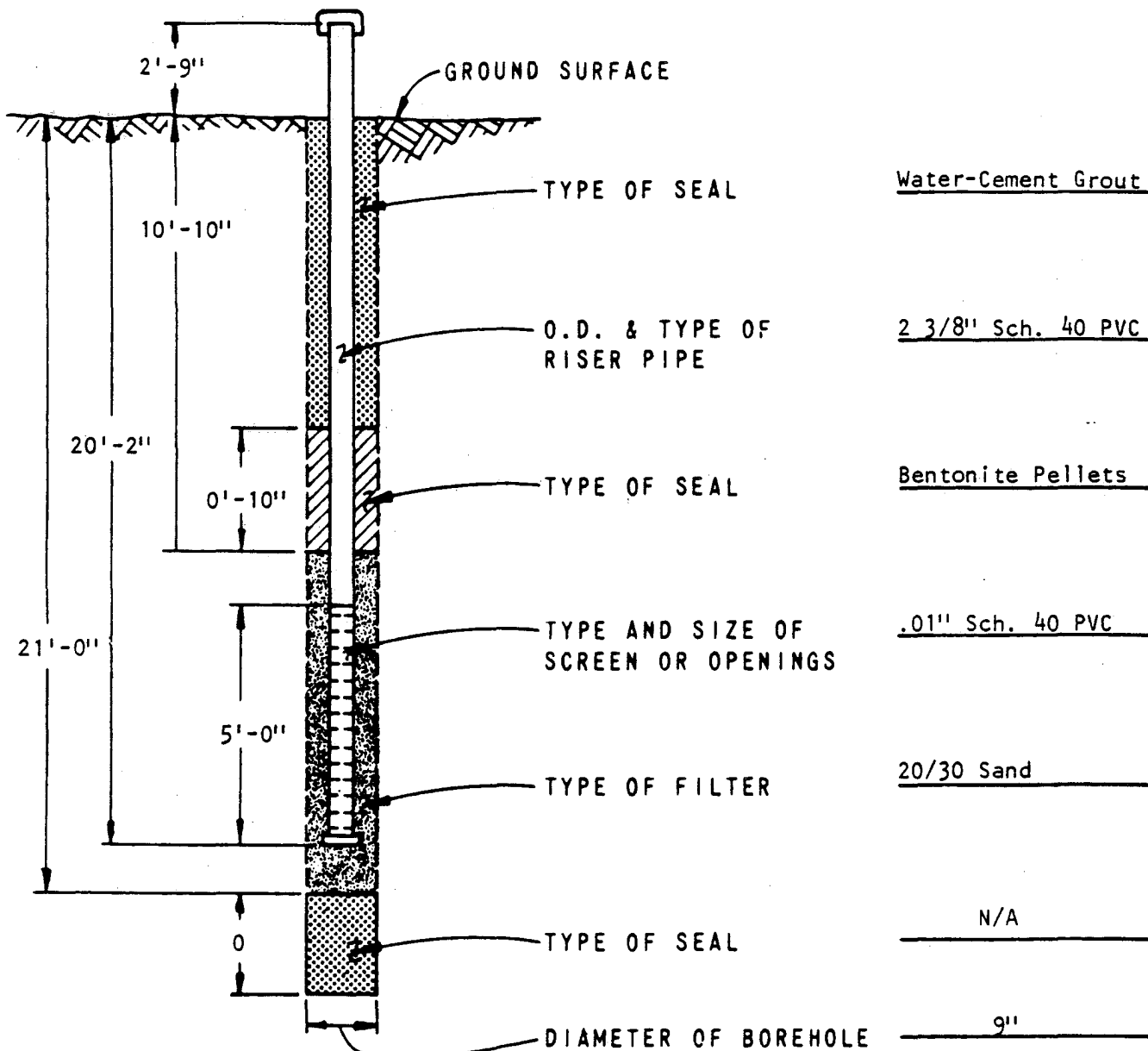


BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. P-10

CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle	PROJECT NO 14845
PROJECT LOCATION Agrico South	COORDINATES N 2110 E 4575	GROUND ELEVATION 127.36	DATE 11/10/88
STRATUM MONITORED Upper Sands		INSPECTOR P. L. Nelson	
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh	



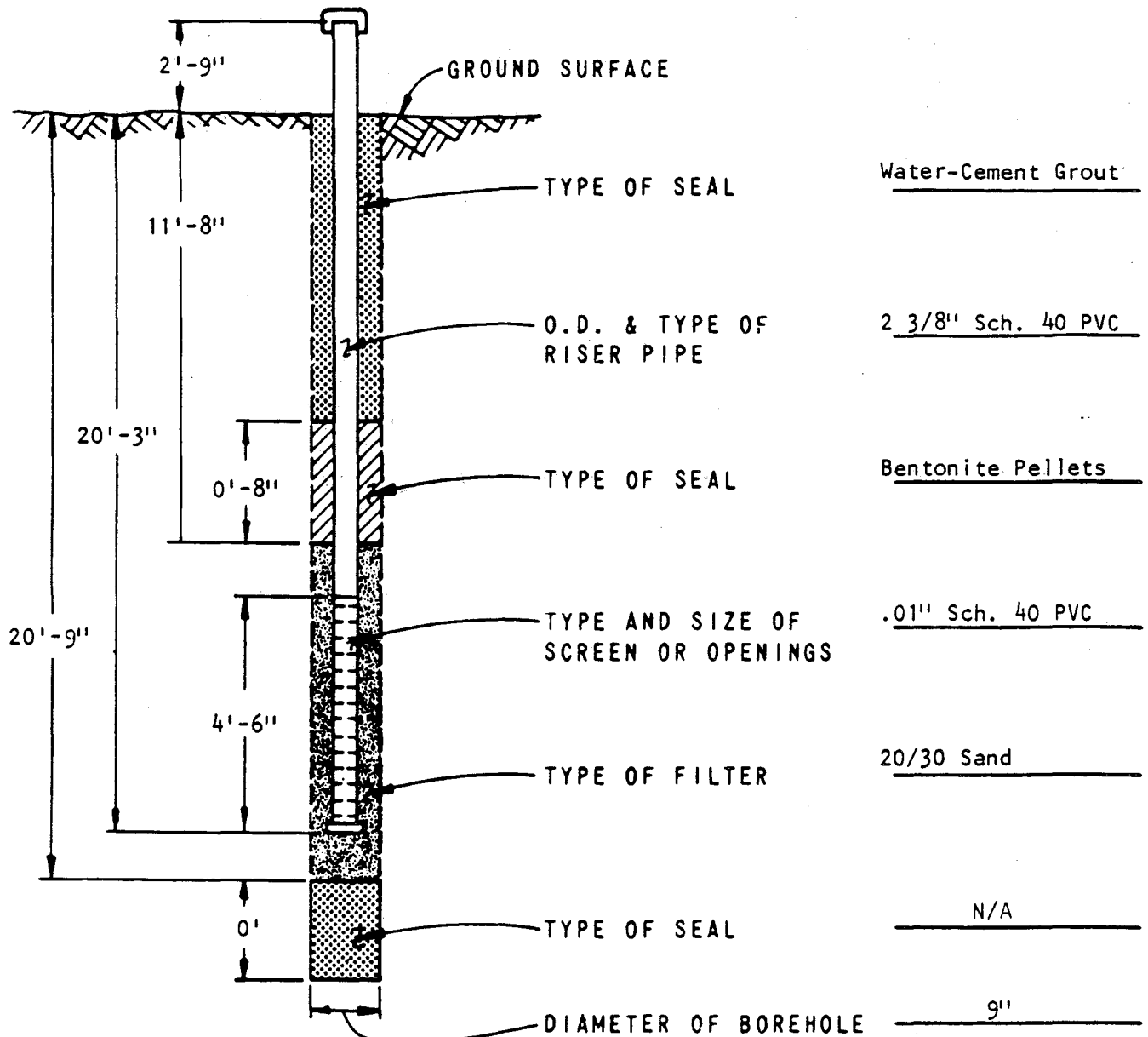
METHOD OF INSTALLATION:
Augered 21' w/6" ID HSA, cleaned out w/4 3/4" roller bit to 21', install 10" of sand, alternate sand and pulling auger, place pellets, install cement grout and pull remaining augers.

REMARKS:
Placed grout to 2'-8" below ground surface. Protective casing to be added later. Water level 3'-3" below ground surface after installing piezometer.

P-ST-021B



CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle		PROJECT NO 14845
PROJECT LOCATION Agrico South	COORDINATES S 1215 W 200	GROUND ELEVATION 113.1	DATE 11/9/88	
STRATUM MONITORED Upper Sands		INSPECTOR P. L. Nelson		
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh		



METHOD OF INSTALLATION:

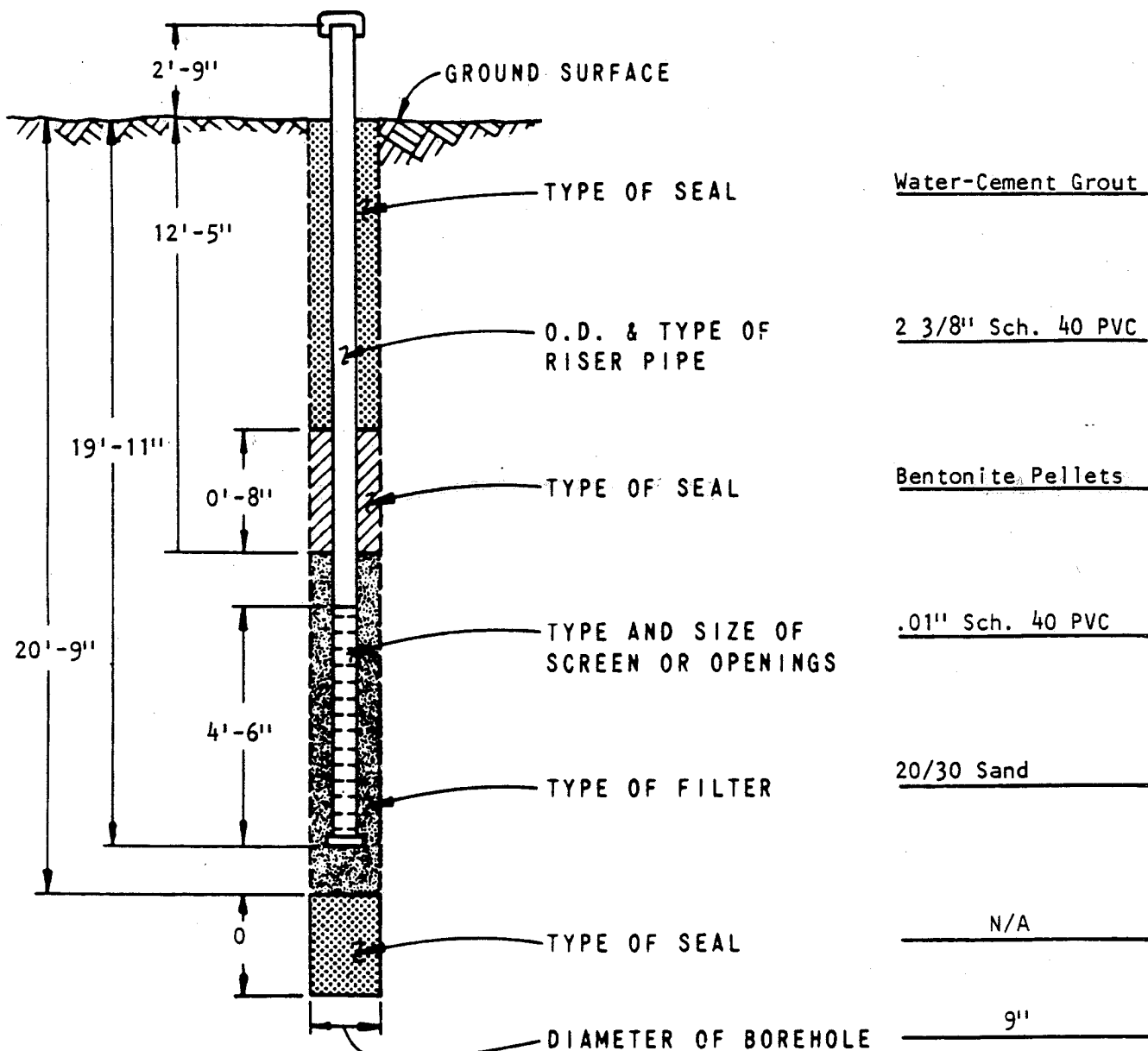
Augered to 20' w/6" ID HSA, washed boring out to 20'-9" w/4 3/4" roller bit, placed 6" sand, installed piezometer, alternated sand and pulling augers, installed pellets, placed grout.

REMARKS:

Grouted to 1'-8" below ground surface. Protection pipe to be installed later. Ground water table was 3'-3" below ground surface after installation of piezometer.



CLIENT Seminole Electric Cooperative, Inc.		PROJECT Combined Cycle		PROJECT NO 14845
PROJECT LOCATION Agrico South	COORDINATES N 2600 E 755	GROUND ELEVATION 126.30	DATE 11/10/88	
STRATUM MONITORED Upper Sands		INSPECTOR P. L. Nelson		
CHECKED BY M. R. Osbourn		APPROVED BY L. J. Almaleh		



METHOD OF INSTALLATION:
Augered to 20' w/ 6" ID HSA, cleaned out hole w/ 4 3/4" roller bit to 20'-9", installed sand, put in piezometer, alternated sand and pulling augers, placed bentonite, installed grout and pulled remaining augers.

REMARKS:
Grout was 2'-2" below ground surface. Protective casing to be added later. Water level was 4'-4" below ground surface after installing piezometer.

PIEZOMETER INSTALLATION REPORT

STONE & WEBSTER ENGINEERING CORP.

 PIEZOMETER NO.
P-3A

 SITE
Seminole Electric Cooperative

 J.O. NO.
18191.04

 DATE 11/17/88 DRILLER Ardaman/R.P. INSPECTOR D. Cregger

 COORDINATES 900 South 1800 East GROUND ELEV. 121.7

 INSTALLED IN BORING adjacent to B-3 ELEV. TOP OF LEADS. _____

 RIG & CREW TIME 11/17/88 to _____

DETAILED INSTALLATION DESCRIPTION:

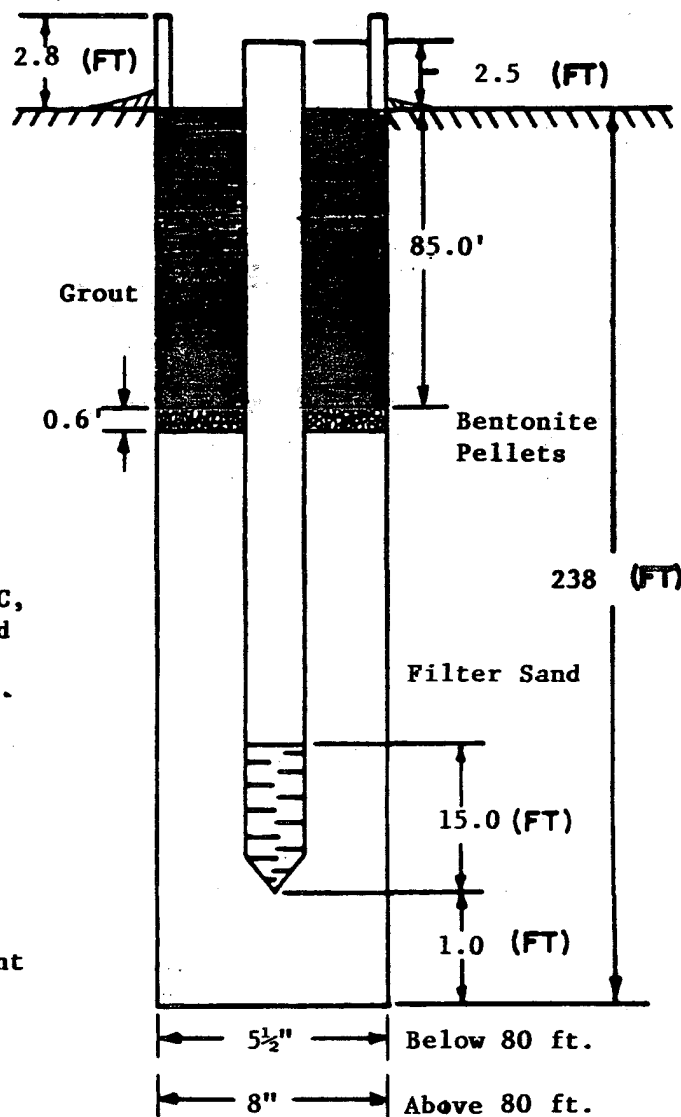
Hole washed with 2 tanks potable water until clear return. PVC placed in bottom of hole and back-filled with sandblast sand (20-30 size). Bentonite pellets dropped for seal, then bentonite grout to surface and concrete in steel guard pipe.

DESCRIPTION OF PIEZOMETER TIP AND STAND PIPE ASSEMBLY

Nominal 2-inch diameter schedule 40 PVC, threaded flush joint couplings, threaded end cap at base. Length = 239 ft. Screen slot size = 0.001.

DESCRIPTION OF SOIL AT TIP ELEVATION:

White limestone w/some amber colored flakes; fairly hard rock w/o significant water loss.



NOTE: SKETCH IN ALL COMPONENTS PERTINENT TO THE INSTALLATION WITH APPLICABLE DIMENSIONS EG: FILTER SAND, SEALS, GROUT, CASING, ETC.

FIELD TEST BORING RECORD COVER SHEET
STONE & WEBSTER ENGINEERING CORP.BORING NO.
P-3A

SITE Seminole Electric Coop/Hardee County	J.O. NO. 18191.04	SHEET 1 OF 3
COORDINATES <u>900 South</u> <u>1800 East</u> GROUND ELEV. <u>121.7</u>		
INCLINATION <u>Vert.</u> BEARING <u>N/A</u> INSPECTOR <u>D.M. Gregger</u>		
Ardaman & Associates		
DATE START/FINISH <u>11/17 /88</u> CONTRACTOR/DRILLER <u>Roger Parker</u>		
STATIC G.W. DEPTH/DATE _____ (FT) / _____ DRILL RIG TYPE <u>Failing 1500</u>		
DEPTH TO BEDROCK <u>32</u> (FT) TOTAL DEPTH DRILLED <u>238.0</u> (FT)		
METHODS :		
DRILLING SOIL <u>8 inch roller bit & 6 inch casing to 80 ft.</u>		
SAMPLING SOIL <u>1½" I.D. Standard Split Spoon, wash samples below 160 ft.</u>		
DRILLING ROCK <u>5 7/8" Tricone roller bit (worn to 5½" Ø)</u>		
SPECIAL TESTING OR INSTRUMENTATION <u>Installed piezometer in lower carbonate rock section, screen depth 222-237 ft.</u>		
COMMENTS <u>Hawthorn formation monitoring and groundwater sampling well adjacent to test broing B-3.</u>		

SUMMARY				NOTES	
SOIL DRILLED <u>238</u> (FT) ROCK CORED <u>0</u> (FT)				1. DATUM IS M.S.L. UNLESS OTHERWISE INDICATED LEGEND FOR FIELD BORING LOGS DISTURBED SAMPLES W - WASH S - SPLIT BARREL (ASTM - D1586 UNLESS OTHERWISE NOTED) E - ENVIRONMENTAL Z - OTHER, DESCRIBE: UNDISTURBED SAMPLES US - SHELBY TUBE UF - STATIONARY (FIXED PISTON) UO - OSTERBERG UP - PITCHER UD - DENISON X - OTHER, DESCRIBE: N - STD PENETRATION RESISTANCE BLOWS/FT (140 LB. HAMMER, UNLESS OTHERWISE NOTED) REC - RECOVERY RQD - ROCK QUALITY DESIGNATION () - INCHES OF SAMPLE RECOVERY NQ - WIRELINE ROCK CORE SAMPLES	
NUMBER SPLIT BARREL SAMPLES <u>3</u>					
NO. & TYPE UNDISTURBED SAMPLES <u>None</u>					
DRILL RIG & CREW TIME _____ (HRS.)					
LIST ALL TEST, INSPECTION, & CALIBRATION RECORDS ATTACHED: _____ <u>Piezometer Installation Report.</u>					
GROUNDWATER (DEPTH BELOW GROUND SURFACE)					
DEPTH	DATE	DEPTH	DATE		
33.5	11/17/88				
36.0	11/18/88				
				APPROVED	DATE

FIELD BORING LOG
STONE & WEBSTER ENGINEERING CORP.

BORING NO.
P-3A

SITE Seminole Electric/Pok-Hardee Site							J.O. NO. 18191.04	SHEET 2 OF 3		
ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOWS/OR REC / ROD	SPT N VALUE	GROUP SYMBOL	DRILLER Ardaman/R.P.		INSPECTOR D. Cregger	
							SAMPLE DESCRIPTION			
121.7	0						<u>Silty Sand:</u> overburden (See log of test boring B-3) Top of rock at 32.0 ft.			
	40						<u>Clayey Sand and Silty Sand:</u> phosphatic sand of upper Hawthorn formation. (see log of test boring B-3) Split Spoon Refusal at 85 ft.			
	100						<u>Silty Clay and Clayey Silt:</u> phosphatic sand of upper Hawthorn formation. (see log of test boring B-3)			
	120	S	24			ML	<u>Gravelly Phosphatic Silt:</u> nonplastic, widely graded, 10-30% limestone gravel, 10-20% mostly fine black phosphate sand; buff to light gray occrust w/black speckling; firm; (Hawthorn Formation).			
	140	S	25	50/2"	50+	ML	<u>Sandy Phosphatic Silt:</u> nonplastic, poorly graded, 2-5% phosphate nodule gravel to ½" max; 15-25% coarse to fine, mostly coarse phosphatic sand; buff to light gray; indurated (very stiff), chaotic internal structure (Hawthorn Formation).			
	160									

FIELD BORING LOG
STONE & WEBSTER ENGINEERING CORP.

BORING NO.
P-3A

SHEET
3 OF 3

SITE
Seminole Electric/AGRICOLA

J.O. NO.
18191.04

DRILLER
Ardaman/E.

INSPECTOR
D. Cregger

ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER	BLOWS/OR REC / ROD	SPT N VALUE	GROUP SYMBOL	SAMPLE DESCRIPTION
20/ft E.O.D. 11/15/88	160	S	26			CL	<u>Silty Clay</u> : slightly to moderately plastic; 5-10% gravel (limestone) to 3/4" max; 5-10% coarse to fine sand; light gray w/greenish gray inclusions (Lower Hawthorn). Clay disturbed, can't determine consistency.
	180						Hard layer 188-189 ft.
	200	W	27				Phosphatic sand in wash cuttings, w/few greenish clay balls, also greenish porcellanite chips
	220						Hard layer 210-211 ft.
	240	W	28				Hard layer 220-238 ft.
238ft E.O.D. 11/16/88	240						Limestone - white cuttings & also clearish brown (aragonite) cuttings. Mud scraped from bit & placed in jar.
	260						Bottom of hole at 238.0 ft.
	280						
	300						

PIEZOMETER INSTALLATION REPORT
STONE & WEBSTER ENGINEERING CORP.

PIEZOMETER NO.

P-10A

SITE

Seminole Electric Coop/Polk-Hardee Site

J.O. NO.

18191.04

DATE 11/28/88 DRILLER R. Parker INSPECTOR D. CreggerCOORDINATES E 4500 N 2190 GROUND ELEV. 127.4INSTALLED IN BORING P-10A ELEV. TOP OF LEADS. _____RIG & CREW TIME full day to install
DETAILED INSTALLATION
DESCRIPTION :

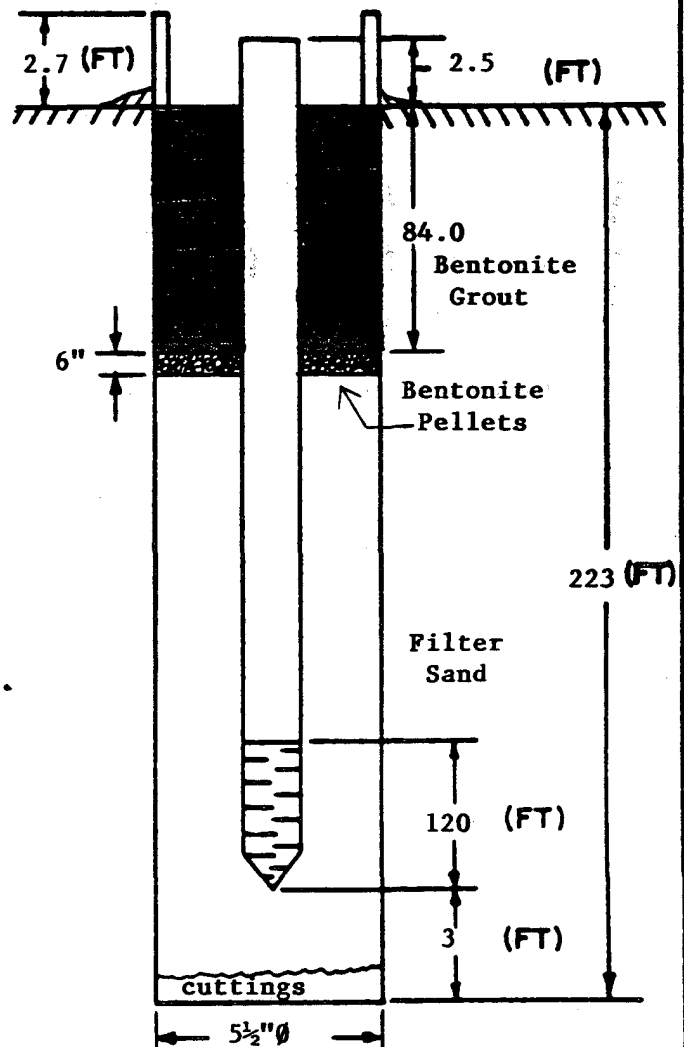
Drill out w/5½"Ø bit and flush hole, silt coming off wall at 100-ft depth. Set screw joint screen & riser then backfill w/uniform fine sand (20-30 size sandblast sand) - used 2400 lb. Place bentonite pellets one-at-a-time and tamp w/weighted tape - used 12 lb tremie grout with 4 bags & 3 lb super gelx per 55 gallon drum - used 13 bags total. Concrete in steel guard pipe later.

DESCRIPTION OF PIEZOMETER TIP
AND STAND PIPE ASSEMBLY

Nominal 2"Ø schedule 40 PVC with threaded-flush joint couplers, in 10-ft sections, conical screw-in tip, slot size = 0.010", by Monoflex, Inc.

DESCRIPTION OF SOIL AT TIP
ELEVATION :

Phosphatic sand and clay with cemented zones - Hawthorne formation (lower).



NOTE : SKETCH IN ALL COMPONENTS PERTINENT TO THE INSTALLATION WITH APPLICABLE DIMENSIONS EG : FILTER SAND, SEALS, GROUT, CASING, ETC.

FIELD TEST BORING RECORD COVER SHEET
STONE & WEBSTER ENGINEERING CORP.BORING NO.
P-10A

SITE Seminole Electric Coop/Polk-Hardee Site	J.O. NO. 18191.04	SHEET 1 OF 3
COORDINATES E4500 N2190 GROUND ELEV. 127.4		
INCLINATION VERT BEARING N/A INSPECTOR D. Gregger		
DATE: START/FINISH 11/21/88 CONTRACTOR/DRILLER Ardaman/R. Parker		
STATIC G.W. DEPTH/DATE (FT) / DRILL RIG TYPE Failing 1500		
DEPTH TO BEDROCK 31.0 (FT) TOTAL DEPTH DRILLED 223 (FT)		
METHODS:		
DRILLING SOIL 8-inch roller bit and 6-inch casing to 80 ft.		
SAMPLING SOIL Wash samples.		
DRILLING ROCK 5 7/8-inch hard rock roller bit to bottom of hole		
SPECIAL TESTING OR INSTRUMENTATION Installed Piezometer		
COMMENTS Hawthorne formation water quality well.		

SUMMARY				NOTES																	
8" cased SOIL DRILLED 80 (FT) 5 1/2" uncased ROCK CORED 143 (FT)				I. DATUM IS M.S.L. UNLESS OTHERWISE INDICATED LEGEND FOR FIELD BORING LOGS DISTURBED SAMPLES W - WASH S - SPLIT BARREL (ASTM - D1586 UNLESS OTHERWISE NOTED) E - ENVIRONMENTAL Z - OTHER, DESCRIBE: UNDISTURBED SAMPLES US - SHELBY TUBE UF - STATIONARY (FIXED PISTON) UO - OSTERBERG UP - PITCHER UD - DENISON X - OTHER, DESCRIBE: N - STD PENETRATION RESISTANCE BLOWS/FT (140 LB. HAMMER, UNLESS OTHERWISE NOTED) REC - RECOVERY RQD - ROCK QUALITY DESIGNATION () - INCHES OF SAMPLE RECOVERY NQ - WIRELINE ROCK CORE SAMPLES																	
NUMBER SPLIT BARREL SAMPLES 0																					
NO. & TYPE UNDISTURBED SAMPLES 0																					
DRILL RIG & CREW TIME (HRS.)																					
LIST ALL TEST, INSPECTION, & CALIBRATION RECORDS ATTACHED:																					
GROUNDWATER (DEPTH BELOW GROUND SURFACE) <table border="1" style="width:100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width:15%;">DEPTH</th> <th style="width:15%;">DATE</th> <th style="width:15%;">DEPTH</th> <th style="width:15%;">DATE</th> </tr> </thead> <tbody> <tr> <td>8.3</td> <td>11/28/88</td> <td></td> <td></td> </tr> <tr> <td>9.9</td> <td>11/29/88</td> <td></td> <td></td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>						DEPTH	DATE	DEPTH	DATE	8.3	11/28/88			9.9	11/29/88						
DEPTH	DATE	DEPTH	DATE																		
8.3	11/28/88																				
9.9	11/29/88																				
APPROVED				DATE																	

FIELD BORING LOG
STONE & WEBSTER ENGINEERING CORP.

BORING NO.
P-10A

SHEET
2 OF 3

SITE						J.O. NO.	INSPECTOR
Seminole Electric Coop/Polk- Hardee Site						18191.04	D. Cregger
ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER		GROUP SYMBOL	SAMPLE DESCRIPTION	
127.4	0					Sand: poorly graded, mostly fine grained; white. <u>Reclaimed mine land.</u>	
	20					Top of "rock" (mine pit bottom) @ 31 ft.	
		W	1	30	31'	<u>Cemented Yellow Brown Sandy Clay:</u>	
				35	35'	Some chips of bone flake.	
	40	W	2	45	42'	<u>Yellow Brown and Gray to White Lime Rock Frags:</u>	
				50		Some pebbles.	
		W	3	55	53'	<u>Calcareous Clay:</u> Mostly white lime rock fragments w/clay balls. Salt & pepper sand.	
	57.0			60		<u>Dark Gray Clay:</u> dark gray clay w/black sand.	
	60	W	4	65	67'	Hawthorn Formation.	
				70	68.5'	Cemented clayey sand at 67-68.5 & 78-81 ft.	
		W	5	80	78'	<u>Phosphatic Sandy Clay:</u> dark gray clay in bit for casing seat; cuttings mostly light gray "salt & pepper" limestone & some buff limestone, only occ yellow brown limestone.	
81.0	80			80	81'	<u>Phosphatic Sand:</u> light gray to buff (no clay balls) limestone fragments as above; w/rope-like organics.	
	85			85		<u>Phosphatic Sand:</u> light gray to buff w/black specks; fast drilling	
	90	W	6	90	89'	<u>Dark Gray Clay:</u> greenish gray soft sticky clay w/phosphate sand.	
	100						
	105			105			
	110	W	7	110			
	120						
	125			125			
	130	W	8	130			
	140						
	145			145	147'	<u>Phosphatic Sand:</u> light gray to buff w/black phosphate fragments; cemented at 151-157 ft.	
	150	W	9	150	148'		
					151'		
	160				157'		

SHEET
3 OF 3

SITE						J. O. NO.	SHEET
Seminole Electric Coop/Polk-Hardee Site						18191.04	3 OF 3
ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER		GROUP SYMBOL	SAMPLE DESCRIPTION	
	160	W	10	160		<u>Clay:</u> mixed buff-gray and dark greenish gray moderately plastic clay with phophatic sand and limestone fragments. 175 **** 180 **** Porcellanite marker bed at 180ft (very hard) <u>Clay:</u> gray moderately plastic, with phosphate sand. Trace of clearish green porcellanite chips in wash. 187 **** 193 **** 200 **** <u>Clay:</u> light gray w/phosphate. Extremely hard, <u>amber colored chert</u> at 204 underlain by brown clay. 201 **** 204 **** 215 <u>Cemented Clay:</u> light gray clay and phosphate sand. Hard layer 1½ ft thick. 220 ****	
				165			
	180	W	11	180			
				185			
				187			
				193			
	200	W	12	200			
				205			
				215			
	220			220			
				219.5		Total Depth: 223.0 ft.	
				221		$\begin{array}{r} -127.4 \\ 95.6 = -95.6 \text{ MSL} \end{array}$	
	240						
	260						

PIEZOMETER INSTALLATION REPORT

STONE & WEBSTER ENGINEERING CORP.

SITE Seminole Electric Coop/Polk-Hardee Site		PIEZOMETER NO. P-12A
		J.O. NO. 18191.04
DATE 12/2/88	DRILLER R. Parker	INSPECTOR D. Cregger
COORDINATES from map E 1070 N2620	GROUND ELEV. 126.3	
INSTALLED IN BORING P-12A		ELEV. TOP OF LEADS.
RIG & CREW TIME 7:30 a.m. - 2:00 p.m.		

DETAILED INSTALLATION DESCRIPTION :

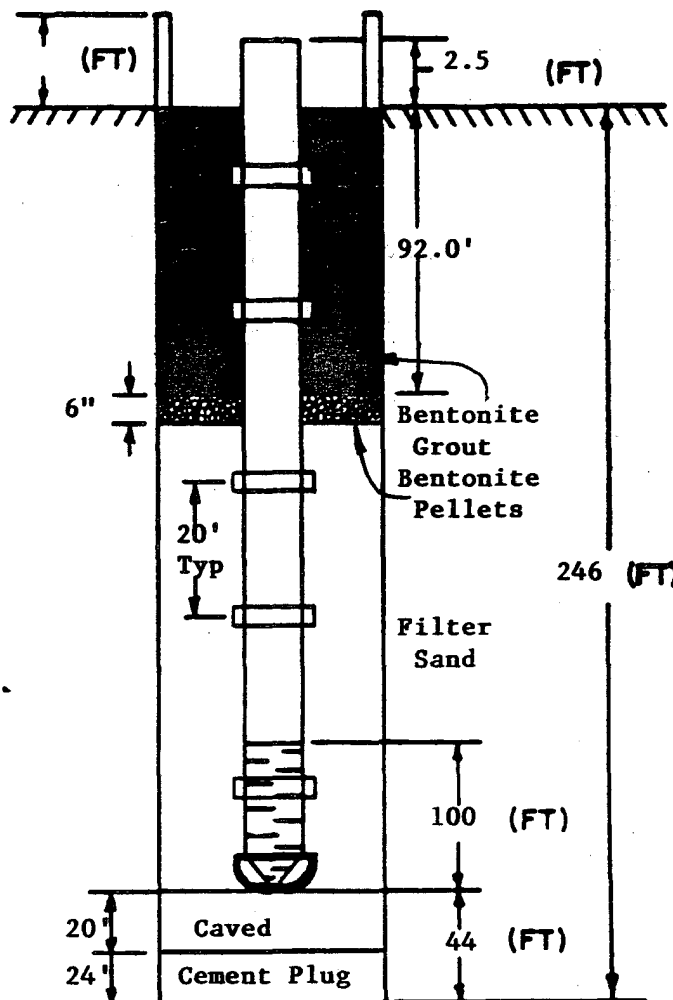
Tremie grouted cement plug into water loss zone at 241ft and set overnight. Place 1½ bag sand in a.m. and it bridged on laitance layer. Glued couplers on way down and place sand (20-30 size) to 9.5ft above screen - total 2500 lb. Place bentonite and tamped to 6" thick - 12lb. Pulled casing and tremie grout to surface.

DESCRIPTION OF PIEZOMETER TIP AND STAND PIPE ASSEMBLY

Nominal 2"Ø schedule 40 PVC with glued couplers, in 20ft sections. PVC end cap for 0.010-inch slot size PVC screen.

DESCRIPTION OF SOIL AT TIP ELEVATION :

Phosphatic Sand:
fine grained gray w/black speckles;
w/occ sandy clay interbeds.



NOTE : SKETCH IN ALL COMPONENTS PERTINENT TO THE INSTALLATION WITH APPLICABLE DIMENSIONS EG : FILTER SAND, SEALS, GROUT, CASING, ETC.

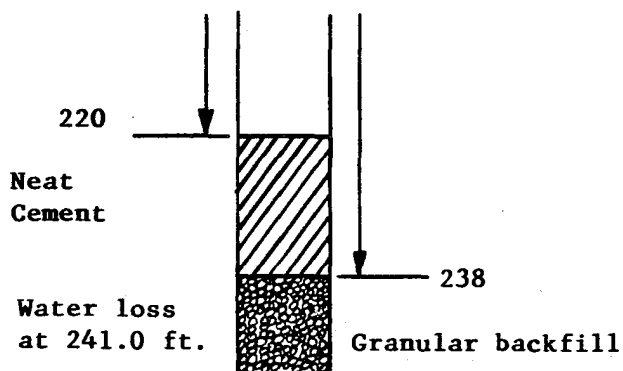
BOREHOLE BACKFILL INSPECTION REPORT
STONE & WEBSTER ENGINEERING CORP.BORING NO.
P-12ASITE
Seminole Electric Coop/Polk-Hardee SiteJ.O. NO.
18191.04DATE 12/1/88 DRILLER R. Parker INSPECTOR D. CreggerMETHOD(S) : ☐ SOIL BACKFILL ☒ TREMIE GROUTHOLE DEPTH 246 (FT) HOLE DIAMETER 6" = 0.5 (FT) = 0.196 ft³/ftCASING LEFT IN PLACE (DIA/LENGTH) none (IN./FT)RIG & CREW TIME 10:30 a.m.-12:30 p.m. ☒ CLEANUP SATISFACTORY
☐ LOCATION MARKED WITH STAKE

GROUT RECORD

CEMENT TYPE Florida Lafarge BAG WEIGHT 94lb NO. BAGS USED 5 20 gallons in pumpDETAILS OF MIX : WATER 6 gallons CEMENT 1 bag BENTONITE 0 %1.7' in the barrel x 1.9'Ø -> 2.8ft³/ft -> 4.8 ft³ = 36 gallons

STAGE NO.	DEPTH (FT.)	GROUT TAKE SACKS
<u>1</u>	<u>239 - ?</u>	<u>0.3' x 2.8 = 0.8 ft³ = 6 gallons</u>
<u>2</u>	<u>? - 220 ft</u>	<u>1.2' x 2.8 = 3.3ft³ = 25 gallons</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

COMMENTS : (IF BACKFILL IS BY COMBINATION OF METHODS, SKETCH AND SHOW DEPTHS)



FIELD TEST BORING RECORD COVER SHEET
STONE & WEBSTER ENGINEERING CORP.

BORING NO.

P-12A

SITE

Seminole Electric Coop/Polk-Hardee

J.O. NO.

18191.04

SHEET

1 OF 3

COORDINATES from map
E1070 ± N2620 ± GROUND ELEV. 126.3

INCLINATION VERT BEARING N/A INSPECTOR D. Cregger

DATE: START/FINISH 11/29 / 88 CONTRACTOR / DRILLER Ardaman/R. Parker

STATIC G.W. DEPTH/DATE (FT) / DRILL RIG TYPE Failing 1500

DEPTH TO BEDROCK 29.5 (FT) TOTAL DEPTH DRILLED (FT)

METHODS:

DRILLING SOIL 4½" pilot hole to 80', then 8"Ø + casing to seat at 74'SAMPLING SOIL wash samples in screenDRILLING ROCK 5½"Ø hard rock bit to bottom of holeSPECIAL TESTING OR INSTRUMENTATION Installed piezometer

COMMENTS

SUMMARY

Cased
SOIL DRILLED 74 (FT) ROCK CORED (FT)NUMBER SPLIT BARREL SAMPLES 0NO. & TYPE UNDISTURBED SAMPLES 0DRILL RIG & CREW TIME None (HRS.)LIST ALL TEST, INSPECTION, & CALIBRATION
RECORDS ATTACHED:Piezometer installation report

GROUNDWATER (DEPTH BELOW GROUND SURFACE)

DEPTH	DATE	DEPTH	DATE
71 ft	12/1/88		

NOTES

1. DATUM IS M.S.L. UNLESS OTHERWISE INDICATED
LEGEND FOR FIELD BORING LOGS

DISTURBED SAMPLES

W - WASH

S - SPLIT BARREL (ASTM - D1586 UNLESS
OTHERWISE NOTED)

E - ENVIRONMENTAL

Z - OTHER, DESCRIBE:

UNDISTURBED SAMPLES

US - SHELBY TUBE

UF - STATIONARY (FIXED PISTON)

UO - OSTERBERG

UP - PITCHER

UD - DENISON

X - OTHER, DESCRIBE:

N - STD PENETRATION RESISTANCE BLOWS/FT
(140 LB. HAMMER, UNLESS OTHERWISE NOTED)

REC - RECOVERY

RQD - ROCK QUALITY DESIGNATION

() - INCHES OF SAMPLE RECOVERY

NQ - WIRELINE ROCK CORE SAMPLES

APPROVED

DATE

FIELD BORING LOG
STONE & WEBSTER ENGINEERING CORP.

BORING NO.
P-12A

SITE						J.O. NO.	SHEET		
Seminole Electric Coop/Polk-Hardee Site						18191.04	2 OF 3		
ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER		GROUP SYMBOL	DRILLER R. Parker		INSPECTOR D. Cregger	
						SAMPLE DESCRIPTION			
126.3	0					Top Soil to 3.0 ft then brown subsoil to 6.0 ft Unmined land (pasture).			
		W	1	10	SC	<u>Clayey Sand</u> : fine grained w/mod. plastic fines (from bit sample), white w/occ black coarse sand inclusions.			
	20			15					
		W	2	20	SP	<u>Phosphatic Sand</u> : coarse to fine sand w/trace of silt and clay; light gray w/balck coarse phosphate.			
				25					
		W	3	30	SC	<u>Phosphatic Clayey Sand</u> : coarse to fine sand, gray to yellow-brown w/chips of yellow-brown limestone (pit bottom)			
				32					
				35					
	40			40					
		W	4	41	SC	<u>Phosphatic Clayey Sand</u> : similar to above except w/occ phosphate gravel to 3/8" max, all tan.			
				45					
				46					
				47					
		W	5	50	SM	<u>Phosphatic Silty Sand</u> : coarse to fine sand, tan w/ phosphate gravel to 3/8" max. ;			
				53					
	60			60					
		W	6	62	ML	<u>Phosphatic Silt</u> : fine sand in dark gray slightly plastic silt.			
				65					
				70					
		W	7	74	ML-	<u>Phosphatic Organic Silt</u> : mostly fine sand in dark gray to dark brownish gray slightly plastic silt.			
			76						
			78						
80			80						
	W	8	81	ML	<u>Phosphatic Silt</u> : coarse to fine sand and light gray silt, some limestone chips in wash.				
			85						
			90						
	W	9	95	ML	<u>Phosphatic Silt</u> : same as above except whiter and trace cohesive clay.				
100			100						
	W	10	105	ML	<u>Phosphatic Silt</u> : mostly fine sand and silt with dark gray cohesive clay on top of hard layer at 105.5'.				
			107						
			112						
			115						
120			122	SP	<u>Phosphatic Sand</u> : fine grained sand w/some silt and occ hard cemented layers, light to medium gray. Fast drilling between hard layers.				
			125						
			126						
			132						
			135						
140			138	SC	<u>Phosphatic Clayey Sand</u> : medium to fine grained sand in clayey matrix, light gray.				
			140						
			145						
	W	12	150	SC	<u>Phosphatic Clayey Sand</u> : same as above, atternately white clay and medium gray clay in washed cuttings.				
	W	13	155						

FIELD BORING LOG
STONE & WEBSTER ENGINEERING CORP.

BORING NO.

P-12A

SITE

Seminole Electric Coop/Polk-Hardee Site

J.O. NO.

18191.04

SHEET

3 OF 3

ELEV.	DEPTH (FEET)	SAMPLE TYPE	SAMPLE NUMBER		GROUP SYMBOL	DRILLER	INSPECTOR
						R. Parker	D. Cregger
SAMPLE DESCRIPTION							
	160	W	14	160	CL	<u>Sandy Clay</u> : coarse to fine sand in a greenish-clay; slow drilling.	
				170			
	180			185		<u>Phosphatic Sand</u> : mostly fine sand, gray w/ black speckles; fast drilling	
		W	15	186	SP		
				195			
	200			210		<u>Phosphatic Sand</u> : mostly fine grained, gray w/ black speckles; fast drilling. :	
		W	16	220	SP		
	220			224		<u>Phosphatic Sandy Clay</u> : brown and gray clay lumps and chips of buff to white limerock.	
		W	17	225	CL-		
		W	18	230	LS	<u>Limestone</u> : buff limerock chips w/some med. brown clay lumps and the amber chert marker bed.	
				235	LS		
		240		241		Lost circulation at 241'; very soft drilling to 246' total depth.	

LABORATORY TEST RESULTS
Agrico - South Site
Seminole Electric Cooperative, Inc.

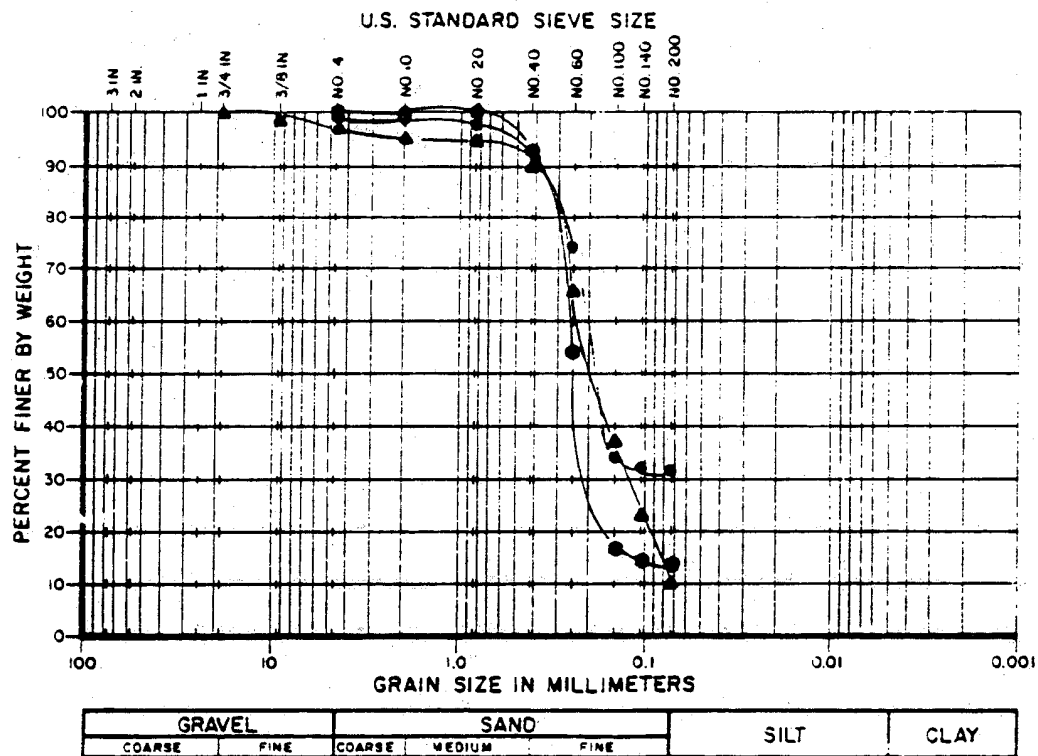
Sample Number	Depth Ft.	Water Content Percent	Dry Density P.C.F.	Liquid Limit Percent	Plastic Limit Percent	Permeability Coefficient cm/sec	Organic Content Percent	Minus 200 Percent
B-1								
2	2.5 - 4.0	15.6	---	---	---	---	2.32	10.5
TW-4	7.5 - 9.5	18.4	113.3	32.4	13.9	---	---	30.0
TW-6	15.0 - 17.0	25.8	98.4	29.4	15.2	---	---	---
TW-8	25.0 - 27.0	34.4	86.5	---	---	---	---	3.0
10	35.0 - 36.5	38.3	---	53.3	29.4	---	---	24.0
14	65.0 - 66.5	65.8	---	107.1	41.9	---	---	32.4
17	70.0 - 71.5	39.4	---	---	---	---	---	15.2
22	95.0 - 96.5	27.6	---	32.1	26.6	---	---	50.8
B-2								
2	2.5 - 4.0	15.9	---	---	---	---	1.0	26.7
4	7.5 - 9.0	16.8	---	28.0	11.1	---	---	20.4
TW-5	10.0 - 12.0	24.8	104.0	115.1	21.9	---	---	31.0
TW-6	15.0 - 17.0	46.8	74.5	88.0	16.0	---	---	---
8	25.0 - 26.5	29.6	---	---	---	---	---	36.1
TW-10	35.0 - 36.0	44.2	81.4	95.7	41.2	---	---	56.0
12	45.0 - 46.5	63.1	---	71.3	30.5	---	---	34.5
14	55.0 - 56.5	38.5	---	54.0	32.9	---	---	53.7
17	70.0 - 71.5	33.8	---	---	---	---	---	6.1
19	80.0 - 81.5	77.4	---	65.6	40.9	---	---	50.0
23	100.0 - 101.5	37.6	---	53.7	35.8	---	---	63.0
B-3								
2	2.5 - 4.0	7.9	---	---	---	---	0.93	36.0
5	10.0 - 11.5	16.4	---	---	---	---	---	24.3
TW-6	15.0 - 17.0	36.0	86.9	114.0	20.0	---	---	---
TW-7	20.0 - 22.0	70.4	59.0	109.7	26.1	---	---	94.0
TW-9	30.0 - 31.5	56.3	69.7	185.2	57.3	---	---	---
10	35.5 - 36.5	43.2	---	---	---	---	---	16.6
	40.0 - 41.5	30.4	---	---	---	---	---	64.5
	55.0 - 56.5	67.7	---	---	---	---	---	38.7
	60.0 - 61.5	53.2	---	---	---	---	---	29.8
	65.0 - 67.0	72.9	59.5	179.0	61.0	---	---	73.0

LABORATORY TEST RESULTS
Agrico - South Site
Seminole Electric Cooperative, Inc.

Sample Number	Depth Ft.	Water Content Percent	Dry Density P.C.F.	Liquid Limit Percent	Plastic Limit Percent	Permeability Coefficient cm/sec	Organic Content Percent	Minus 200 Percent
B-3								
17	70.0 - 71.5	44.7	---	---	---	---	---	13.8
19	80.0 - 81.5	40.7	---	46.0	27.8	---	---	52.9
21	90.0 - 91.5	35.9	---	---	---	---	---	33.8
23	100.0 - 101.5	35.8	---	---	---	---	---	60.5
B-4								
TW-5	10.0 - 12.0	19.0	112.3	78.0	16.1	---	---	27.0
TW-6	15.0 - 17.0	---	---	---	---	---	---	---
9	30.0 - 31.5	42.2	---	63.3	28.7	---	---	25.3
12	45.0 - 46.5	58.7	---	97.7	43.8	---	---	48.1
16	65.0 - 66.5	35.3	---	---	---	---	---	8.0
21	90.0 - 91.5	30.3	---	34.6	30.5	---	---	28.9
B-5								
2	2.5 - 4.0	20.2	---	---	---	---	1.22	39.4
TW-4	7.5 - 9.5	18.0	110.6	28.0	12.1	6.7×10^{-6}	---	33.0
TW-6	15.0 - 17.0	51.0	71.4	123.2	25.7	1.2×10^{-7}	---	48.0
10	35.0 - 36.5	19.4	---	---	---	---	---	9.7
12	45.0 - 46.5	25.3	---	---	---	---	---	14.9
16	65.0 - 66.5	29.1	---	---	---	---	---	36.9
18	75.0 - 76.5	28.7	---	---	---	---	---	36.9
20	85.0 - 86.5	53.5	---	64.2	28.3	---	---	31.5
23	100.0 - 101.5	37.0	---	---	---	---	---	60.5
B-6								
1	0.0 - 1.5	5.4	---	---	---	---	---	7.2
5	10.0 - 11.5	19.5	---	22.4	10.4	---	---	19.4
7	20.0 - 21.5	24.7	---	---	---	---	---	14.8
9	35.0 - 36.5	41.1	---	---	---	---	---	32.6
B-7								
TW-6	15.0 - 17.0	64.7	60.2	176.5	50.4	---	---	46.0
8	25.0 - 26.5	29.1	---	62.8	24.3	---	---	64.5
12	45.0 - 45.7	34.2	---	55.9	35.0	---	---	33.4

LABORATORY TEST RESULTS
Agrico - South Site
Seminole Electric Cooperative, Inc.

Sample Number	Depth Ft.		Water Content Percent	Dry Density P.C.F.	Liquid Limit Percent	Plastic Limit Percent	Permeability Coefficient cm/sec	Organic Content Percent	Minus 200 Percent
B-8									
2	1.5	- 3.0	5.9	---	---	---	---	2.3	32.3
3	5.0	- 6.5	5.7	---	---	---	---	---	10.0
5	10.0	- 11.5	15.6	---	---	---	---	---	21.6
TW-7	20.0	- 22.0	41.8	77.0	86.4	18.6	---	---	
TW-8	25.0	- 27.0	47.5	74.4	152.9	28.0	---	---	
TW-10	35.0	- 37.0	39.9	80.2	92.7	46.6	---	---	18.0
13	50.0	- 51.5	26.2	---	---	---	---	---	44.3
14	55.0	- 56.5	40.4	---	---	---	---	---	30.9
15	60.0	- 66.5	26.7	---	---	---	---	---	14.3
17	70.0	- 71.5	46.8	---	---	---	---	---	13.6
19	80.0	- 81.5	54.9	---	---	---	---	---	46.8
B-9									
4	7.5	- 7.9	19.4	---	---	---	7.4x10 ⁻⁹	8.2	46.4
TW-6	15.0	- 17.0	35.4	89.2	111.0	24.1		---	51.0
TW-8	25.0	- 27.0	72.7	57.4	105.2	43.8		---	54.0
TW-10	35.0	- 37.0	85.7	50.3	197.8	80.9		---	
11	40.0	- 41.5	72.2	---	124.4	40.5		---	71.0
15	60.0	- 61.5	39.1	---	---	---	---	---	13.0
18	75.0	- 75.1	47.8	---	---	---	---	---	54.9
22	95.0	- 96.5	25.2	---	non-plastic		---	---	13.2
B-10									
1	0.0	- 1.5	12.4	---	---	---	---	---	14.3
2	2.5	- 3.0	24.4	---	---	---	---	---	3.8
5	10.0	- 11.5	28.5	---	---	---	---	---	2.1
7	20.0	- 21.5	25.9	---	---	---	---	---	2.2
8	25.0	- 26.5	56.8	---	83.1	26.9	---	---	79.6
10	35.0	- 36.5	39.6	---	---	---	---	---	40.1
11	40.0	- 41.5	37.6	---	---	---	---	---	14.3
13	50.0	- 51.5	53.4	---	---	---	---	---	55.9
15	60.0	- 61.5	44.8	---	55.5	34.3	---	---	48.6
18	75.0	- 76.5	13.1	---	---	---	---	---	33.3
19	80.0	- 81.5	42.0	---	---	---	---	---	52.4
22	95.5	- 96.5	53.1	---	---	---	---	---	55.6



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
1	2	2.5-4'	▲		
1	17	70-71.5'	●		
1	14	65-66.5'	●		

GRAIN SIZE DISTRIBUTION

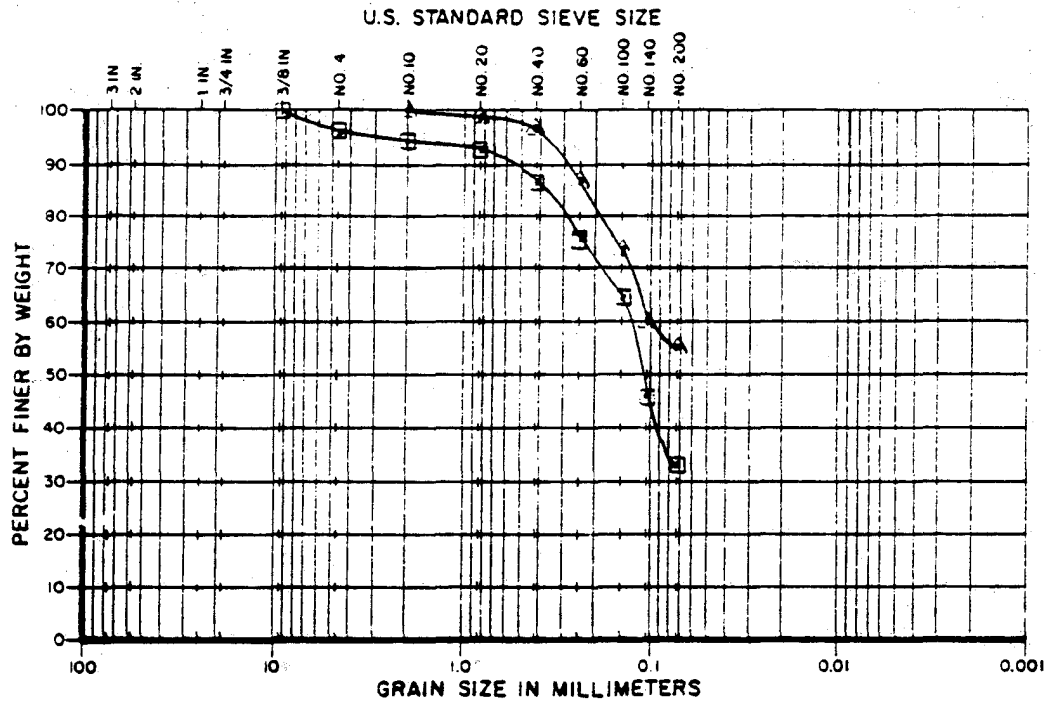
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440 MV COMBUSTION TURBINE
AGRIC
SOUTH SITE

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GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
2	TW-10	35-36'	△		
2	TW-5	10-12'	□		

GRAIN SIZE DISTRIBUTION

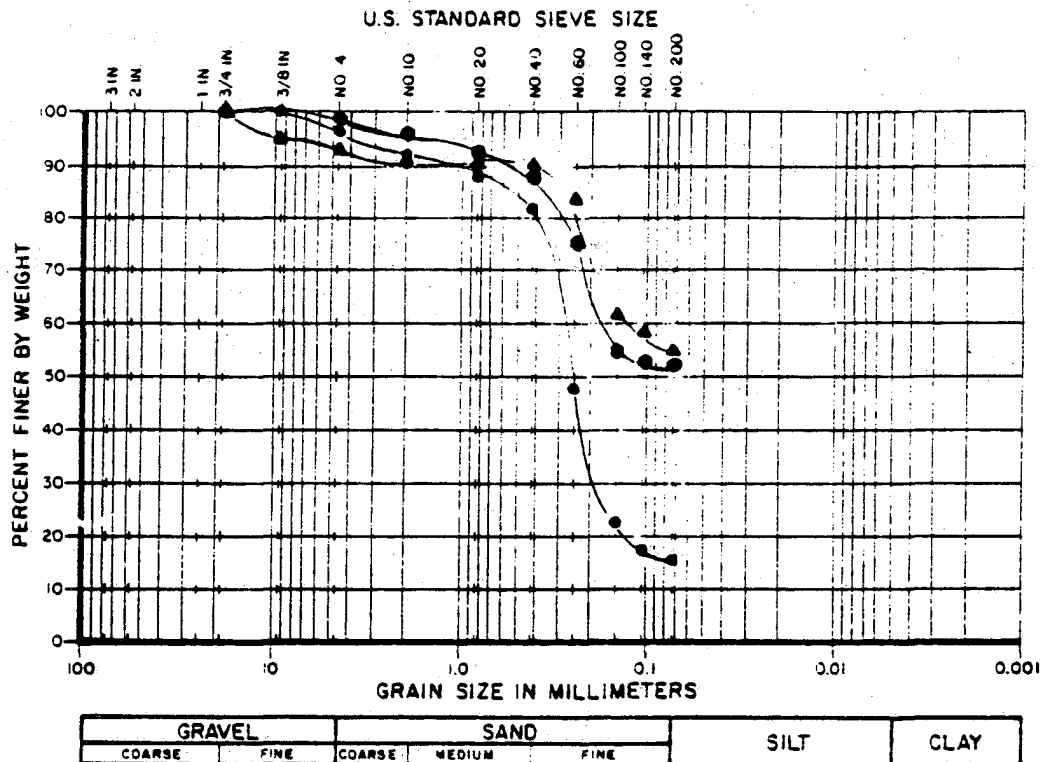
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
3	10	35-38.5'	●		
2	14	55-58.5'	●		
9	18	75-78.5'	▲		

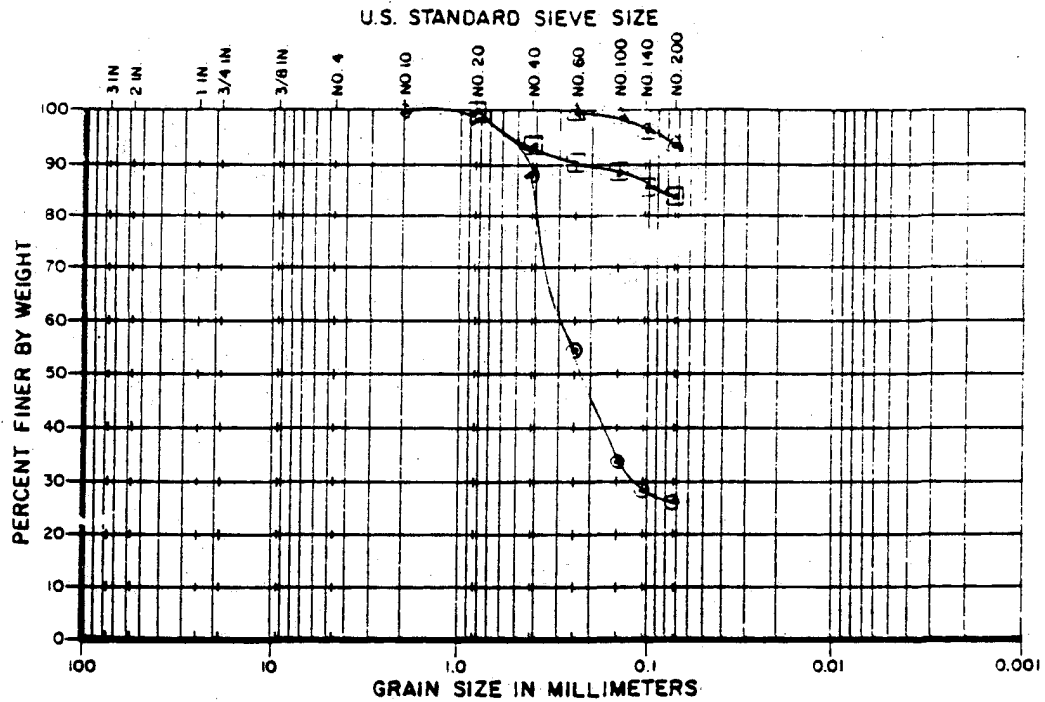
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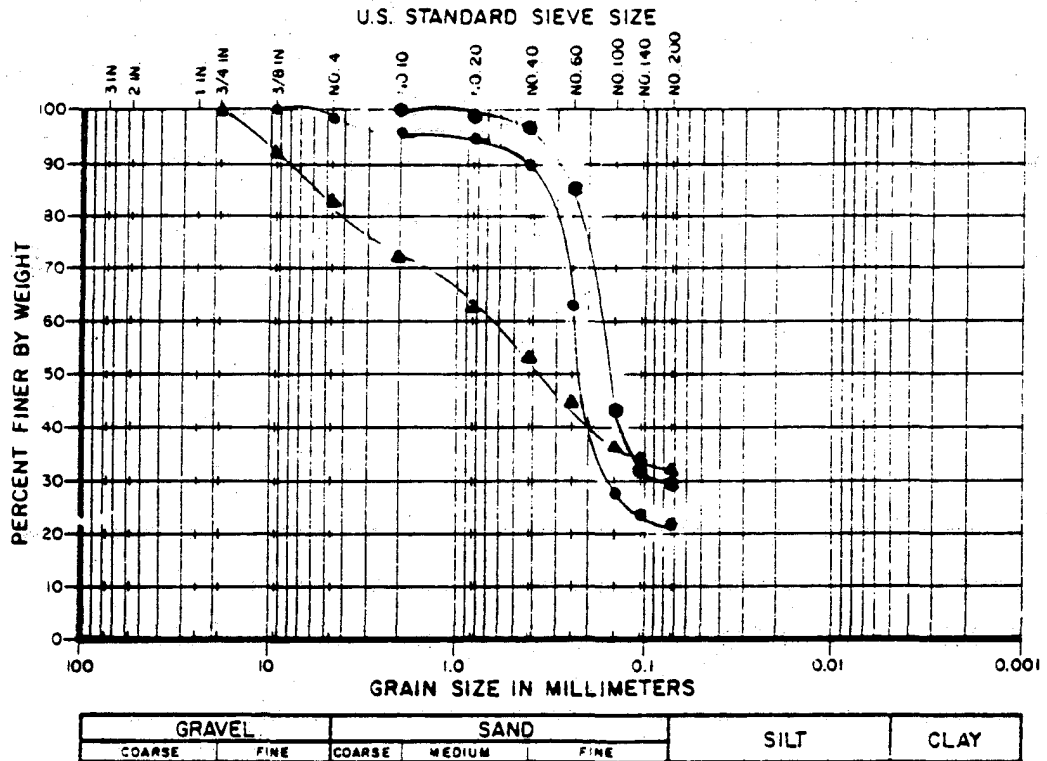


GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
3	TW-6	20-22'	△		
3	TW-16	65-67'	□		
4	TW-5	10-12'	○		

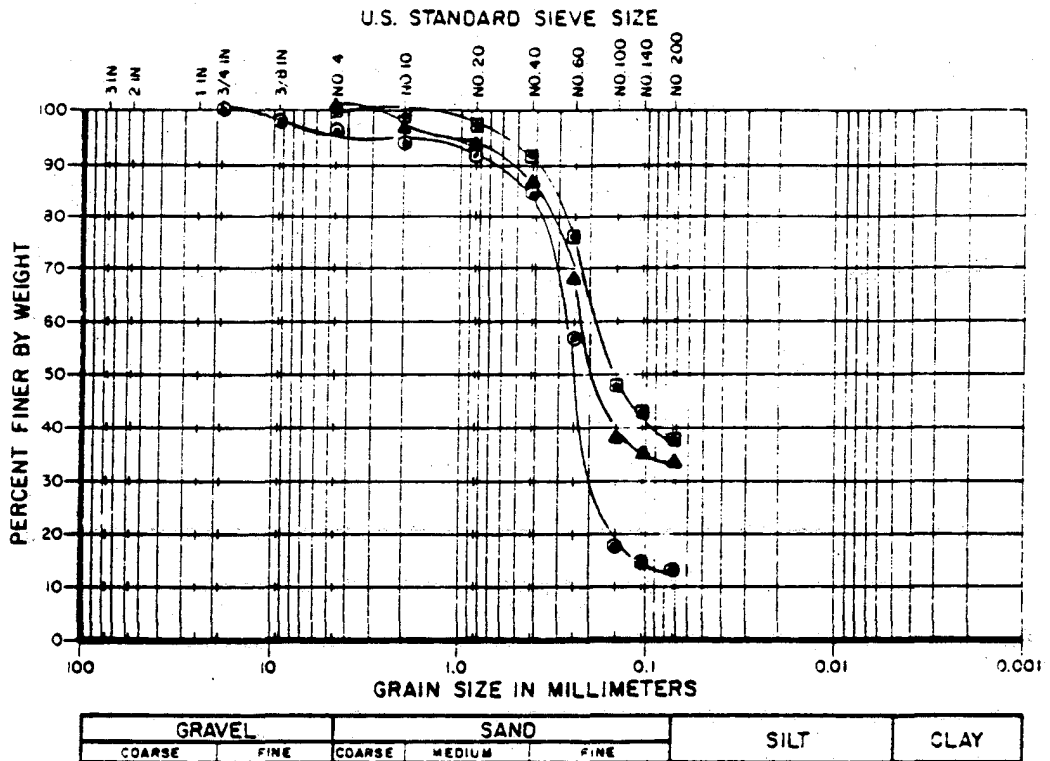
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
8	5	10-11.5'	●		
3	21	90-91.5'	▲		
3	15	60-61.5'	●		

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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
3	14	55-56.5'	□		
2	12	45-46.5'	▲		
8	15	60-61.5'	●		

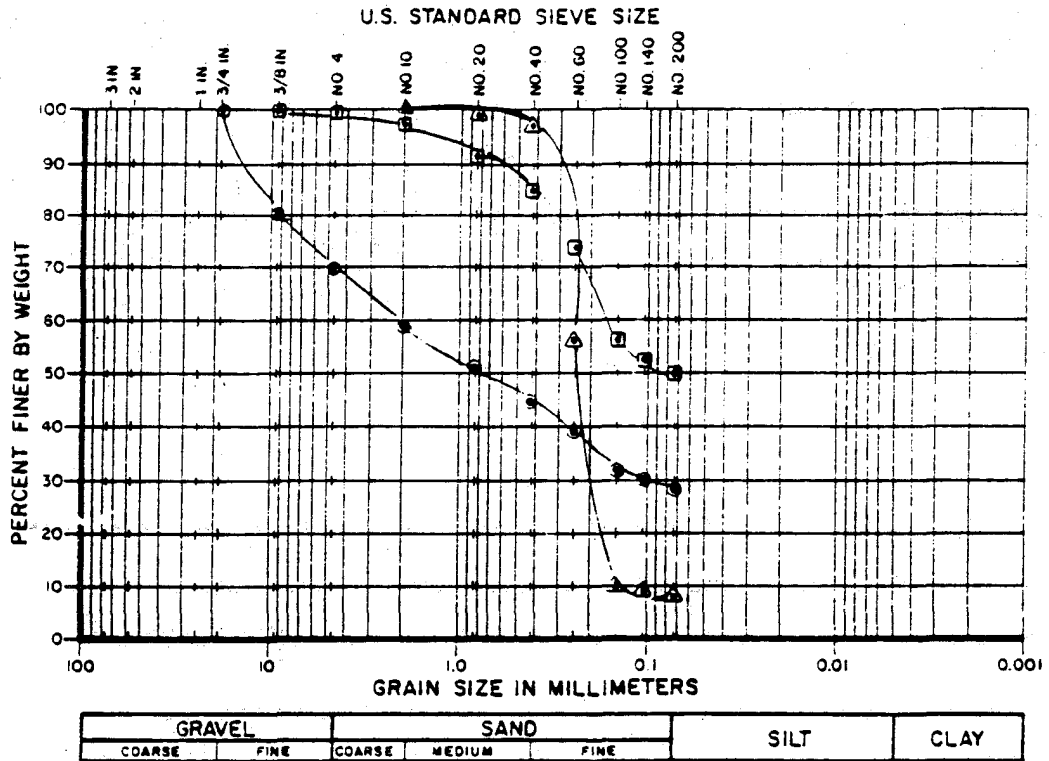
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SOUTH SITE

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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
4	21	45-46.5'	⊙		
4	16	65-66.5'	△		
1	22	95-96.5'	□		

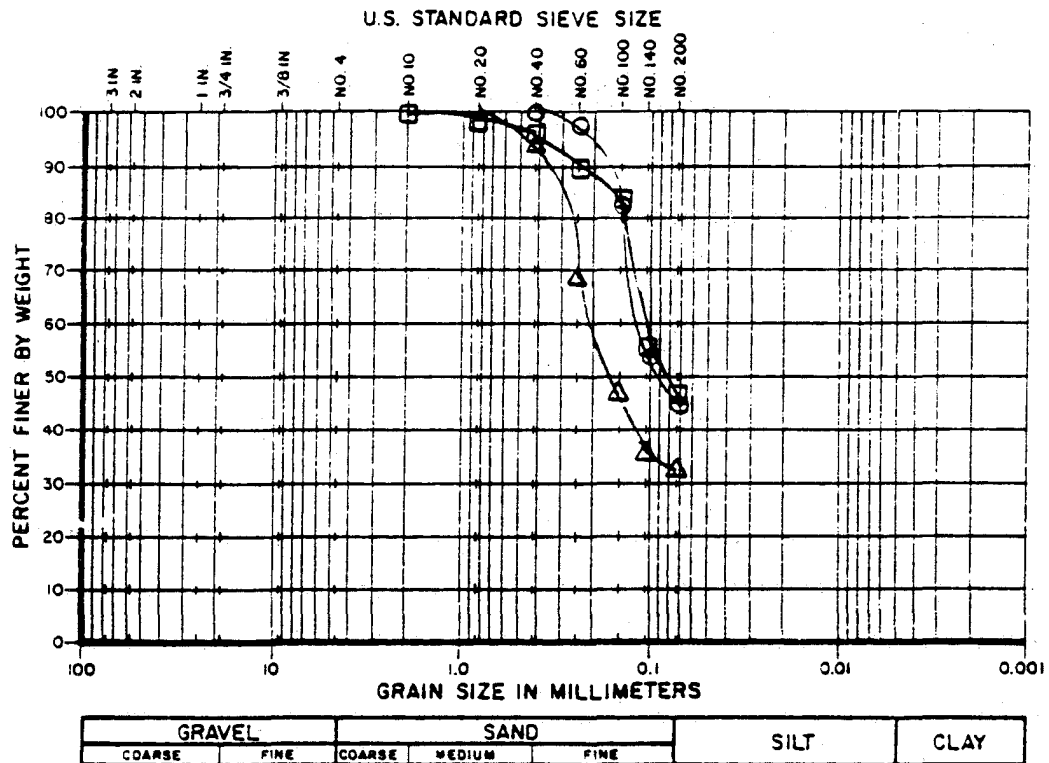
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
5	TW-4	7.5-9.5'	Δ		
5	TW-6	15-17'	◻		
7	TW-6	15-17'	⊙		

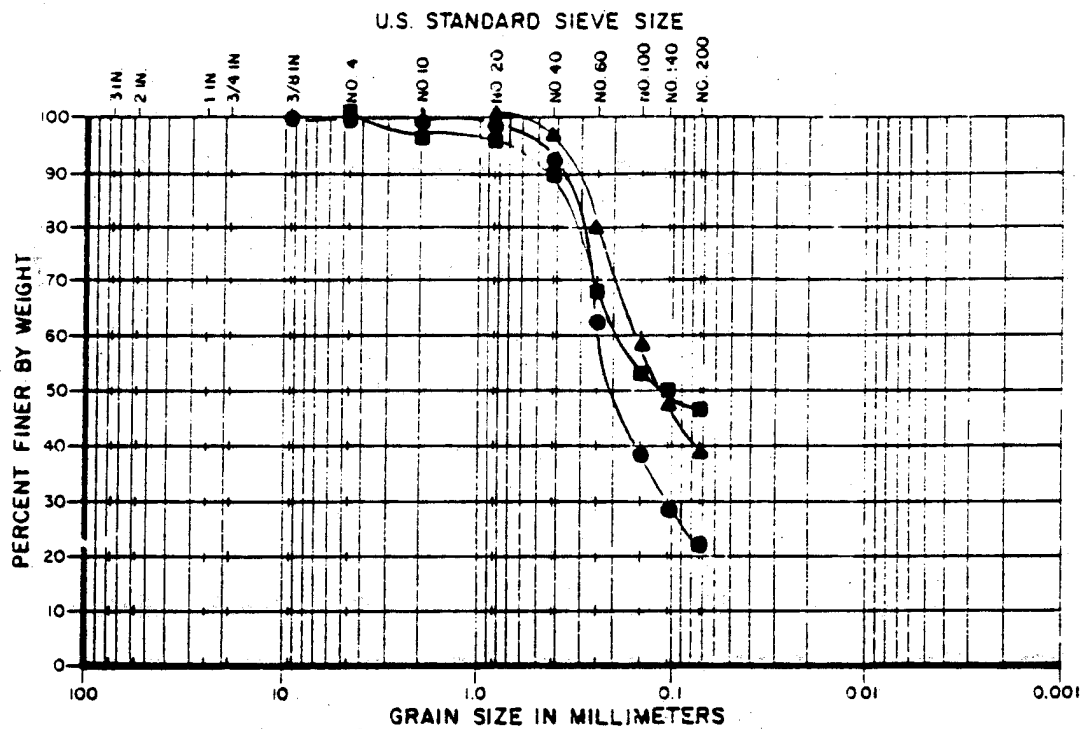
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
2	4	7.5-9.0'	●		
9	4	7.5-9.0'	■		
5	2	2.5-4.0'	▲		

GRAIN SIZE DISTRIBUTION

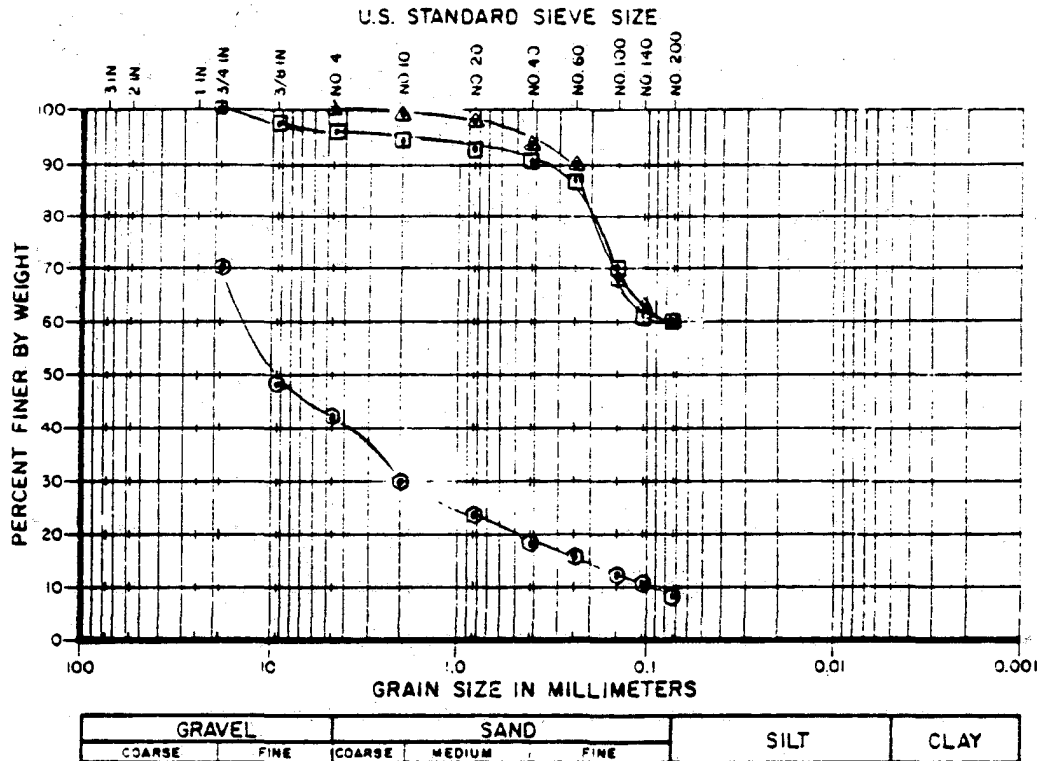
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
5	10	35-36.5'	⊙		
5	23	100-101.5'	△		
3	23	100-101.7'	◻		

GRAIN SIZE DISTRIBUTION

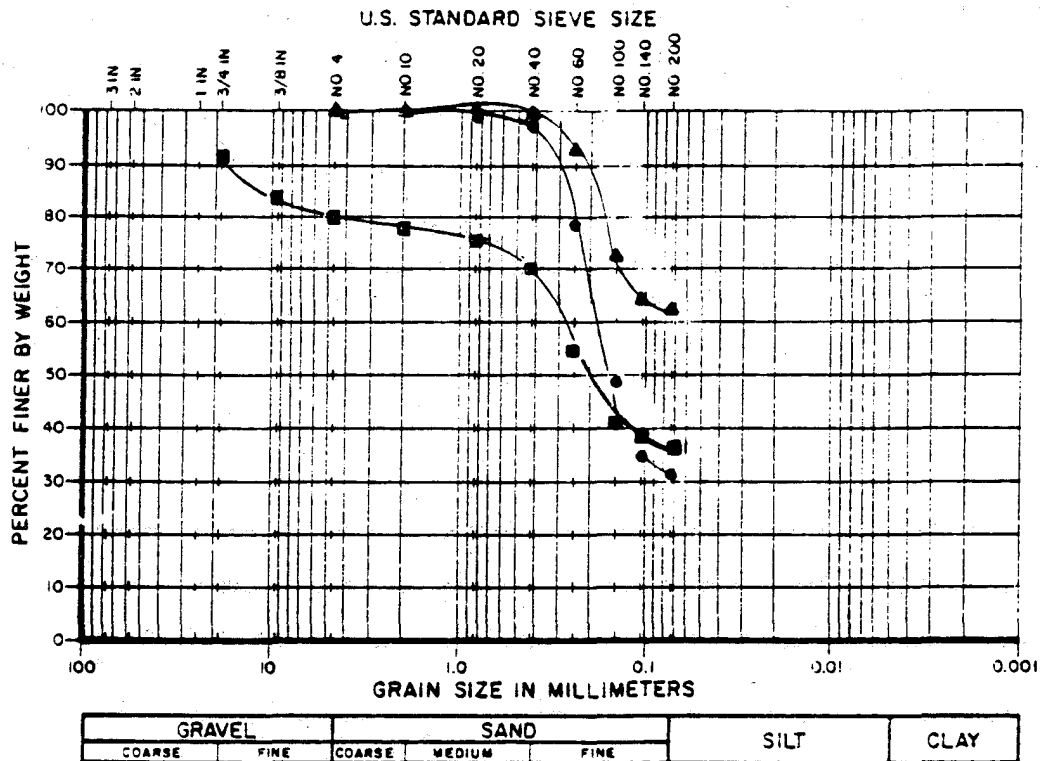
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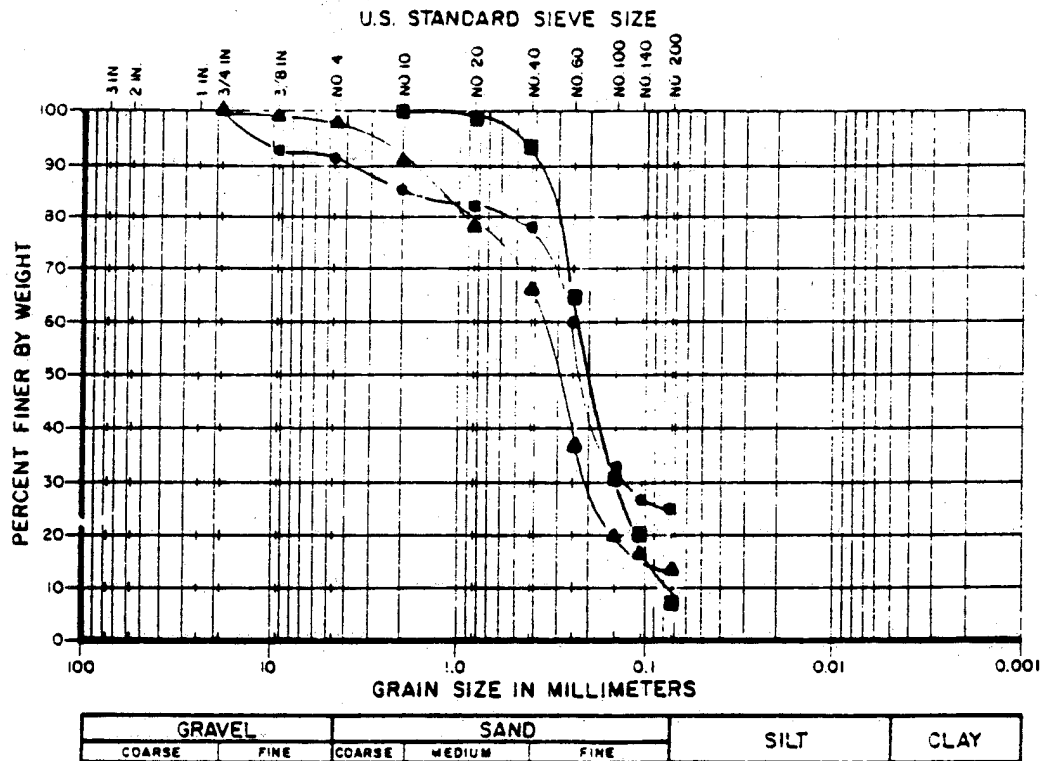
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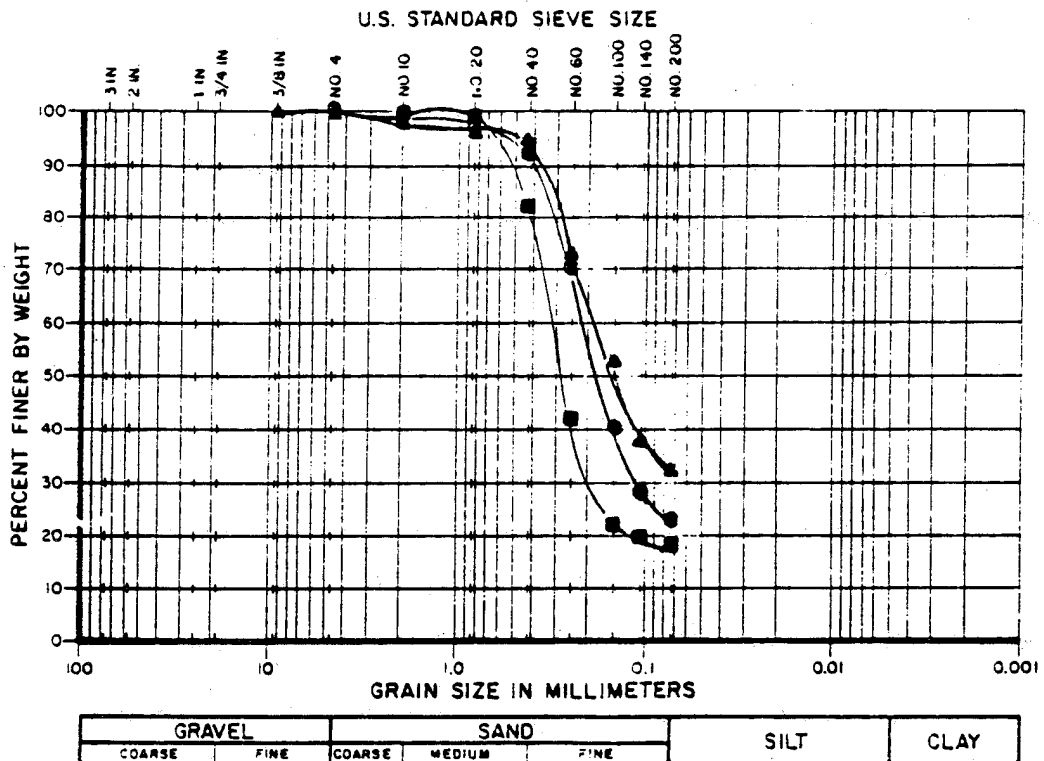
TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
5	20	85-86.5'	●		
5	16	65-66.5'	■		
2	23	100-101.5'	▲		

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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
4	9	30-31.5'	●		
6	7	20-21.5'	▲		
6	1	0-1.5'	■		

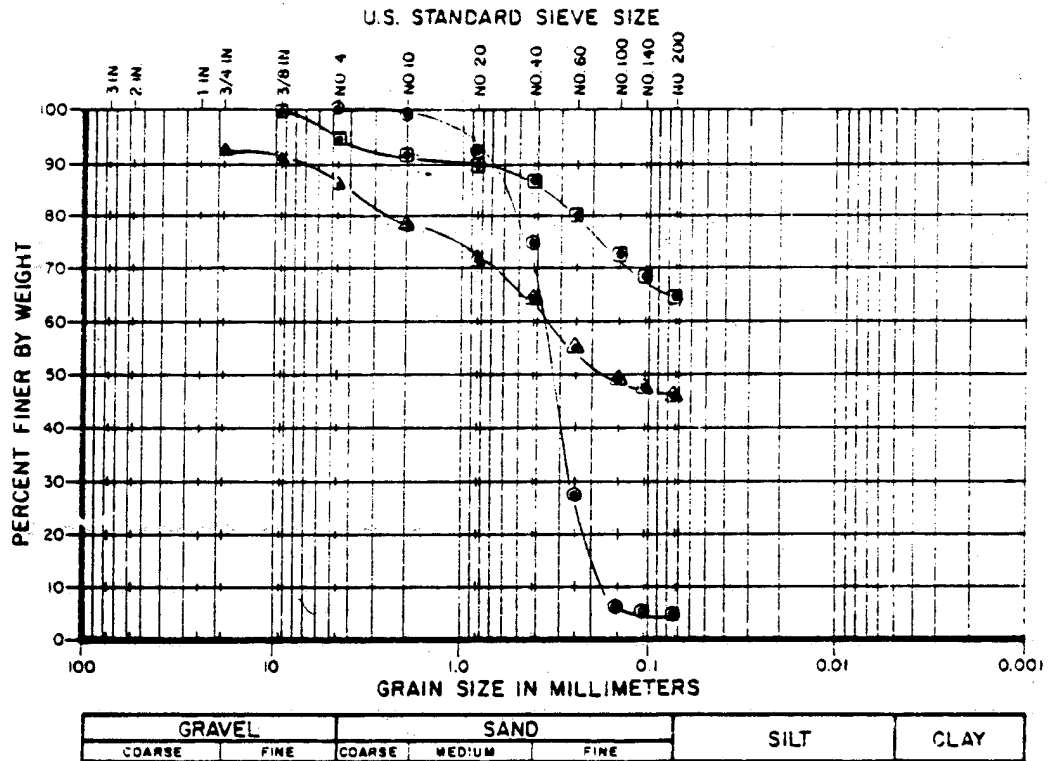
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
8	5	10-11.5'	■		
8	9	35-36.5'	▲		
1	10	35-36.5'	●		

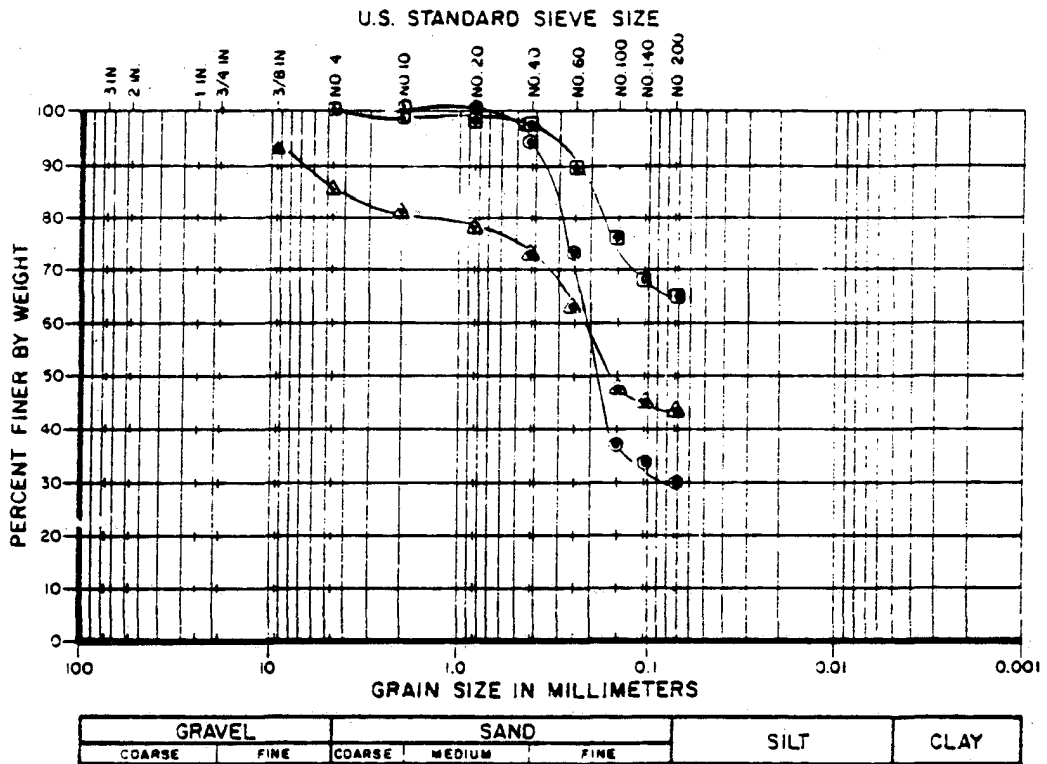
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
2	17	70-71.5'	⊙		
8	19	80-81.5'	△		
7	8	25-26.5'	⊠		

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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
3	11	10-11.5'	□		
8	13	50-51.5'	△		
8	14	55-56.5'	⊙		

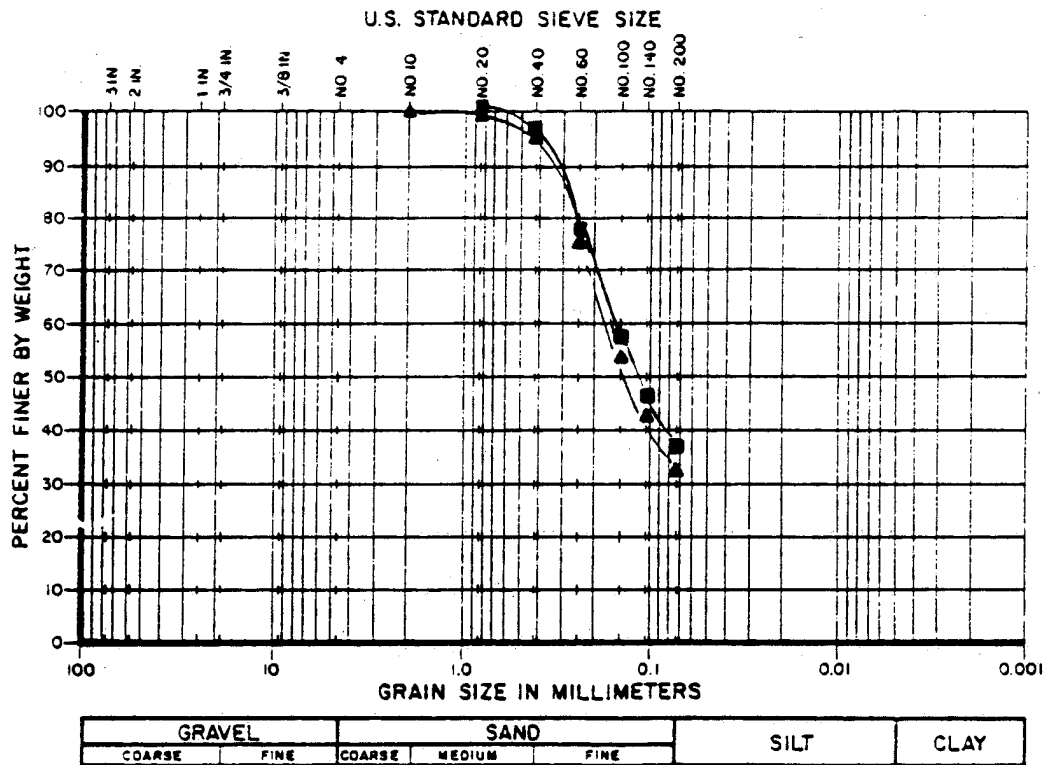
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
8	2	1.5-3'	▲		
3	2	2.5-4'	■		

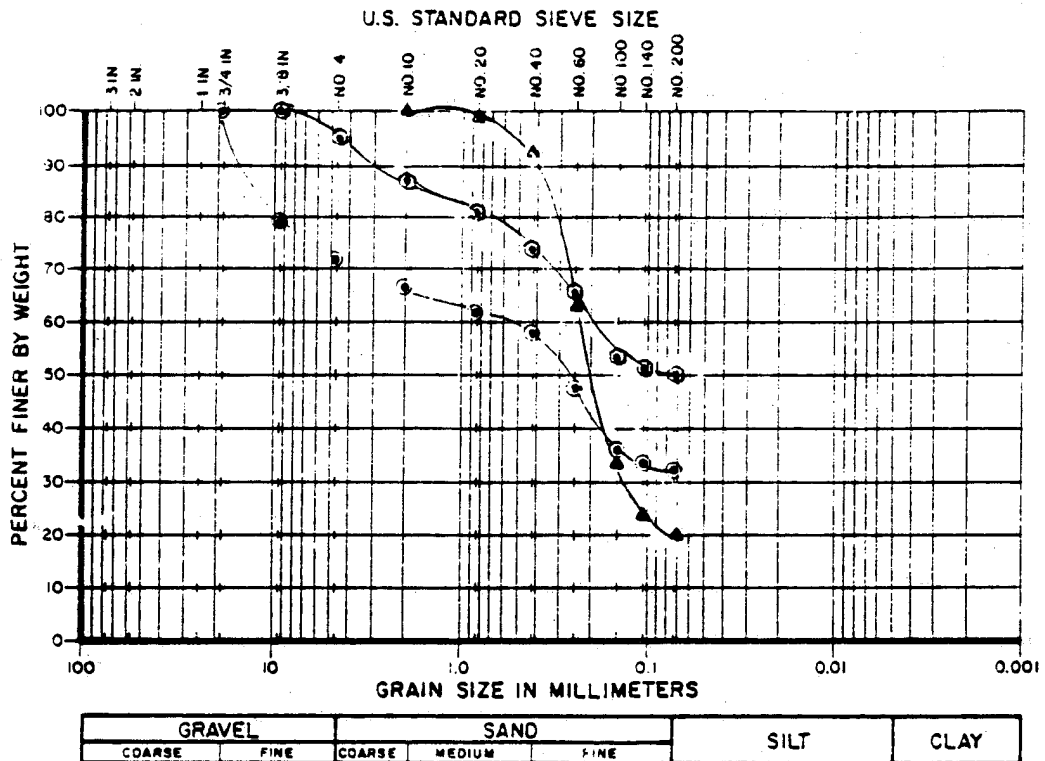
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
7	12	45-45.8'	●		
8	3	5-6.5'	▲		
2	19	80-81.5'	●		

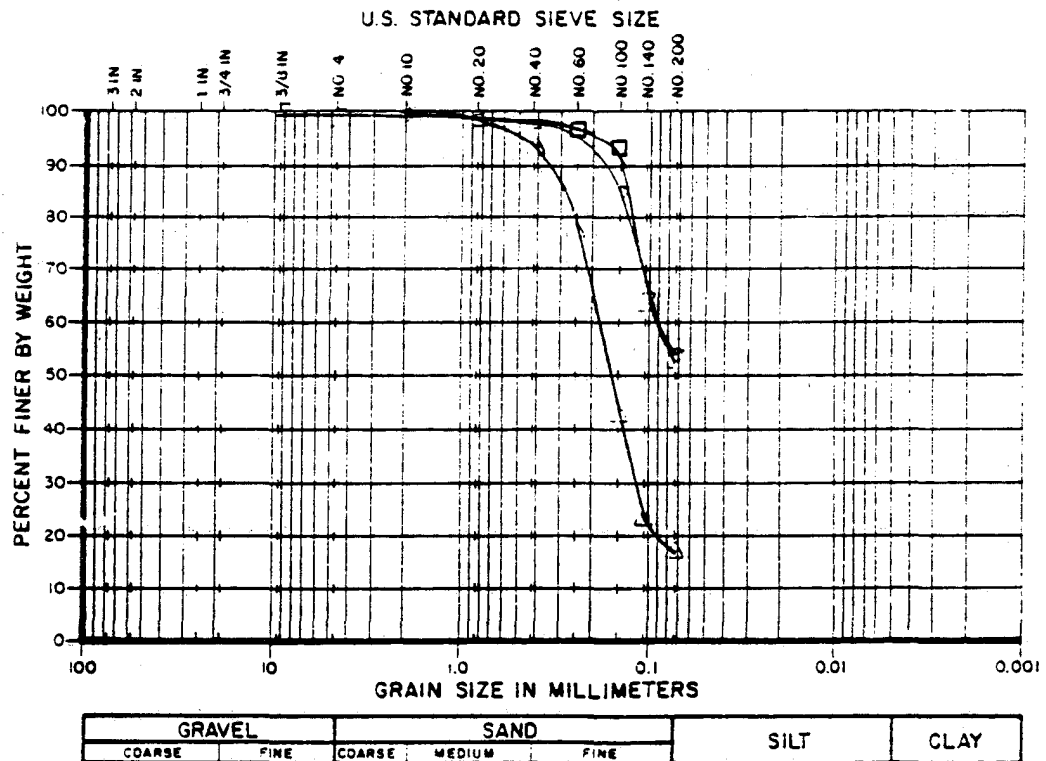
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
8	TW-10	35-37	△		
9	TW-6	15-17	⊠		
9	TW-8	25-27	⊙		

GRAIN SIZE DISTRIBUTION

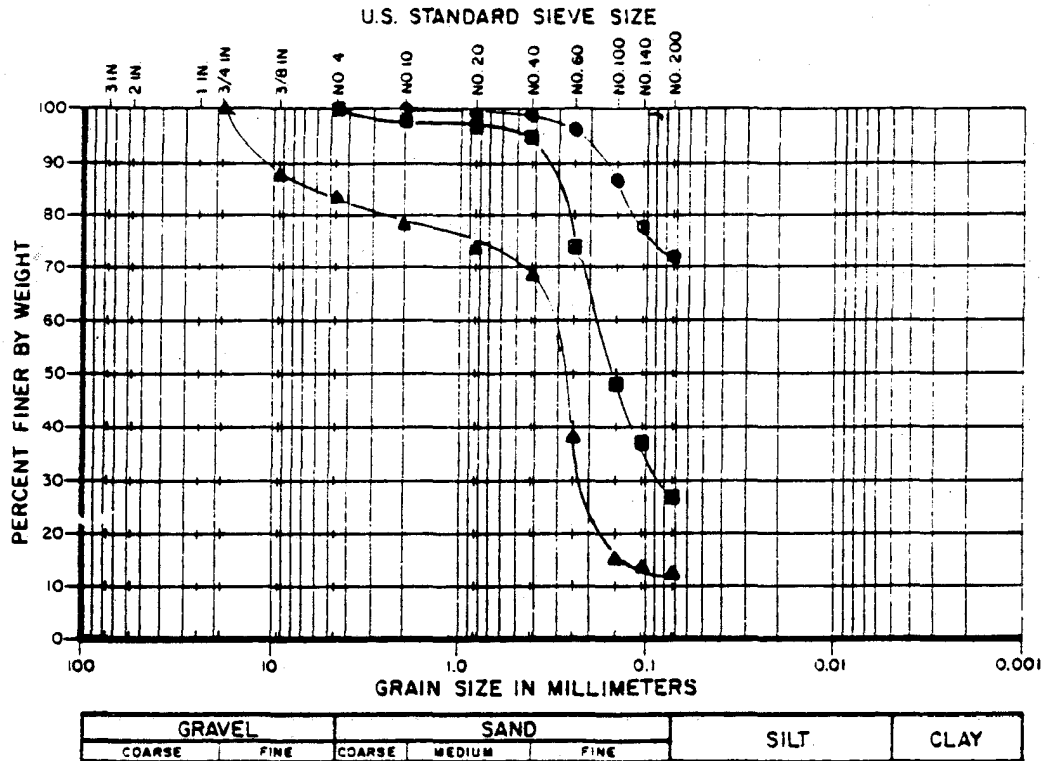
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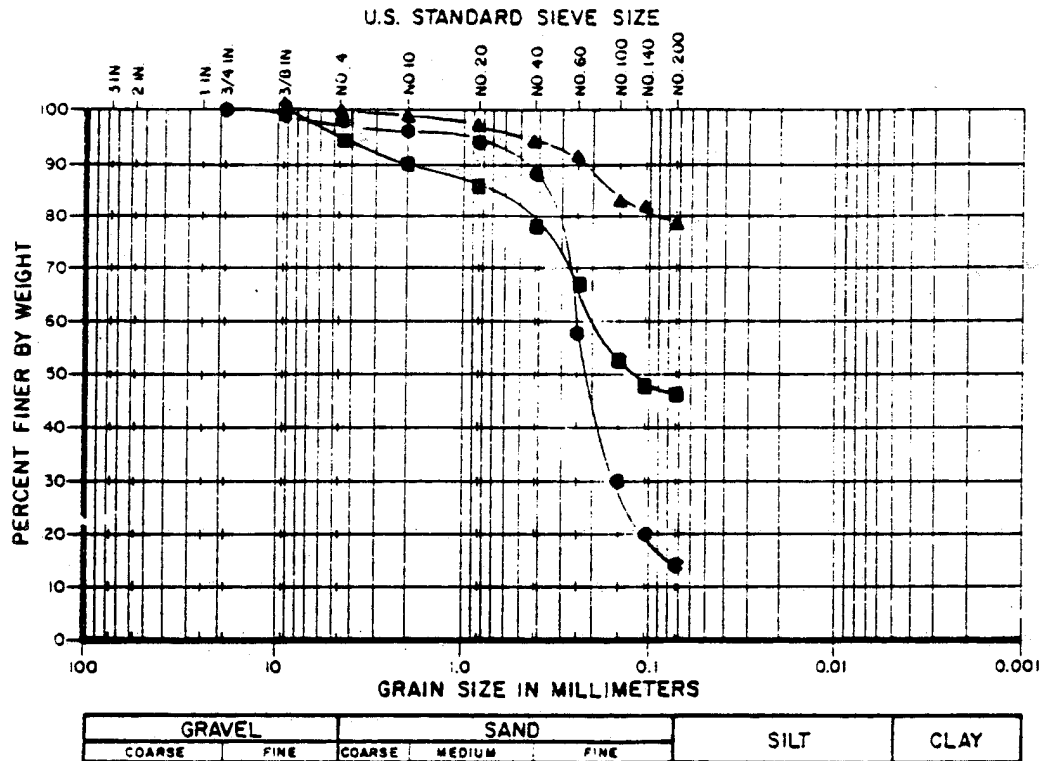
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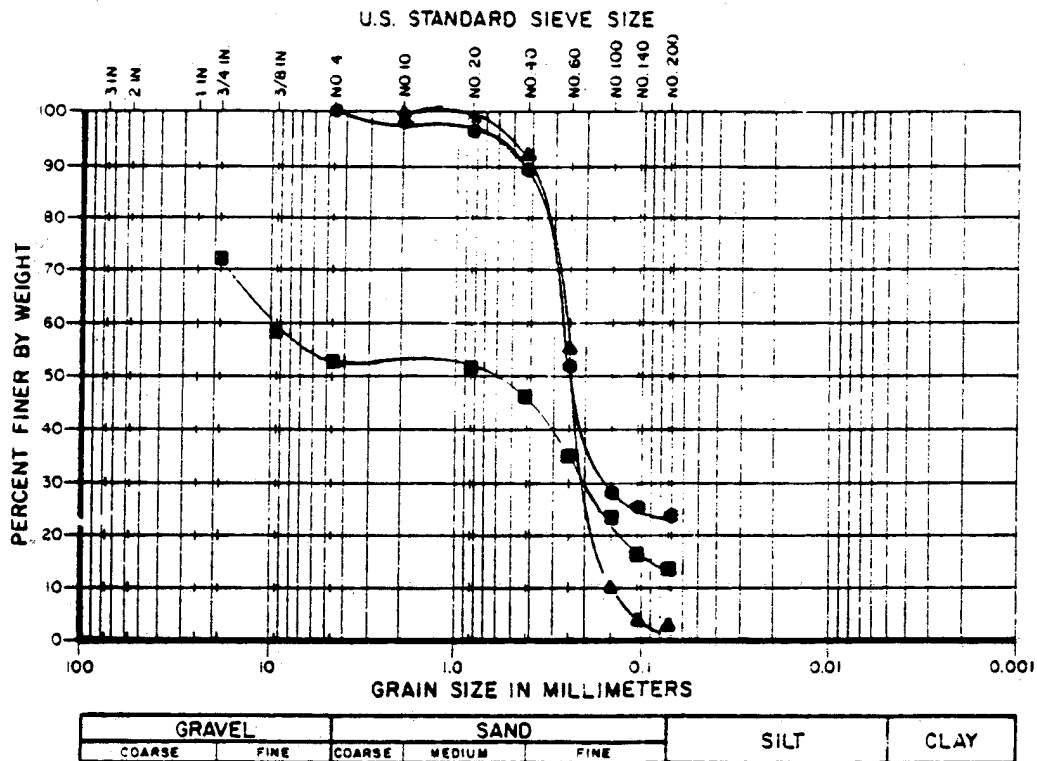
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
10	1	0-1.5'	●		
10	8	25-28.5'	▲		
4	12	45-46.5'	■		

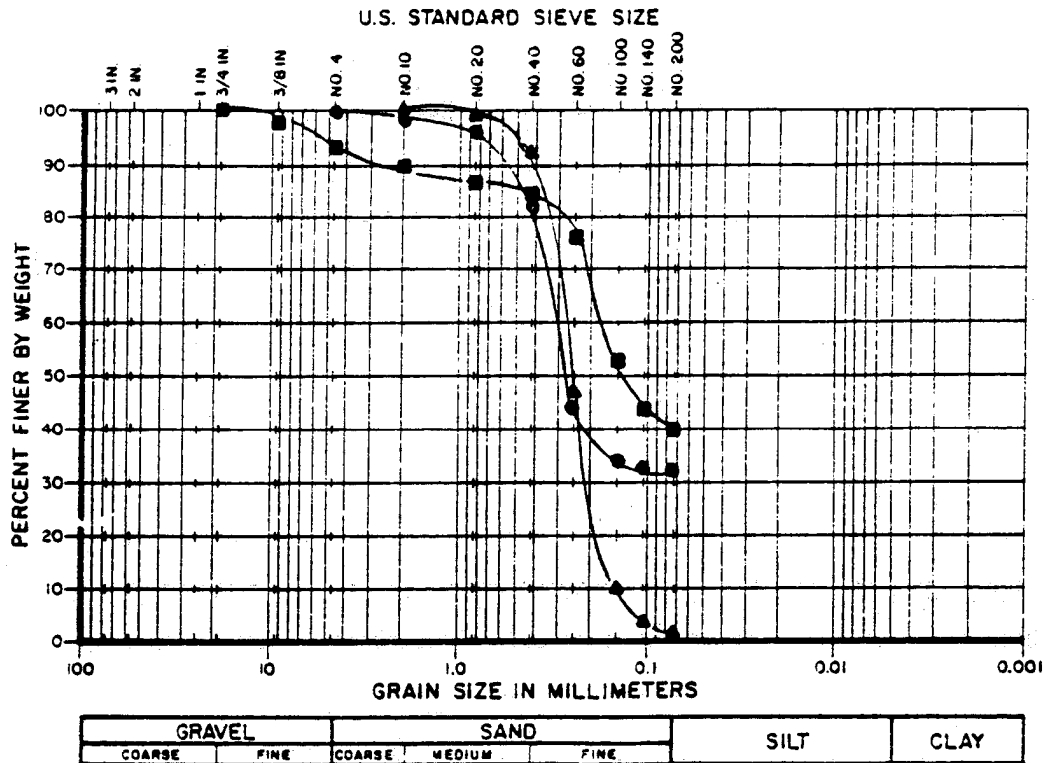
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
10	5	10-11.5'	▲		
3	5	10-11.5'	●		
5	12	45-46.5'	■		

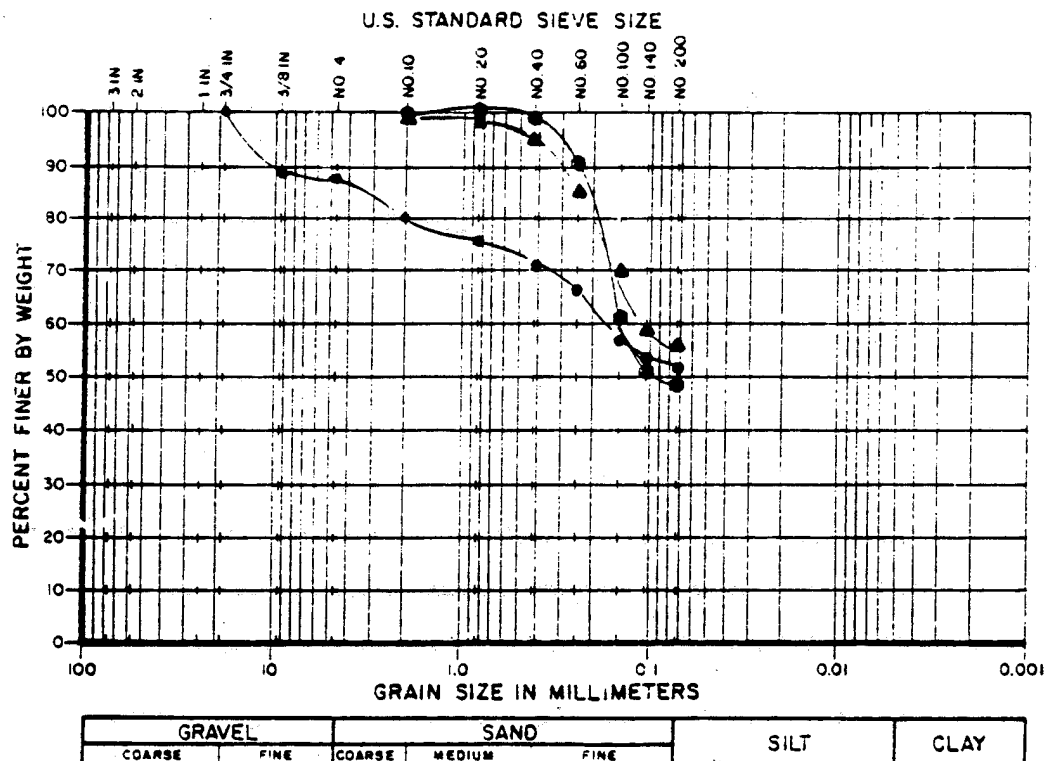
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
10	7	20-21.5'	▲		
10	10	35-36.5'	■		
10	18	75-76.5'	●		

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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
3	19	80'	●		
10	22	95-96.5'	▲		
10	15	60-61.5'	●		

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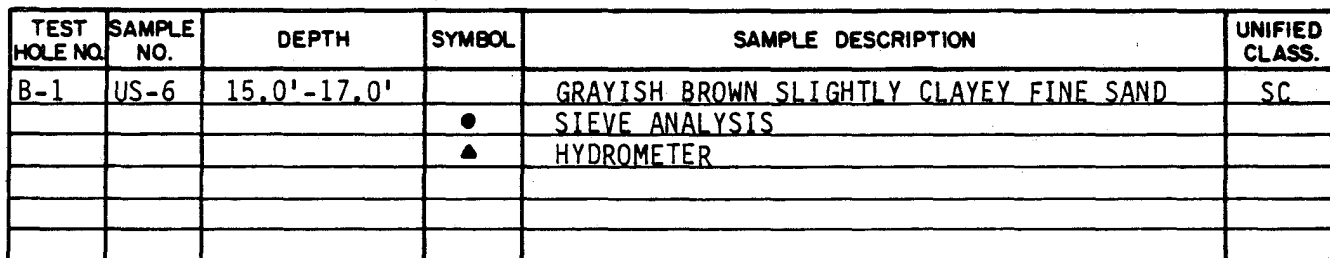
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**440 MV COMBUSTION TURBINE
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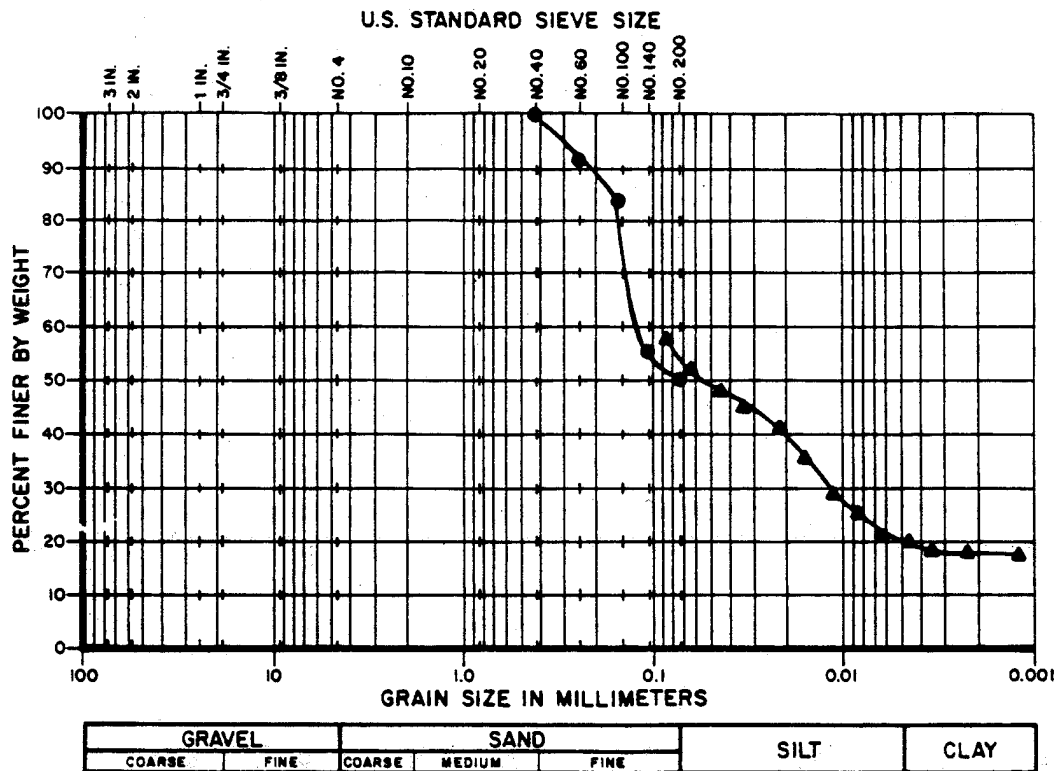
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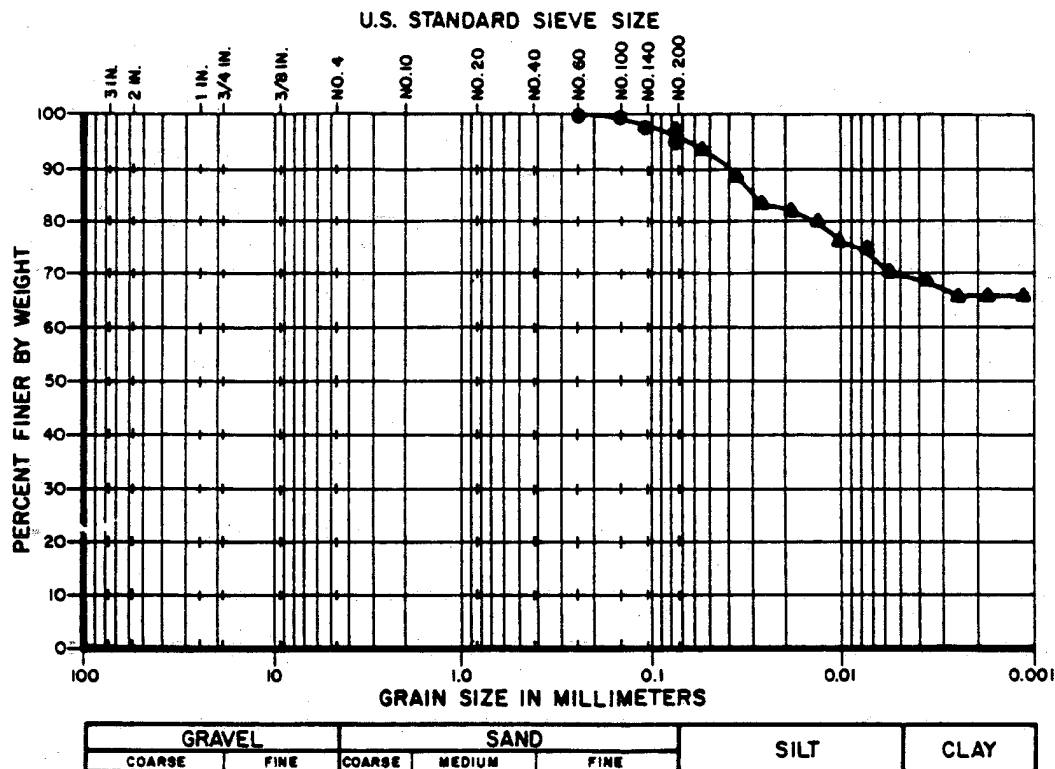


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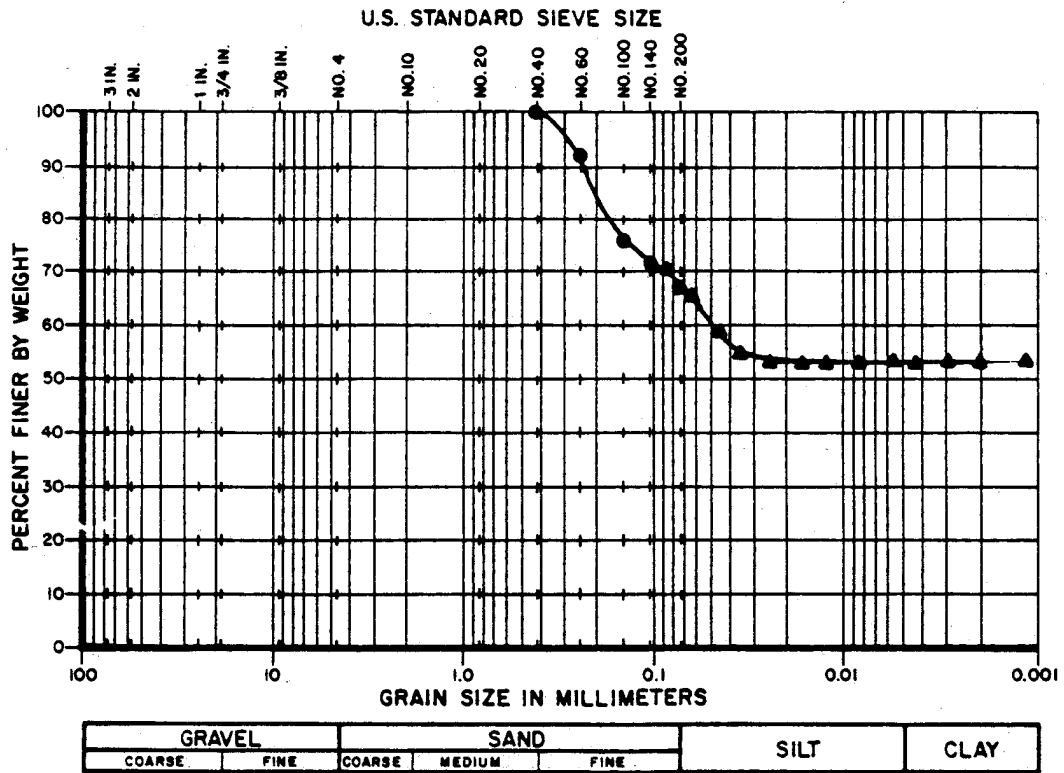
TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-2	US-10'	35.0'-36.0'		BROWNISH YELLOW SANDY CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

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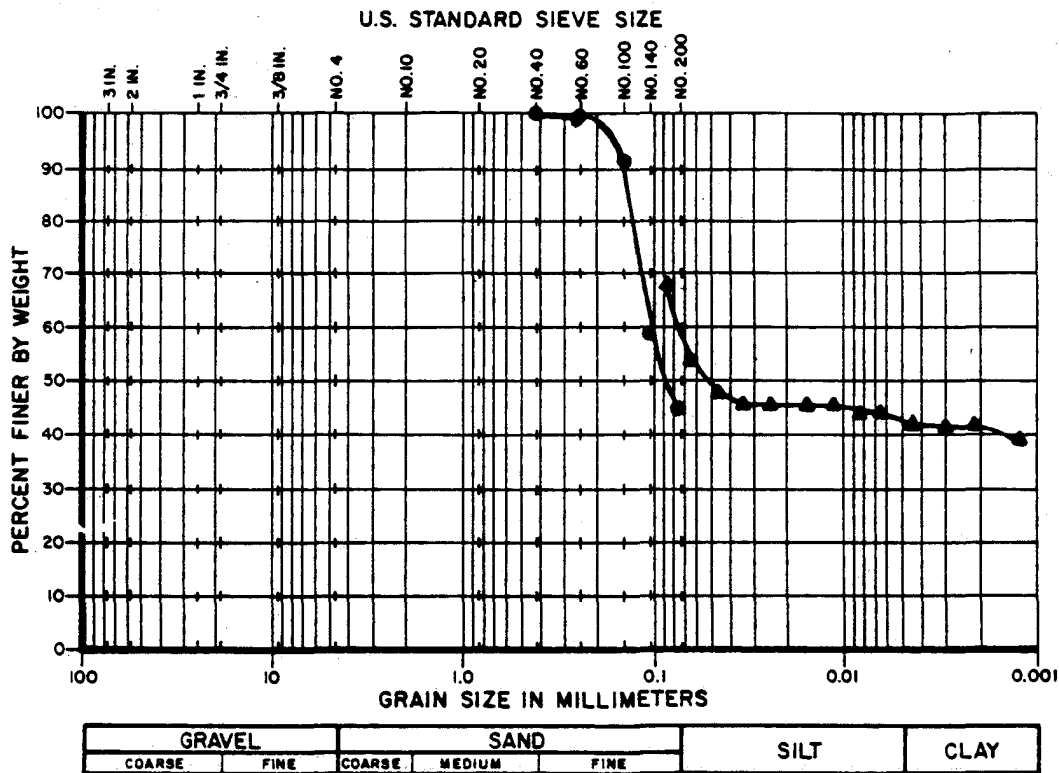
TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-3	US-9	30.0'-31.5'		BROWN CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

GRAIN SIZE DISTRIBUTION			
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TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-3	US-16	65.0'-66.3'		DARK GRAY SANDY CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

GRAIN SIZE DISTRIBUTION		
Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing		
SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
DRAWN BY: HAD FILE NO.: 88-9155A	CHECKED BY: APPROVED BY:	DATE: 12/16/88



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-4	US-6	15.0'-17.0'		GRAY CLAY WITH SEAMS OF GRAY FINE SAND	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

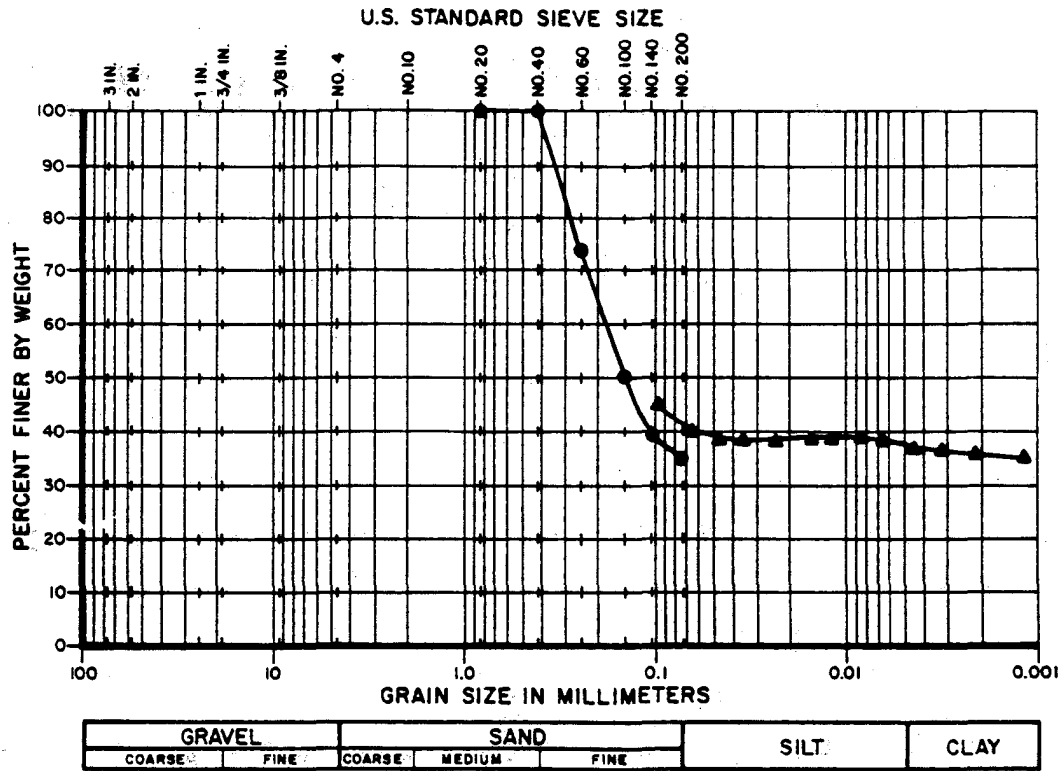
GRAIN SIZE DISTRIBUTION



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SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

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FILE NO. 88-9155A APPROVED BY:



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-5	US-4	7.5'-9.5'		GRAY CLAYEY FINE SAND	SC
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

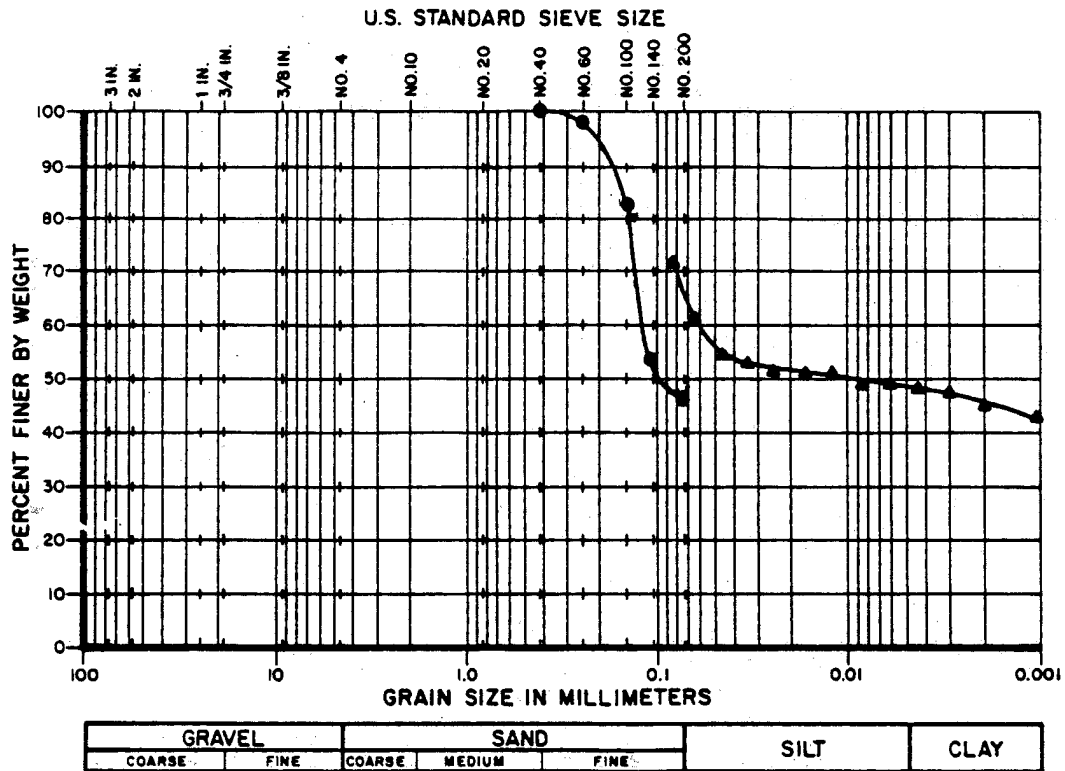
GRAIN SIZE DISTRIBUTION



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FILE NO. 88-9155A	APPROVED BY:	



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-7	US-6	15.0'-17.0'		GREENISH GRAY SANDY CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

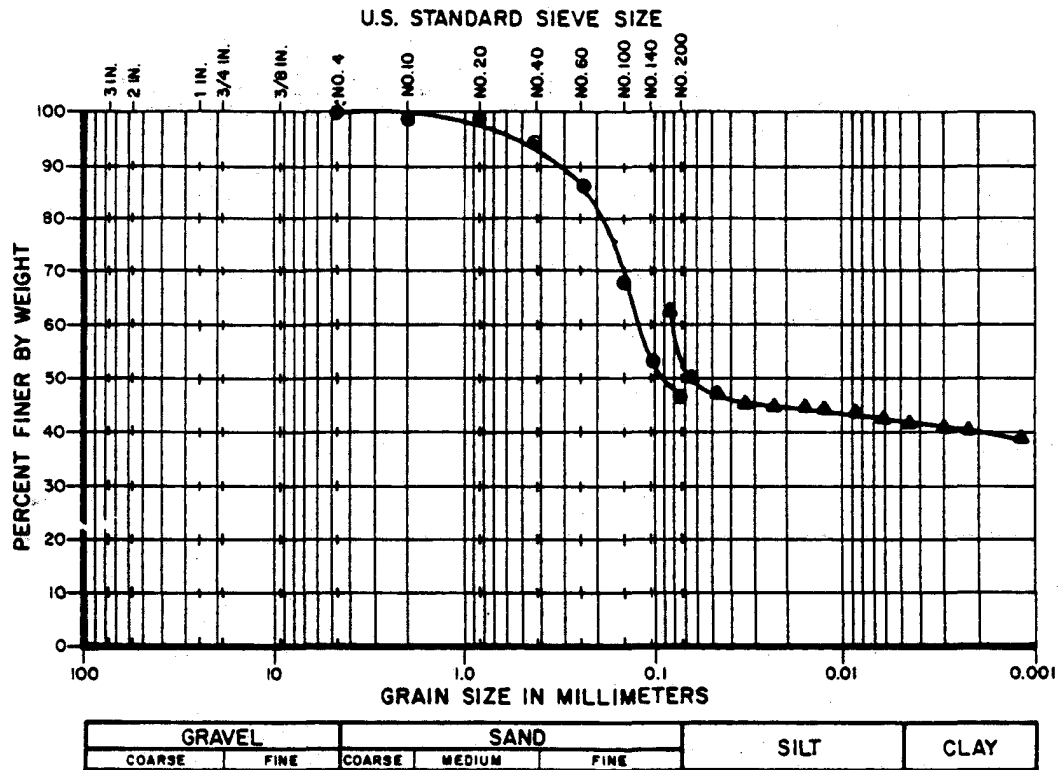
GRAIN SIZE DISTRIBUTION



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FILE NO. 88-9155A APPROVED BY:



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-8	US-7	20.0'-22.0'	●	BROWNISH GRAY SANDY CLAY	CH
			▲	SIEVE ANALYSIS	
				HYDROMETER	

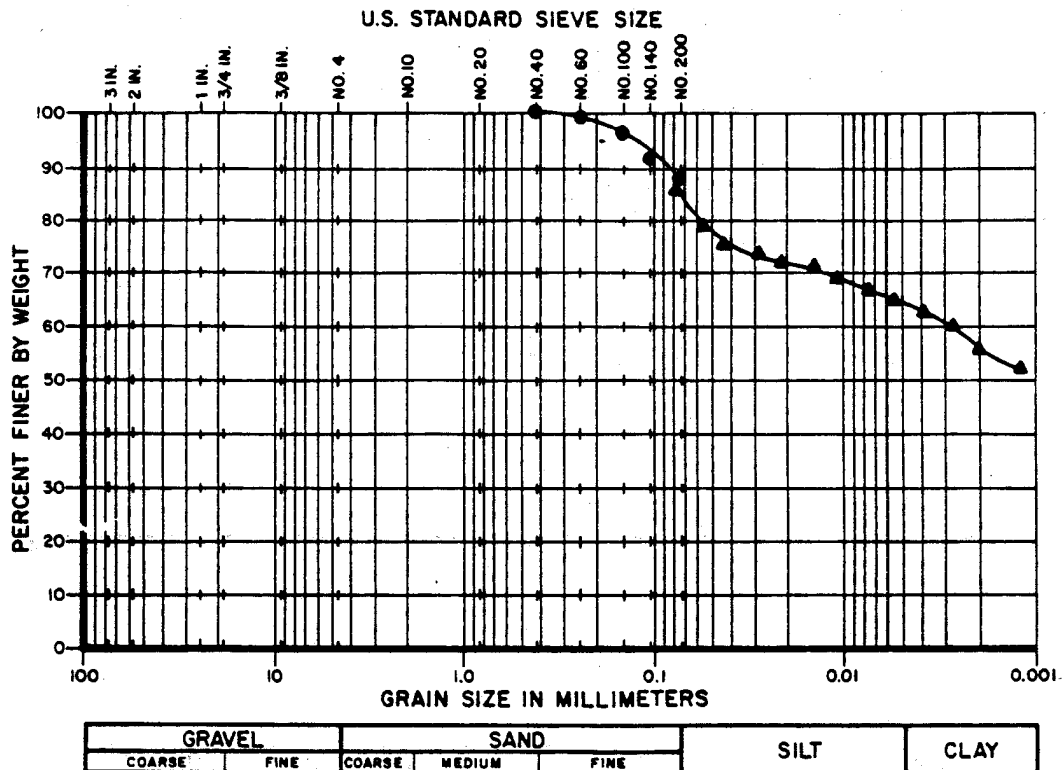
GRAIN SIZE DISTRIBUTION



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Foundations, and Material Testing

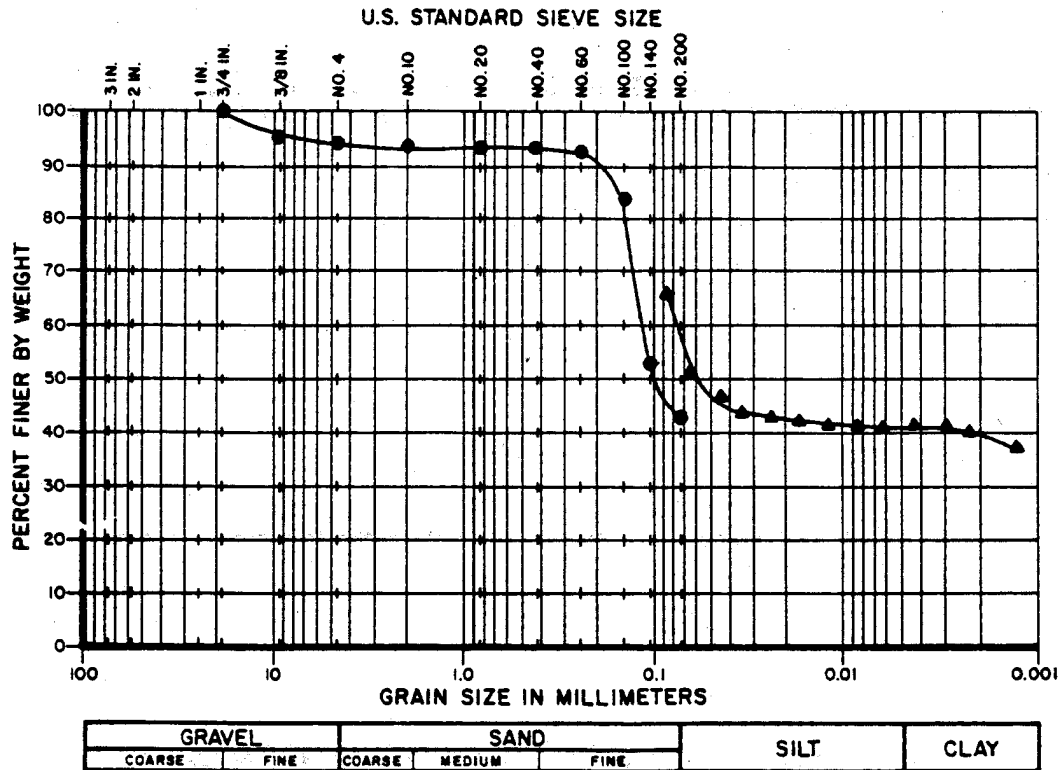
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: DATE: 12/16/88
FILE NO. 88-9155A APPROVED BY:



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-8	US-8	25.0'-27.0'		BROWNISH GRAY SILTY CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

GRAIN SIZE DISTRIBUTION		
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SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
DRAWN BY: HAD FILE NO: 88-9155A	CHECKED BY: APPROVED BY:	DATE: 12/16/88



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-9	US-6	15.0'-17.0'		GREENISH BROWN SANDY CLAY	CH
			●	SLEVE ANALYSIS	
			▲	HYDROMETER	

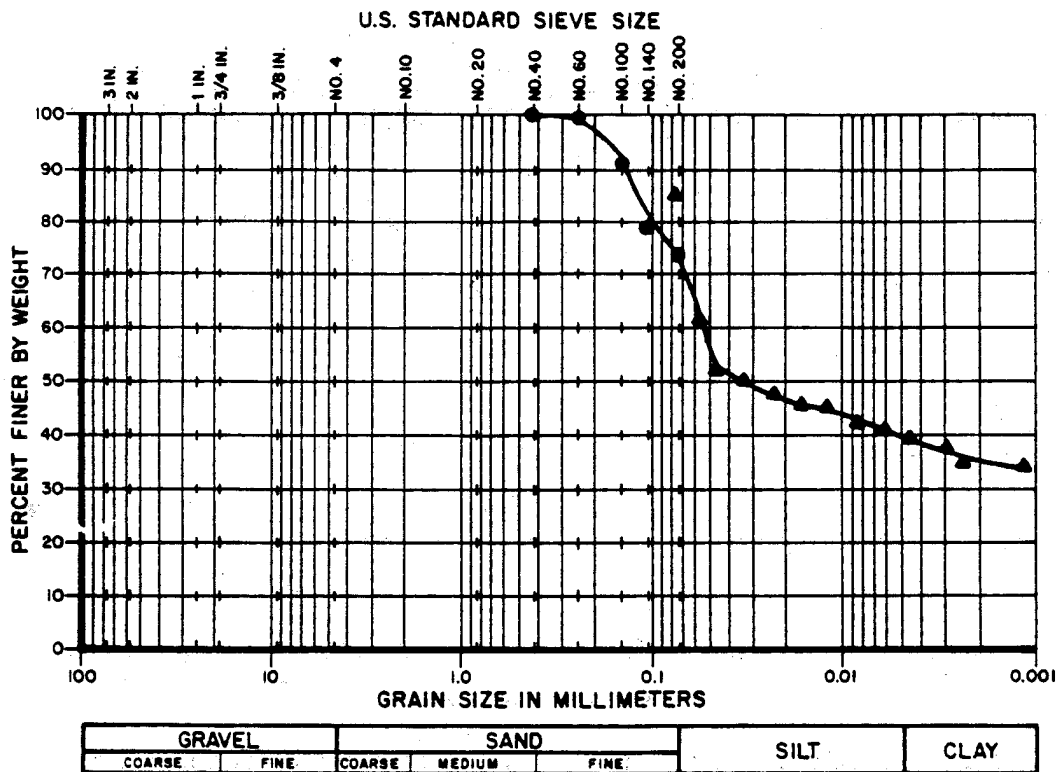
GRAIN SIZE DISTRIBUTION



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Foundations, and Material Testing

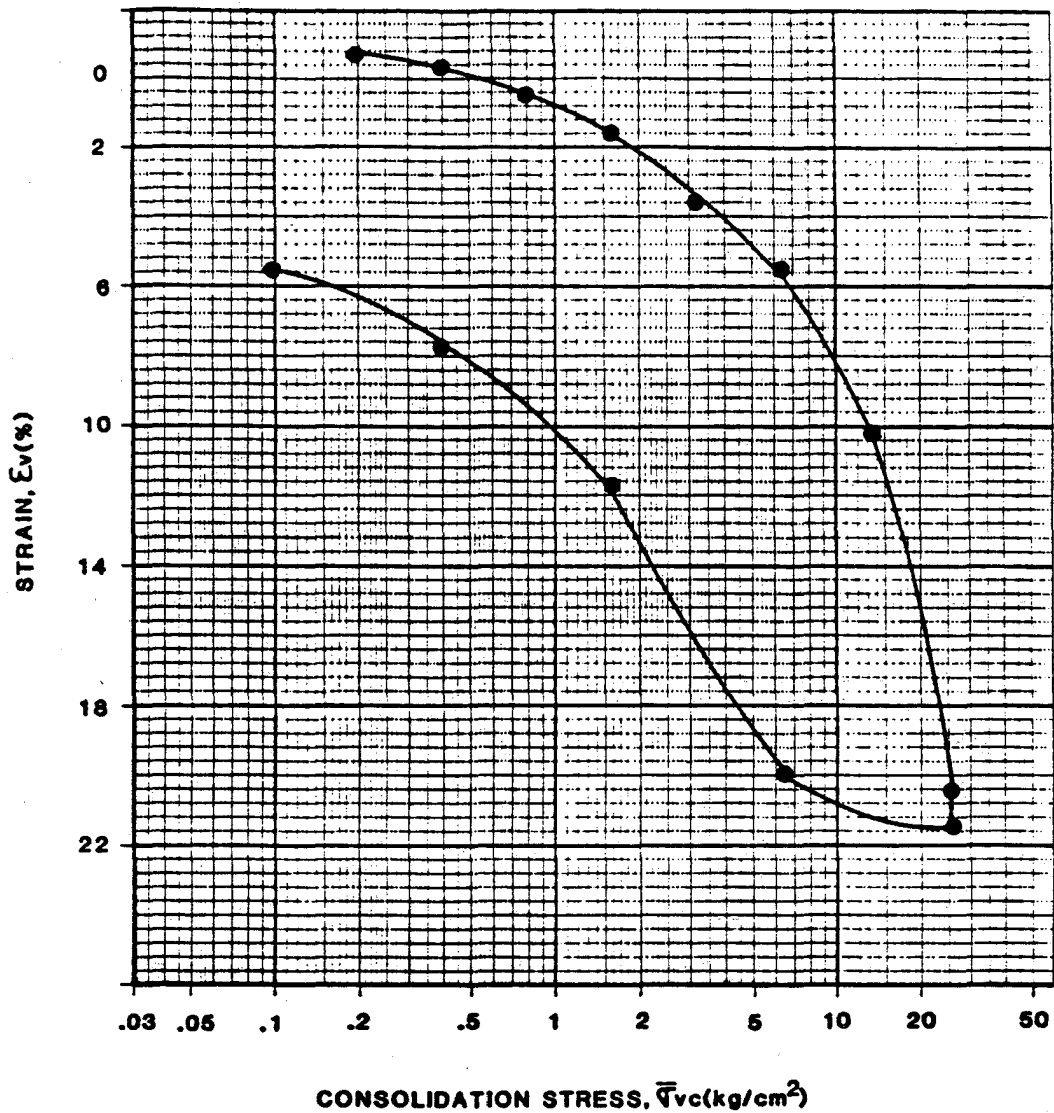
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: DATE: 12/16/88
FILE NO. 88-9155A APPROVED BY:



TEST HOLE NO.	SAMPLE NO.	DEPTH	SYMBOL	SAMPLE DESCRIPTION	UNIFIED CLASS.
B-9	US-10	35.0'-37.0'		GRAY SANDY CLAY	CH
			●	SIEVE ANALYSIS	
			▲	HYDROMETER	

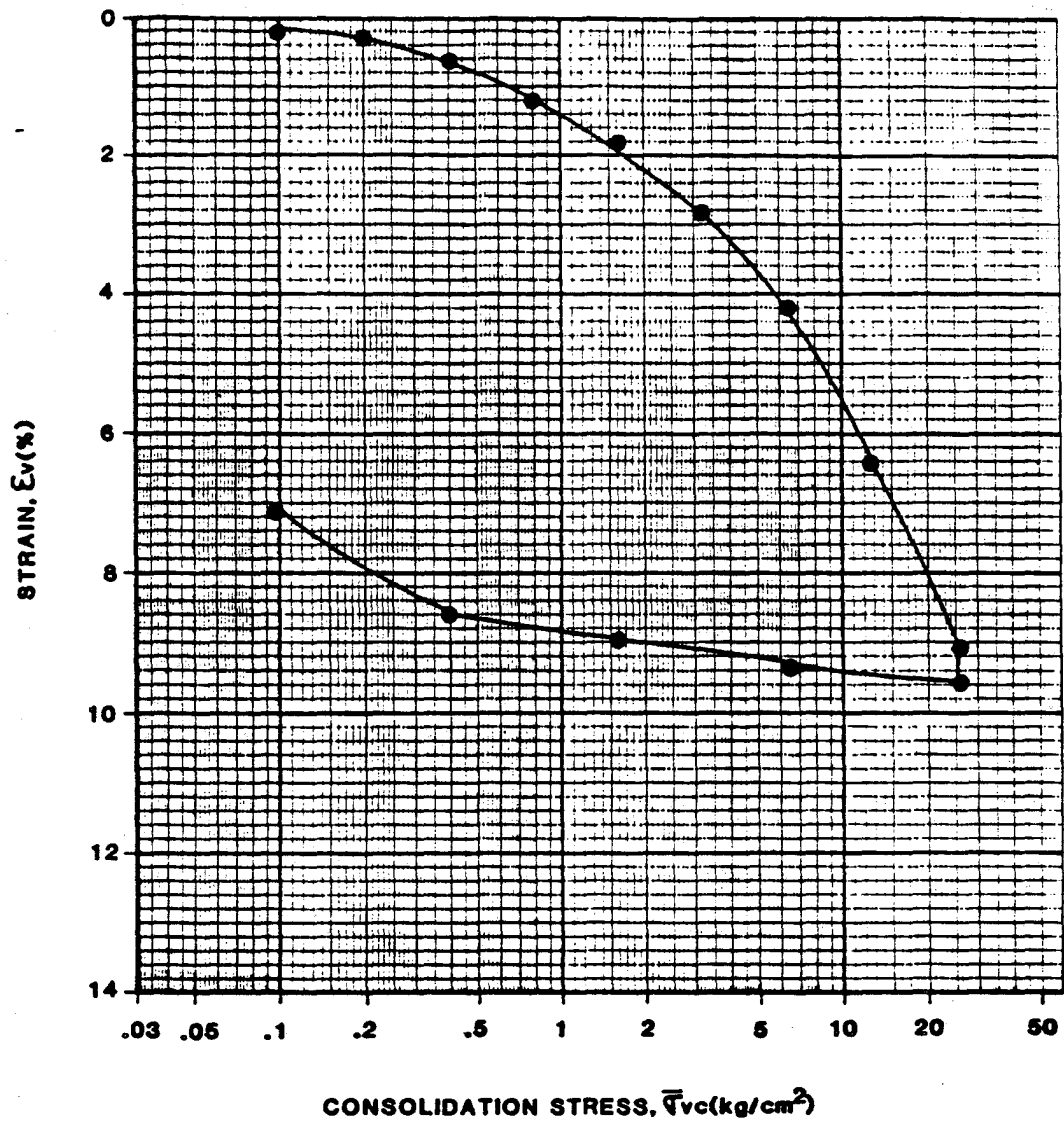
GRAIN SIZE DISTRIBUTION		
Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Material Testing		
SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
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TEST DATA

BORING NUMBER B-2
 SAMPLE NUMBER US-5
 DEPTH (FEET) 10.0'-12.0' , BLOCK #2
 CLASSIFICATION _____
 HEIGHT (INCHES) .74625
 DIAMETER (INCHES) 1.9685
 INITIAL MOISTURE CONTENT(%) 39.8
 INITIAL DRY DENSITY(LB/FT³) 81.2
 SPECIFIC GRAVITY 2.72
 FINAL MOISTURE CONTENT(%) 40.0
 LIQUID LIMIT(%) _____
 PLASTIC LIMIT(%) _____

 Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Materials Testing		
SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
DRAWN BY <u>HAD</u>	CHECKED BY <u>gaw</u>	DATE <u>12/16/88</u>
FILE NO.	APPROVED BY	
88-9155A		



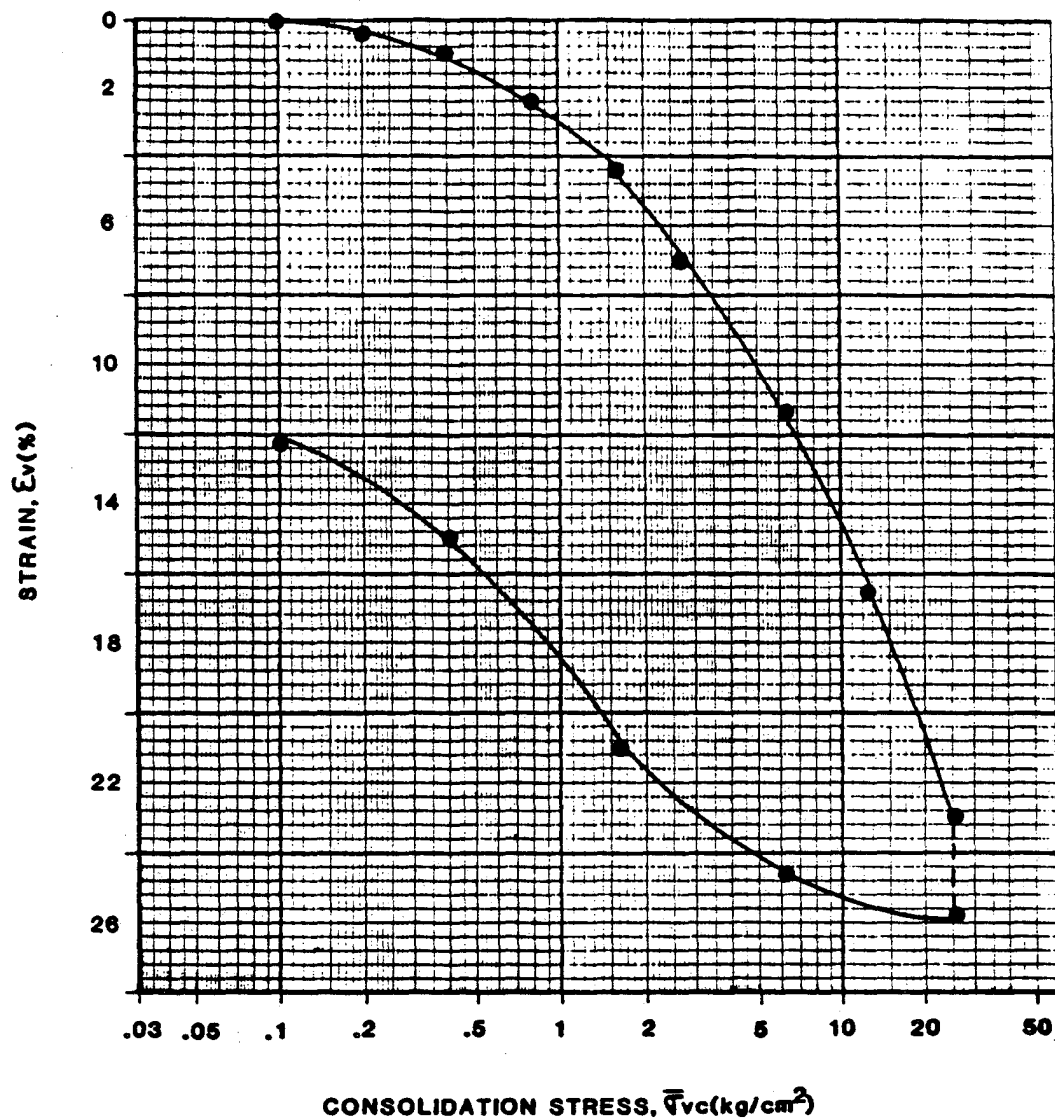
TEST DATA

BORING NUMBER B-1
 SAMPLE NUMBER US-4
 DEPTH (FEET) 7.5'-9.5' CON #1
 CLASSIFICATION _____
 HEIGHT (INCHES) .74550
 DIAMETER (INCHES) 1.9685
 INITIAL MOISTURE CONTENT(%) 16.9
 INITIAL DRY DENSITY(LB/FT³) 108.9
 SPECIFIC GRAVITY 2.68
 FINAL MOISTURE CONTENT(%) 15.5
 LIQUID LIMIT (%) _____
 PLASTIC LIMIT (%) _____


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 AGRICO-SOUTH SITE

DRAWN BY HAD CHECKED BY [Signature] DATE 12/16/88
 FILE NO. 88-9155A APPROVED BY _____



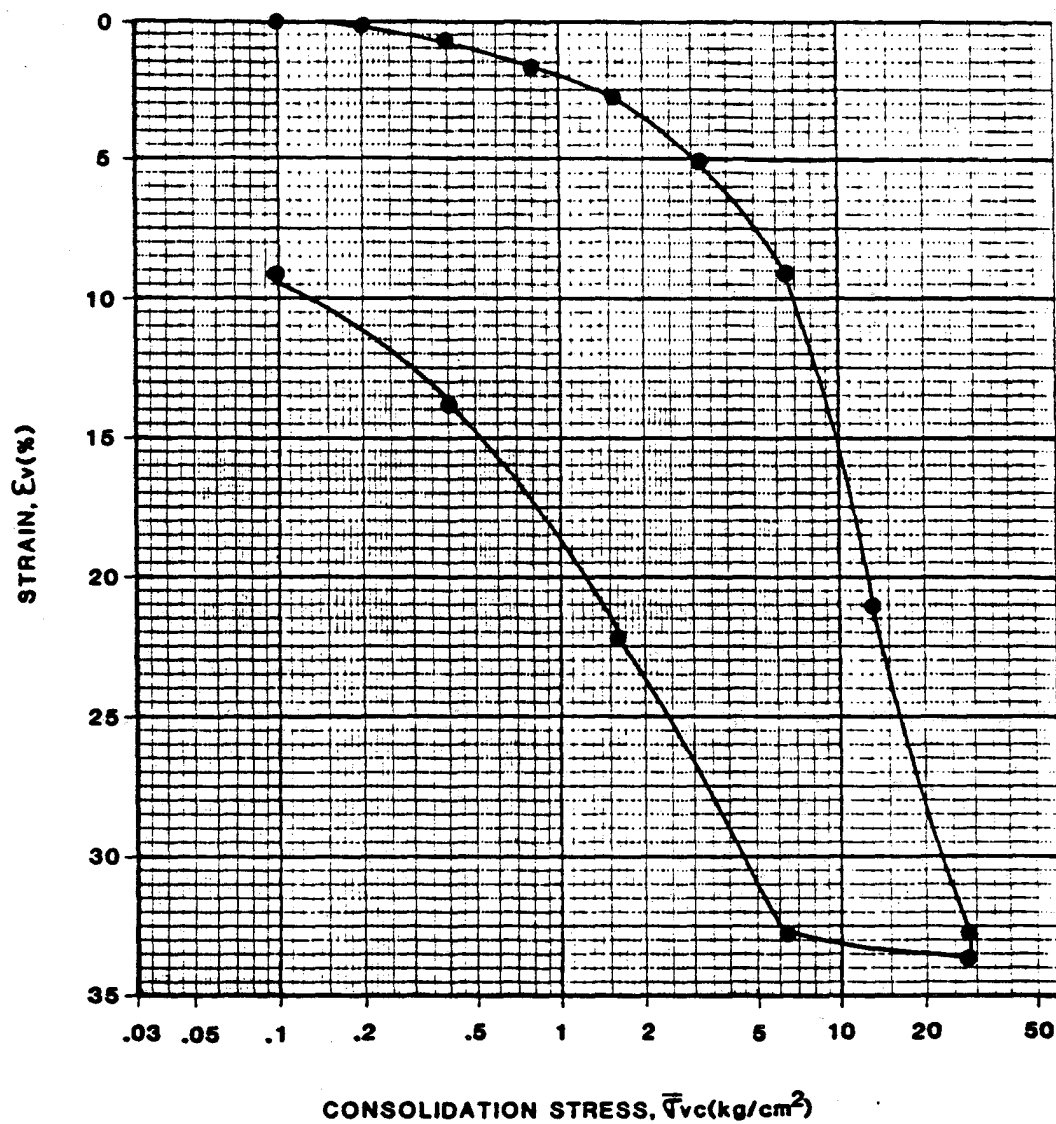
TEST DATA

BORING NUMBER B-5
 SAMPLE NUMBER US-6
 DEPTH (FEET) 15.0'-17.0', CON #1
 CLASSIFICATION _____
 HEIGHT (INCHES) .75025
 DIAMETER (INCHES) 1.9685
 INITIAL MOISTURE CONTENT(%) 44.8
 INITIAL DRY DENSITY(LB/FT³) 72.4
 SPECIFIC GRAVITY 2.70
 FINAL MOISTURE CONTENT(%) 42.3
 LIQUID LIMIT(%) _____
 PLASTIC LIMIT(%) _____


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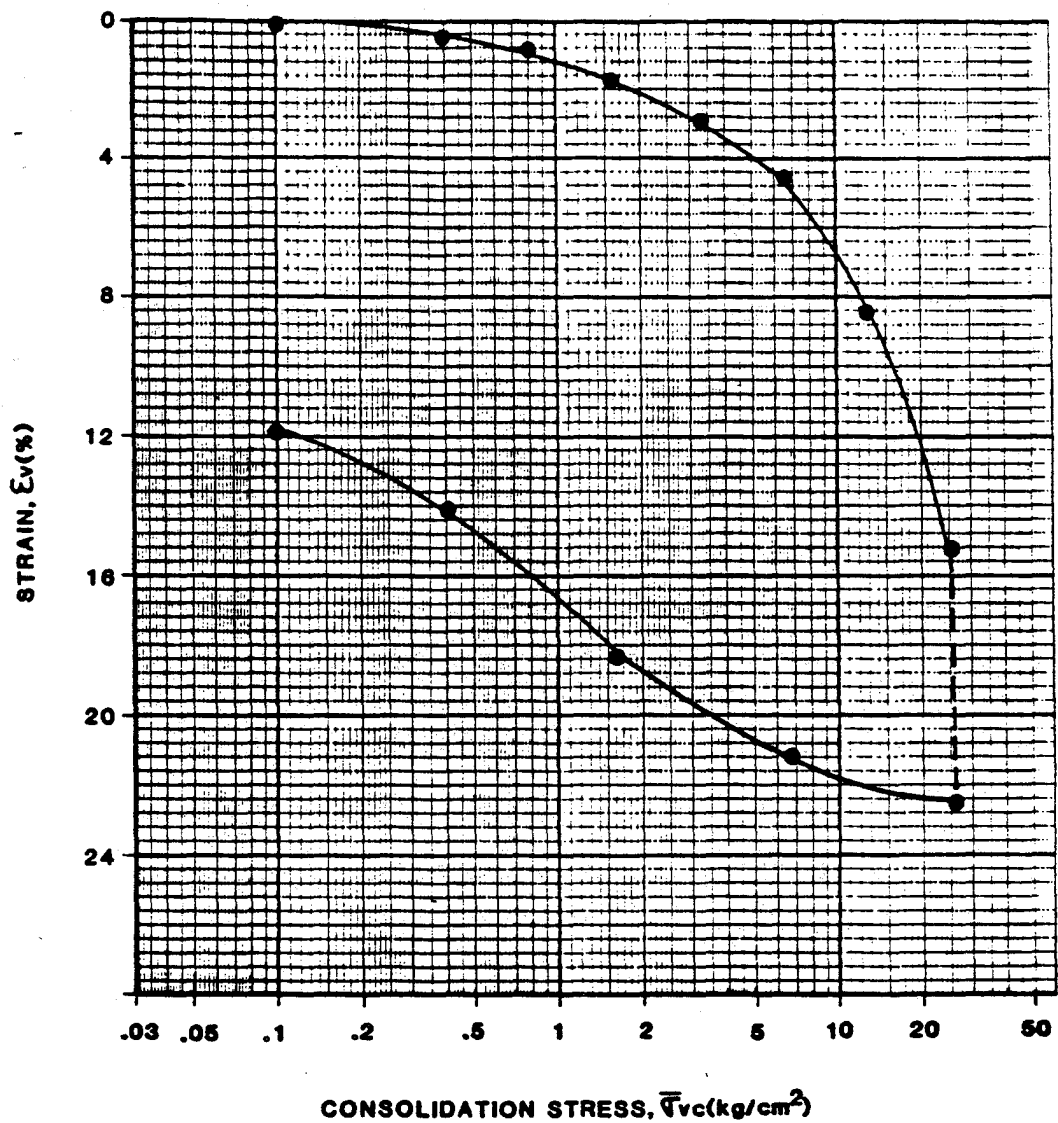
DRAWN BY HAD CHECKED BY gaw DATE 12/16/88
 FILE NO. 88-9155A APPROVED BY _____



TEST DATA

BORING NUMBER B-9
 SAMPLE NUMBER US-8
 DEPTH (FEET) 25.0'-27.0', CON #2
 CLASSIFICATION _____
 HEIGHT (INCHES) .77550
 DIAMETER (INCHES) 1.9865
 INITIAL MOISTURE CONTENT(%) 80.5
 INITIAL DRY DENSITY(LB/FT³) 51.6
 SPECIFIC GRAVITY 2.73
 FINAL MOISTURE CONTENT(%) 52.9
 LIQUID LIMIT(%) _____
 PLASTIC LIMIT(%) _____

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DRAWN BY <u>HAD</u>	CHECKED BY <u>[Signature]</u>	DATE <u>12/16/88</u>
FILE NO. <u>88-9155A</u>	APPROVED BY _____	

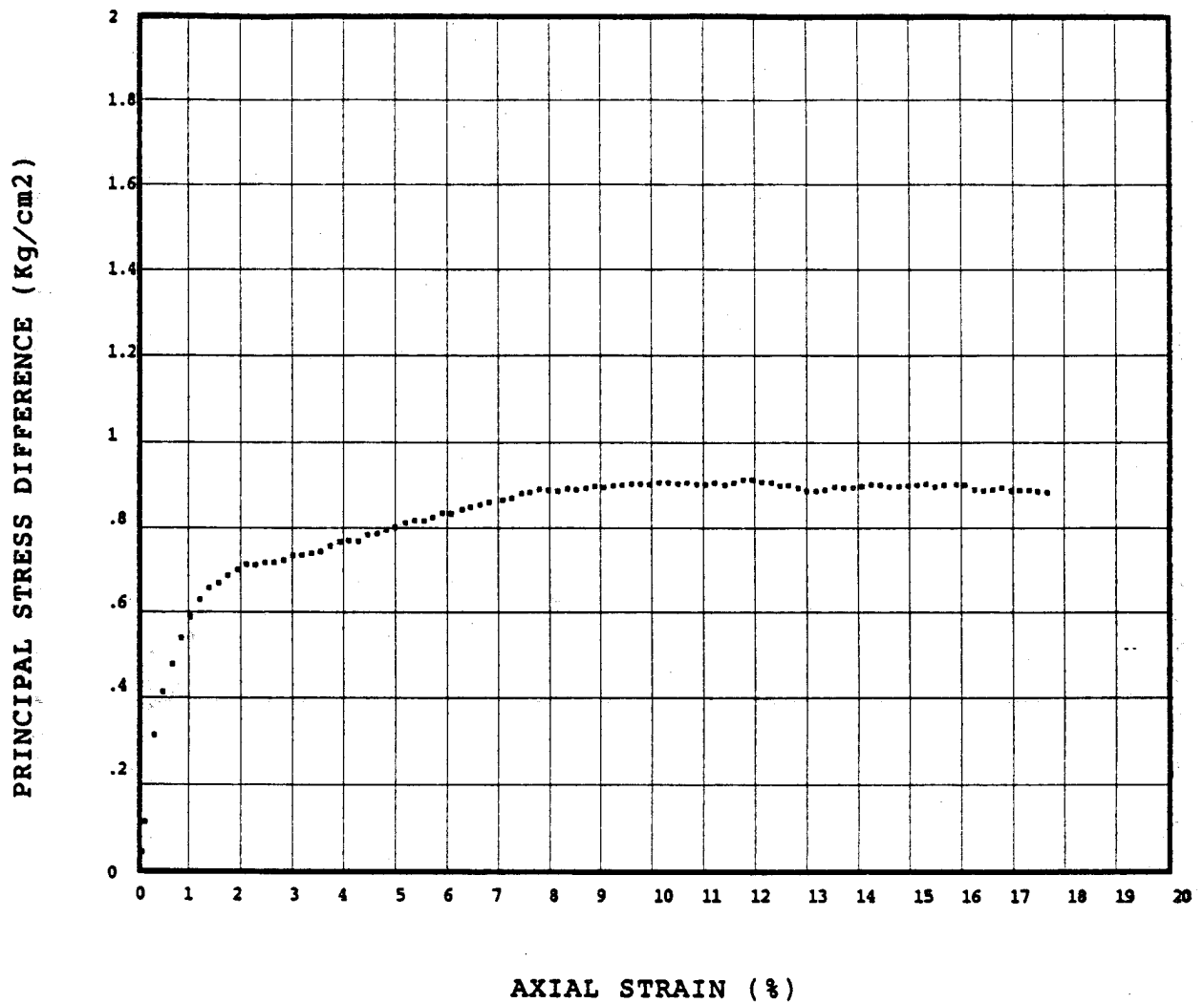


TEST DATA

BORING NUMBER B-3
 SAMPLE NUMBER US-16
 DEPTH (FEET) 65.0'-67.0', CON #1
 CLASSIFICATION _____
 HEIGHT (INCHES) .74800
 DIAMETER (INCHES) 1.9685
 INITIAL MOISTURE CONTENT(%) 63.2
 INITIAL DRY DENSITY(LB/FT³) 59.9
 SPECIFIC GRAVITY 2.69
 FINAL MOISTURE CONTENT(%) 56.5
 LIQUID LIMIT(%) _____
 PLASTIC LIMIT(%) _____

 Ardaman & Associates, Inc. Consulting Engineers in Soil Mechanics, Foundations, and Materials Testing		
SEMINOLE ELECTRIC COOPERATIVE INC. 4040 MEGAWATT COMBUSTION GENERATOR AGRICO-SOUTH SITE		
DRAWN BY: <u>HAD</u>	CHECKED BY: <u>jan</u>	DATE <u>12/16/88</u>
FILE NO.	APPROVED BY	
88-9155A		

Sample Name : B-1, US-4, 7.5'-9.5', BLOCK #2



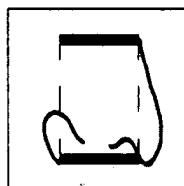
Dry density : 108.40 pcf

Water content : 15.80 %

Saturation : 78.04 %

Cell pressure : 0.30 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardaman & Associates Inc.

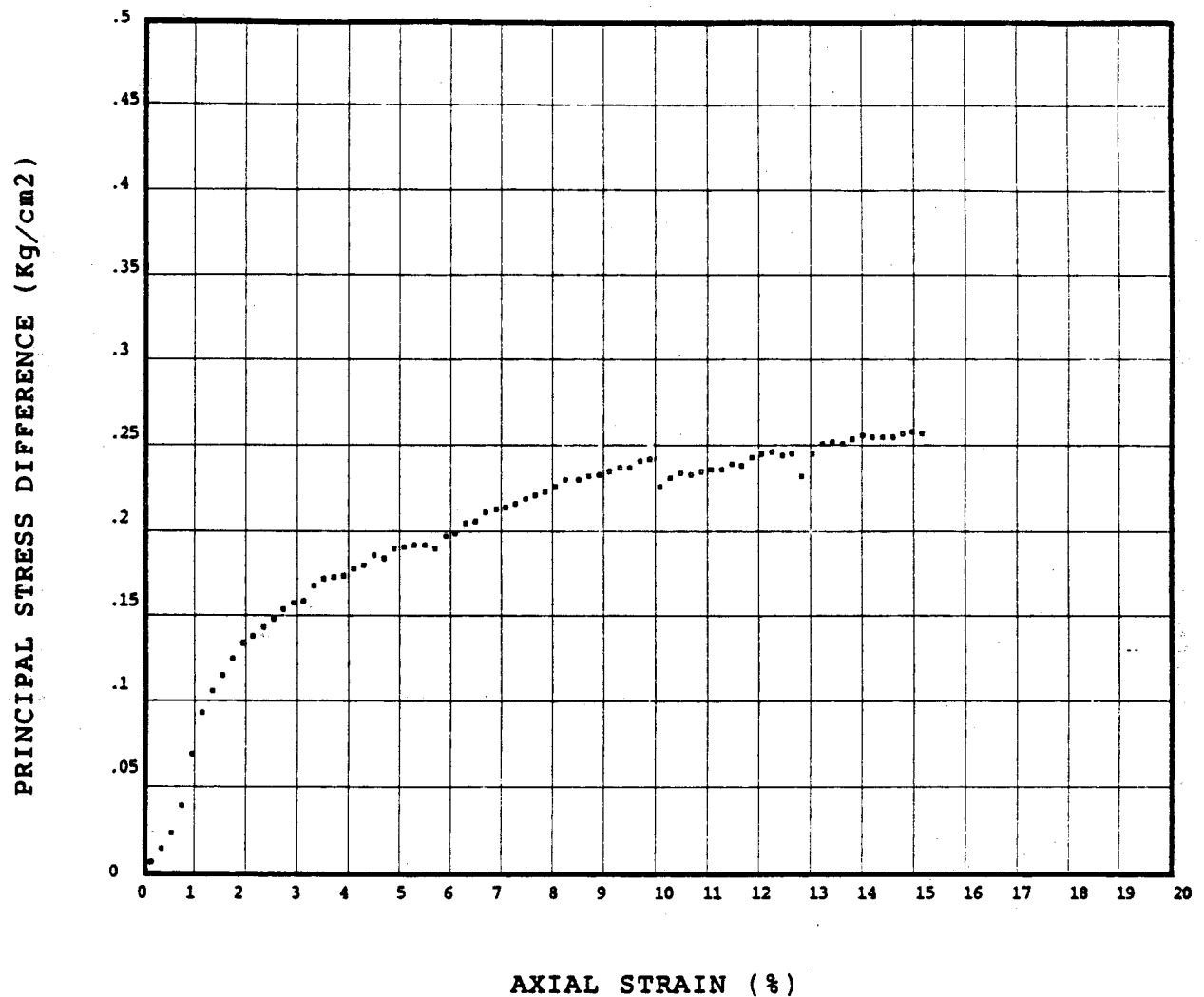
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRIC-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-1, US-8, 25.0'-27.0', SS#1



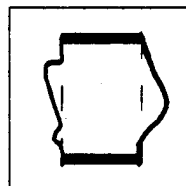
Dry density : 90.03 pcf

Water content : 29.71 %

Saturation : 94.07 %

Cell pressure : 0.73 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardaman & Associates Inc.

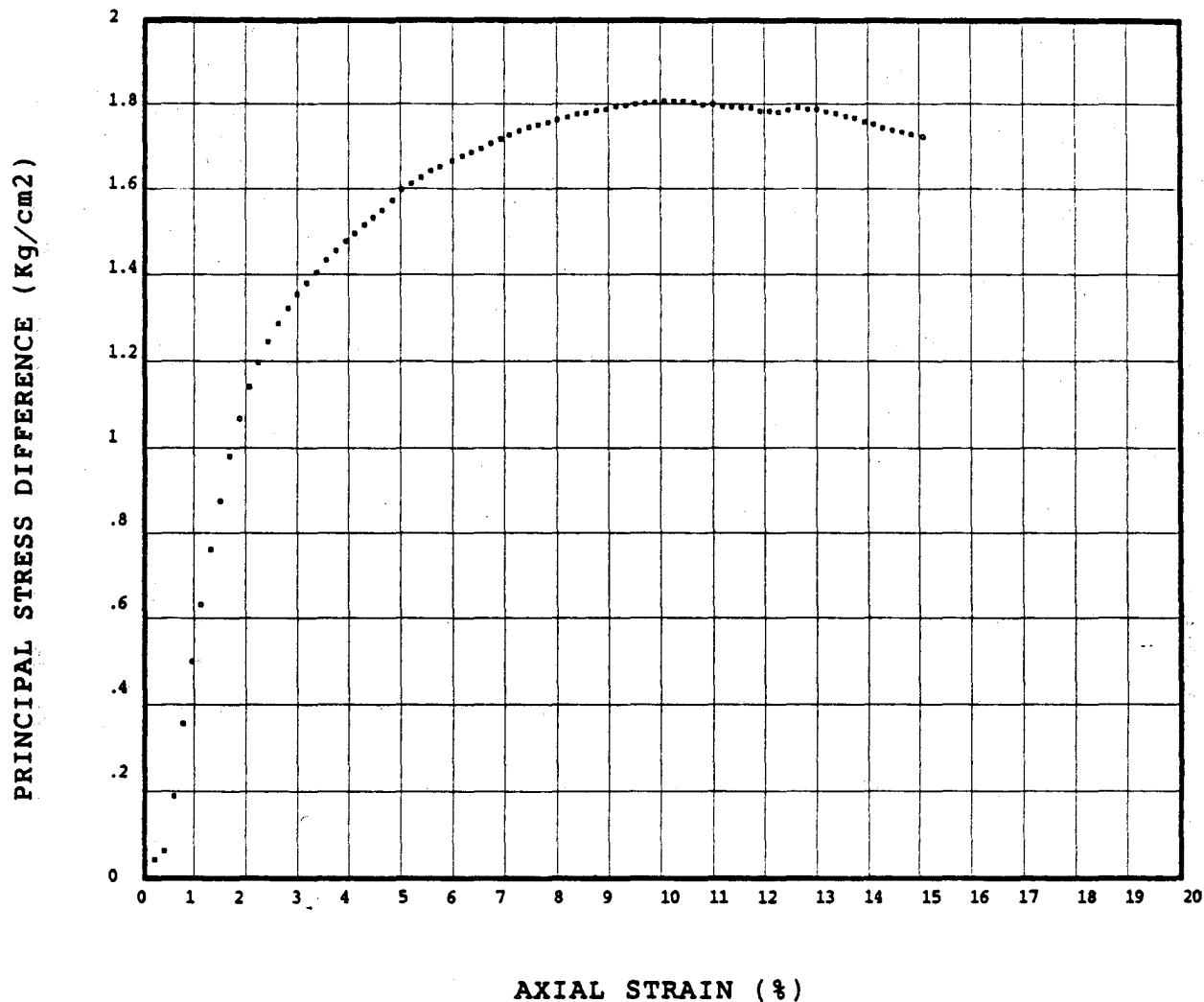
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRIC-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/86

FILE NO.
86-9155A

APPROVED BY:

Sample Name : B-2, US-5, 10.0'-12.0', SS#2



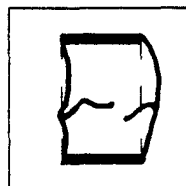
Dry density : 101.49 pcf

Water content : 21.96 %

Saturation : 90.85 %

Cell pressure : 0.37 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardaman & Associates Inc.

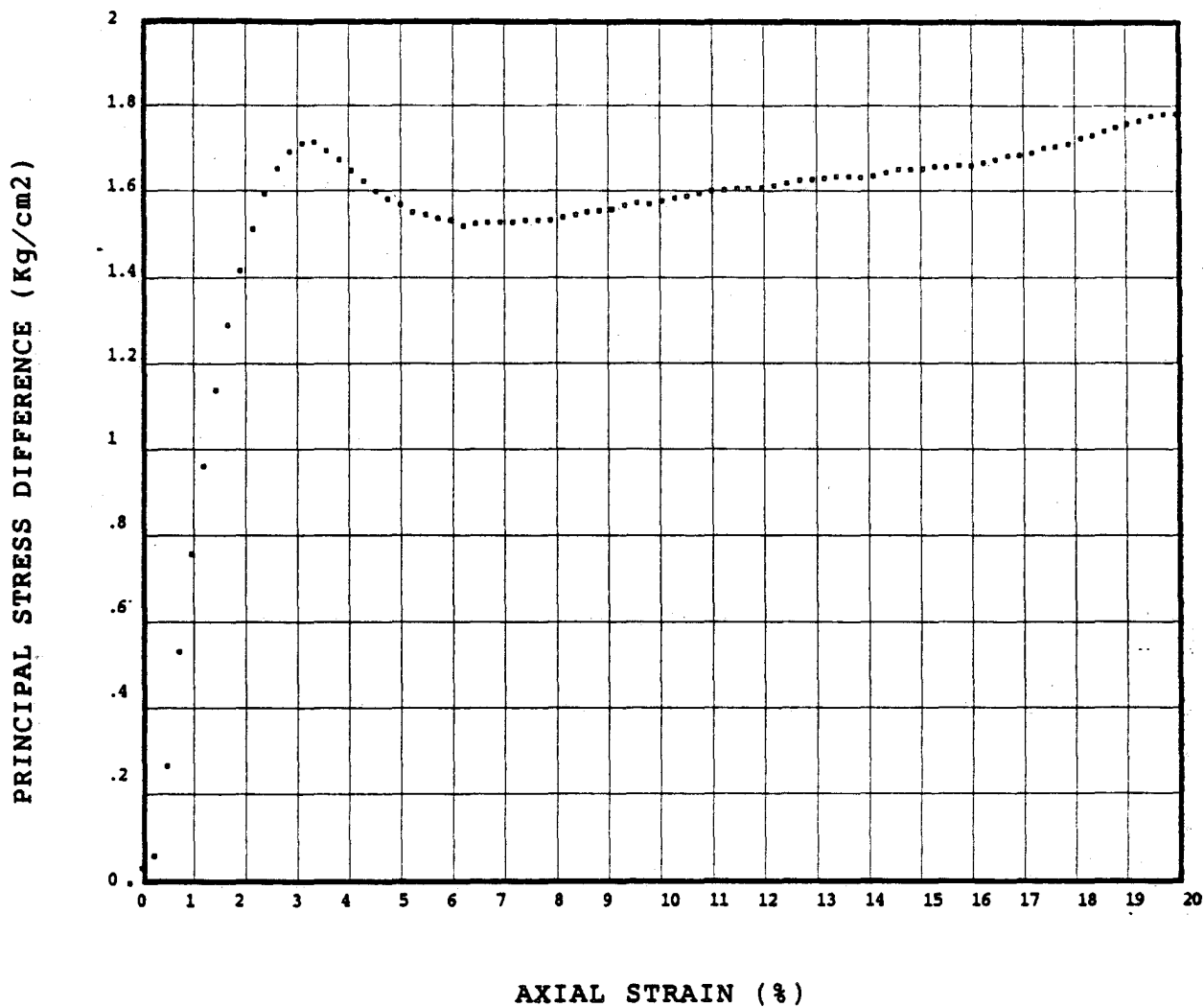
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: JAW DATE: 12/15/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-2, US-10, 35.0'-36.0', SS#1



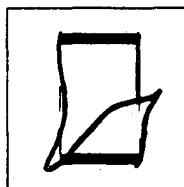
Dry density : 80.86 pcf

Water content : 39.77 %

Saturation : 98.77 %

Cell pressure : 0.90 kg/cm2

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Arden & Associates Inc.

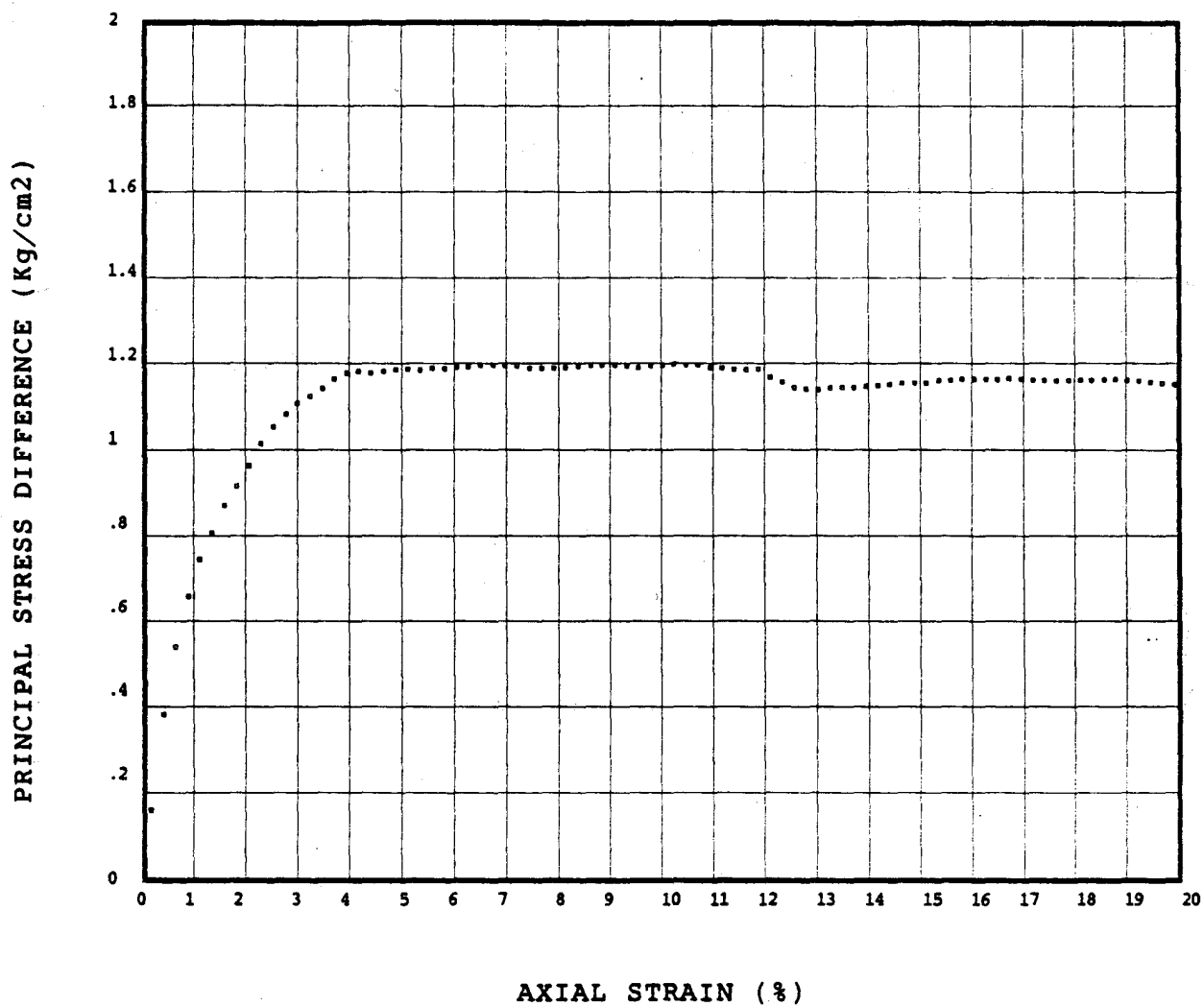
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRIC-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-3, US-7, 20.0'-21.5', SS#1



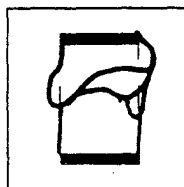
Dry density : 54.40 pcf

Water content : 75.55 %

Saturation : 96.60 %

Cell pressure : 0.58 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAxIAL COMPRESSION TEST



Ardaman & Associates Inc.

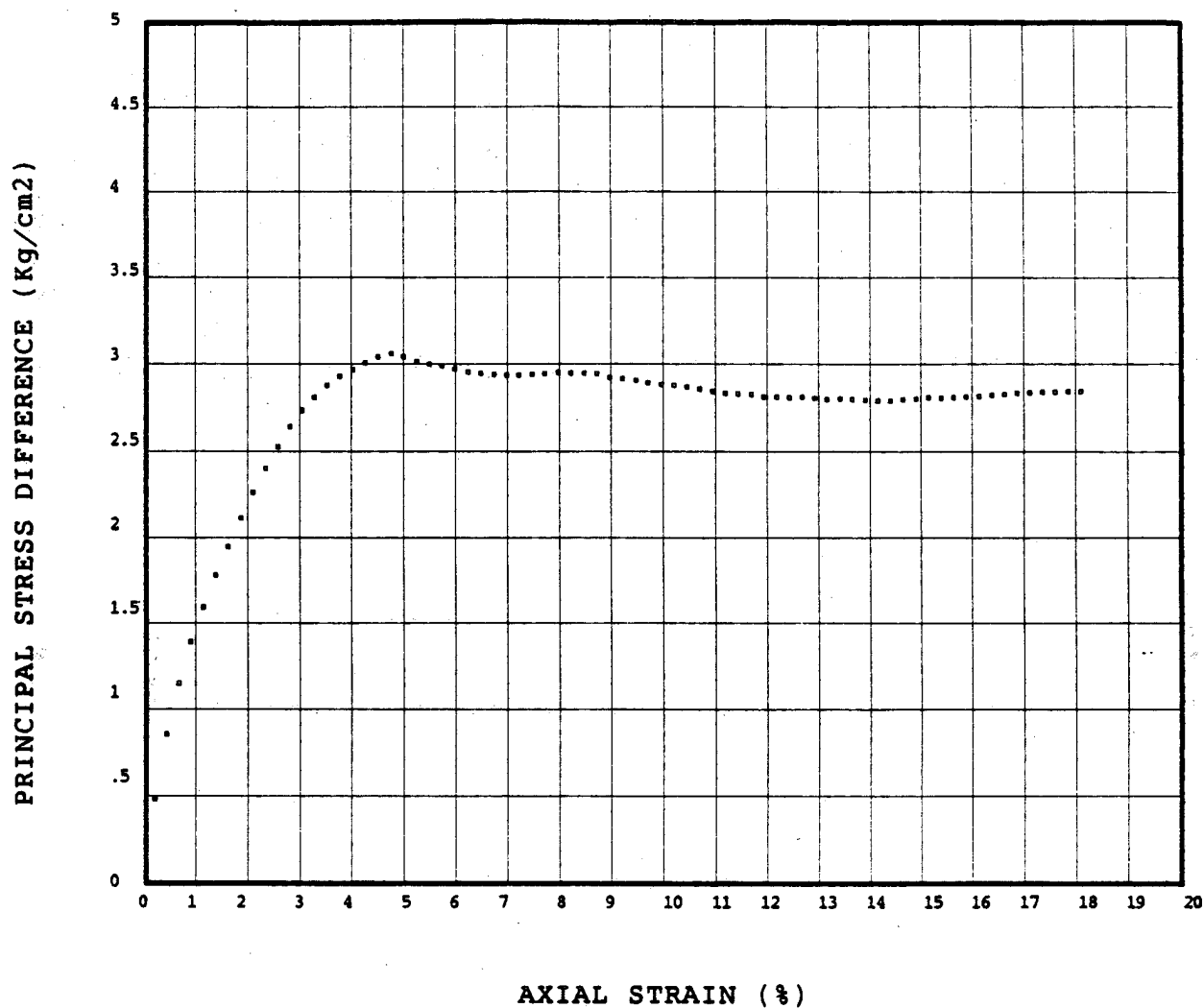
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRIC-SOUTH SITE

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FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-3, US-16, 65.0'-67.0', SS#1



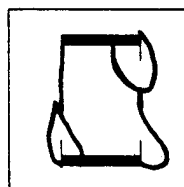
Dry density : 38.50 pcf

Water content : 119.91 %

Saturation : 95.70 %

Cell pressure : 1.61 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardanen & Associates Inc.

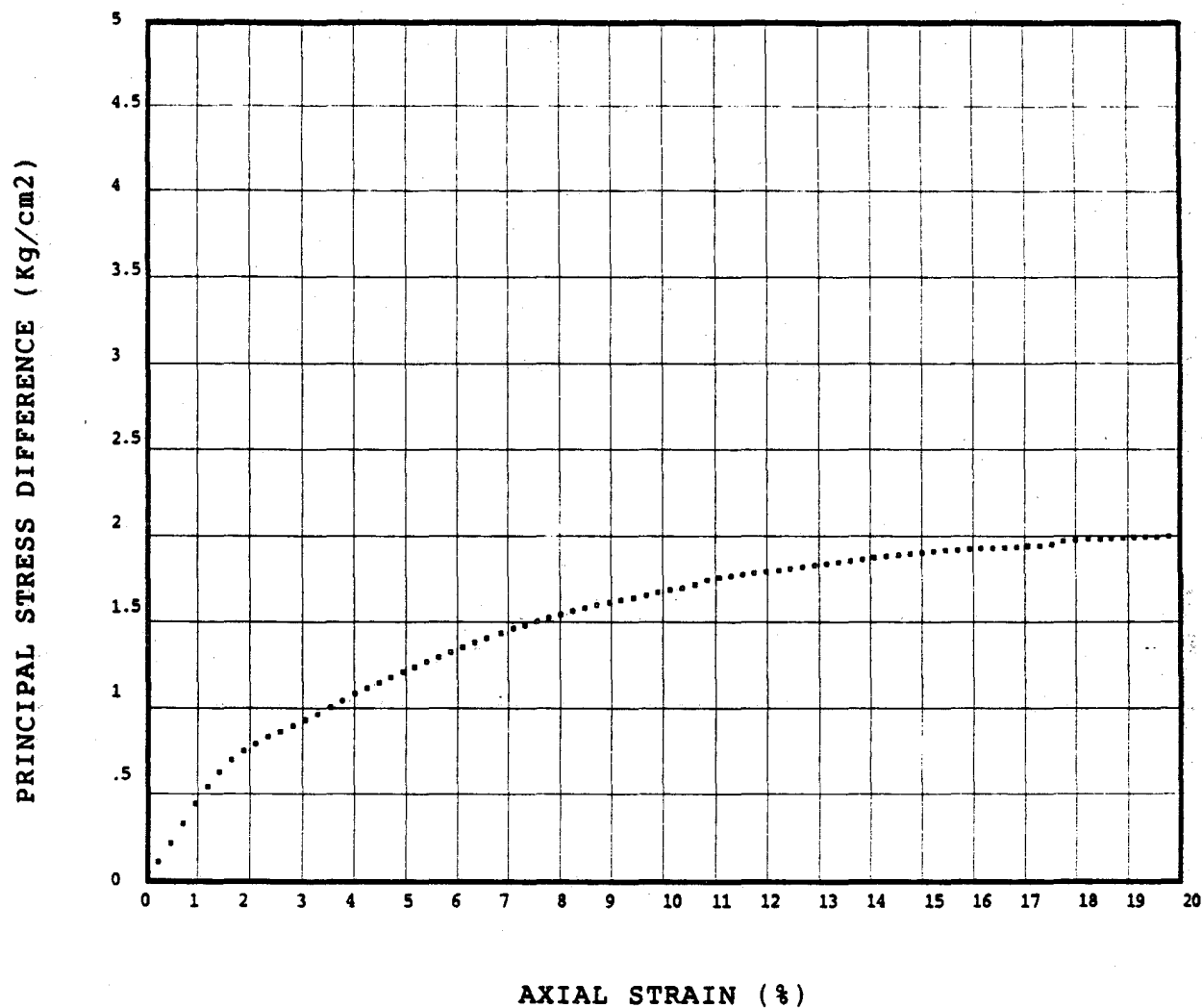
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *ju* DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-4, US-5, 10.0'-12.0', SS#1



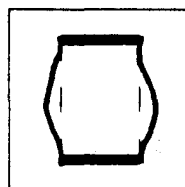
Dry density : 116.46 pcf

Water content : 15.25 %

Saturation : 93.76 %

Cell pressure : 0.39 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAxIAL COMPRESSION TEST



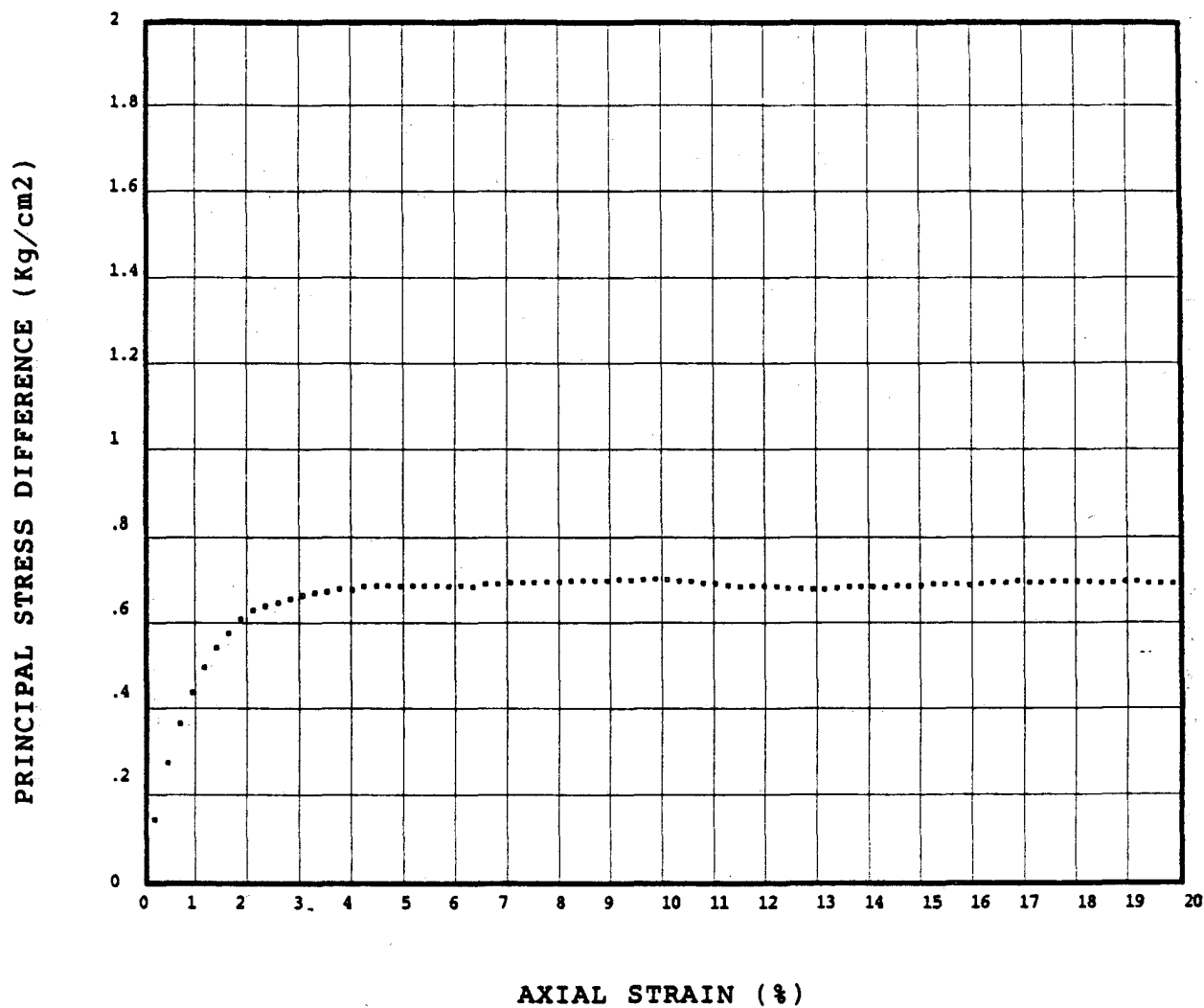
Ardaman & Associates Inc.

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4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/88

FILE NO. 88-9155A APPROVED BY:

Sample Name : B-4, US-6, 15.0'-17.0', SS#1



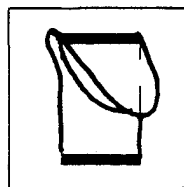
Dry density : 78.66 pcf

Water content : 38.86 %

Saturation : 91.58 %

Cell pressure : 0.63 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAxIAL COMPRESSION TEST



Ardaman & Associates Inc.

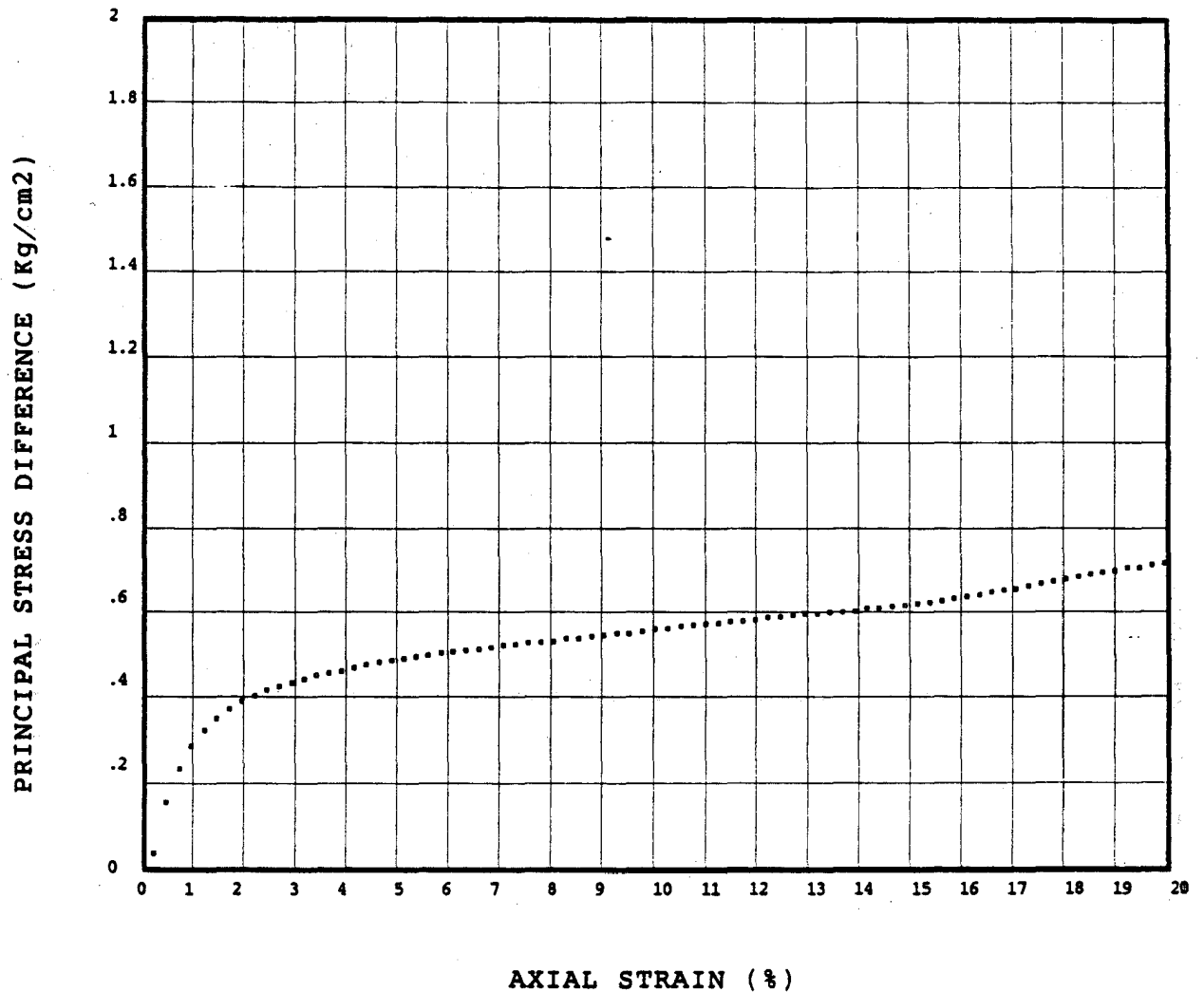
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: YW DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-5, US-6, 15.0'-17.0', SS#1



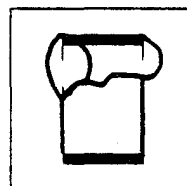
Dry density : 71.49 pcf

Water content : 49.34 %

Saturation : 98.19 %

Cell pressure : 0.49 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardanen & Associates Inc.

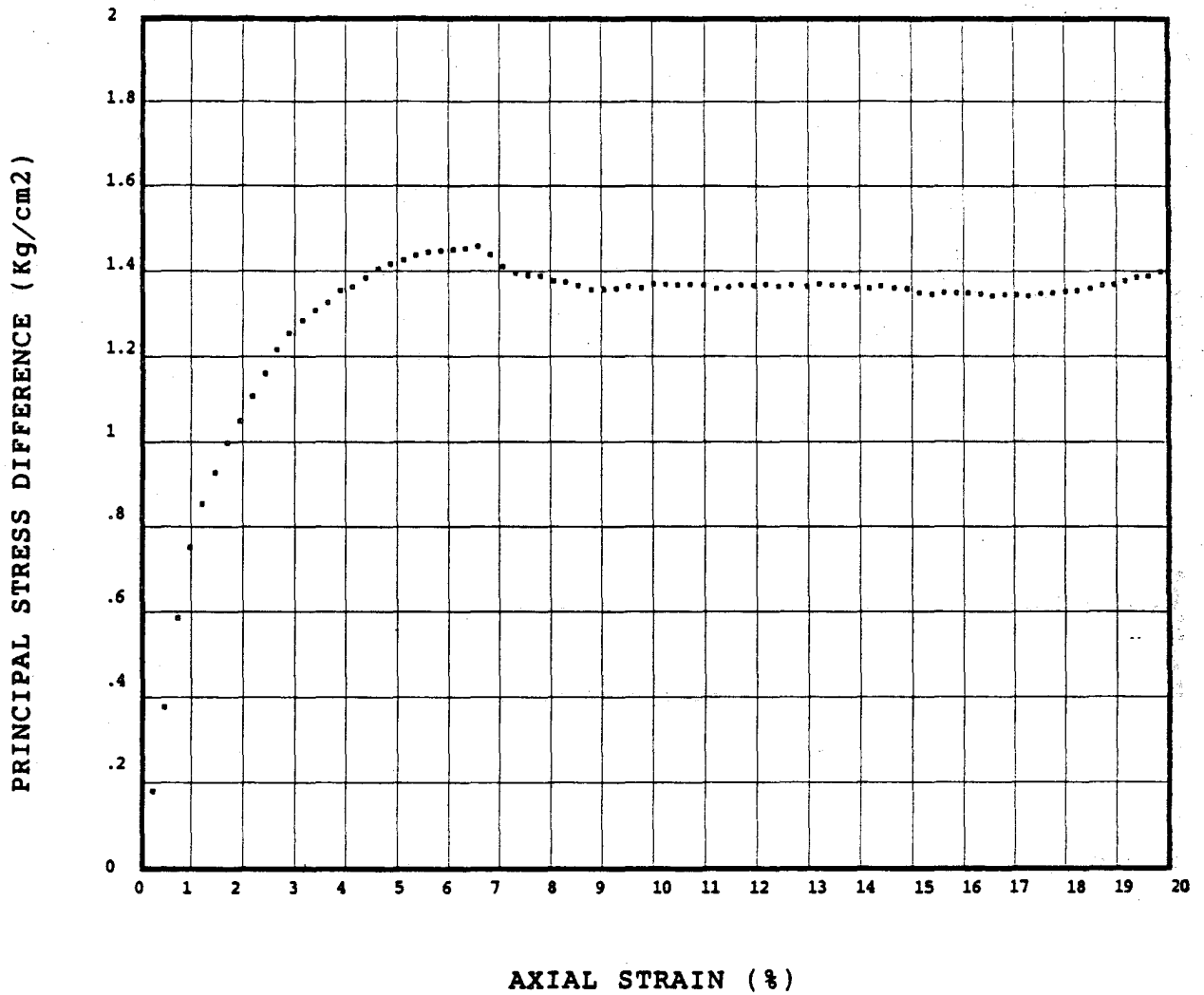
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-7, US-6, 15.0'-17.0', SS#1



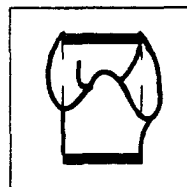
Dry density : 60.44 pcf

Water content : 62.53 %

Saturation : 94.44 %

Cell pressure : 0.49 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardaman & Associates Inc.

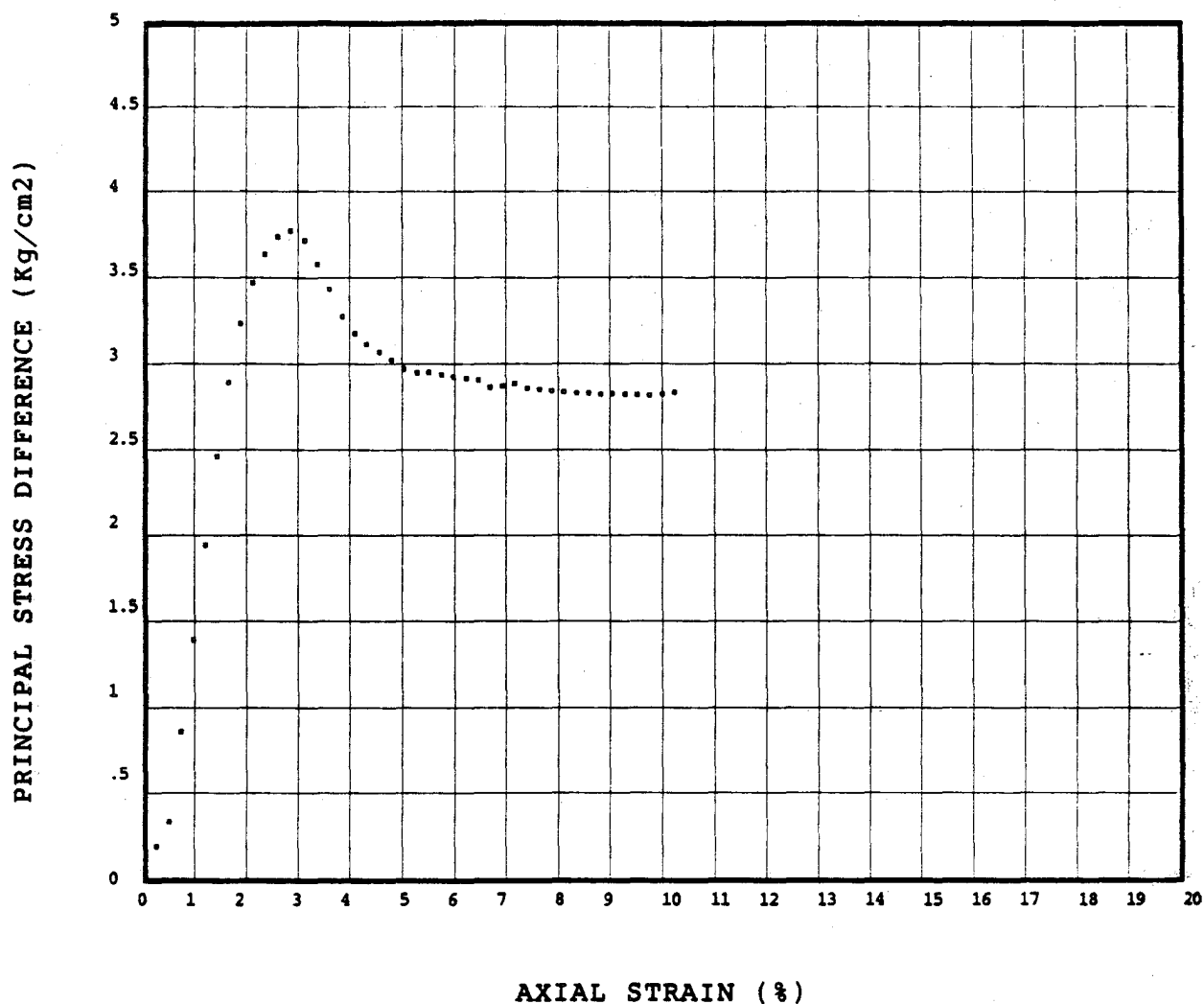
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRICO-SOUTH SITE

DRAWN BY: HAD CHECKED BY: *[Signature]* DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-8, US-10, 35.0'-37.0', SS#1



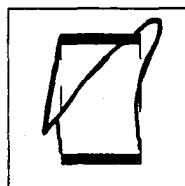
Dry density : 81.63 pcf

Water content : 35.30 %

Saturation : 90.55 %

Cell pressure : 0.93 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



Ardaman & Associates Inc.

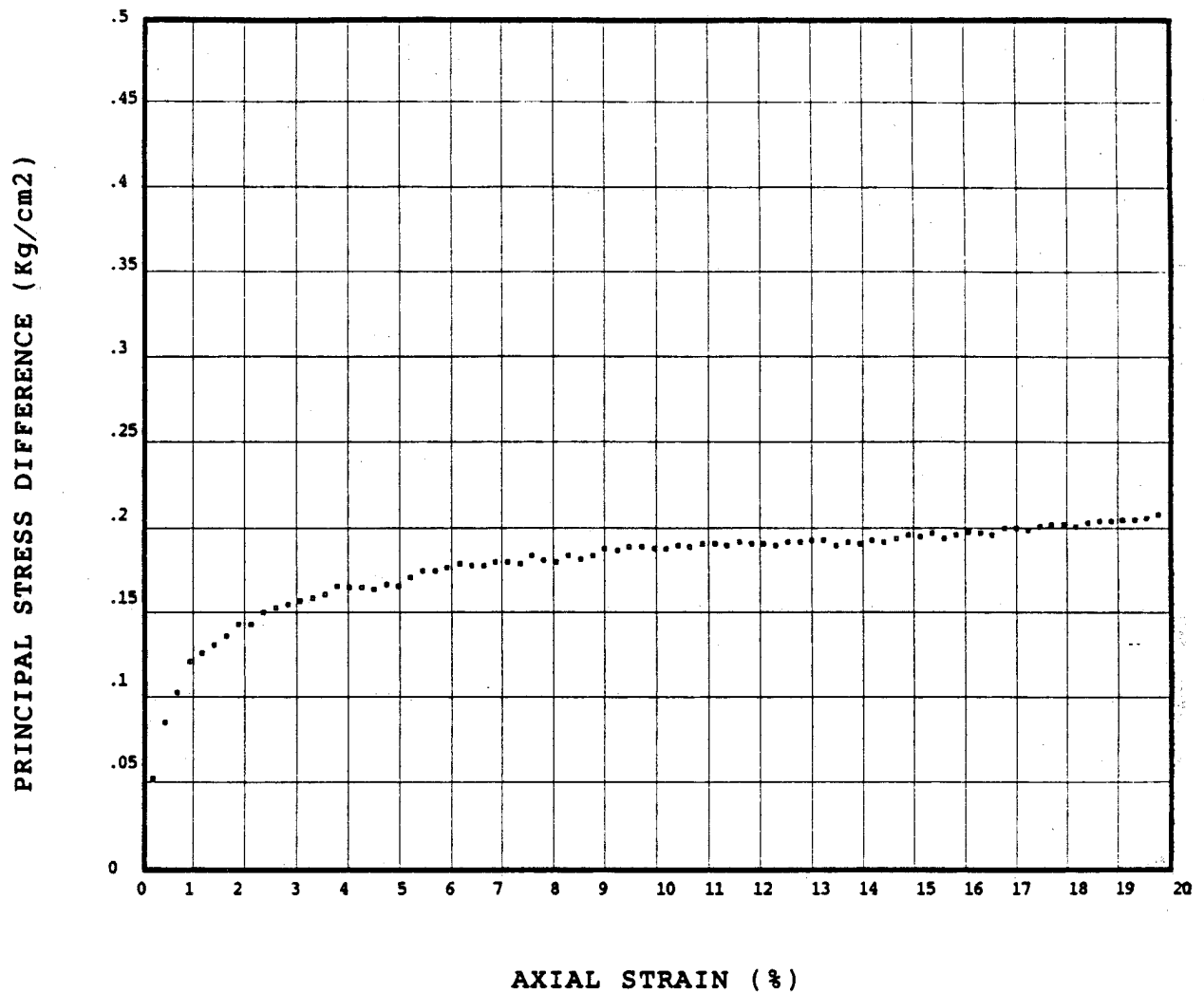
SEMINOLE ELECTRIC COOPERATIVE INC.
4040 MEGAWATT COMBUSTION GENERATOR
AGRIC-SOUTH SITE

DRAWN BY: HAD CHECKED BY: JAW DATE: 12/16/88

FILE NO.
88-9155A

APPROVED BY:

Sample Name : B-9, US-8, 25.0'-27.0', SS#1



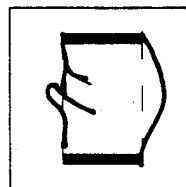
Dry density : 60.61 pcf

Water content : 69.90 %

Saturation : 106.05 %

Cell pressure : 0.73 kg/cm²

Strain rate : 1.00%/min



TYPE OF FAILURE

UNCONSOLIDATED - UNDRAINED
TRIAXIAL COMPRESSION TEST



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4040 MEGAWATT COMBUSTION GENERATOR
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88-9155A

APPROVED BY:

Response to KBN/SECI-88-052 per B&V-SECI-89-145

Item: Section 2.3.1.4

(The following text can be used as an introduction to the SCA appendix that will contain the boring logs--logs previously transmitted direct to KBN by B&V).

The field investigation and laboratory test program were performed in accordance with the following ASTM standards unless otherwise noted.

Field Testing

- | | |
|-----------------------------|--|
| 1. Split Barrel Sampling | D1586 |
| 2. Tin Walled Tube Sampling | D1587 |
| 3. Dilatometer Tests | ASTM Subcommittee D18.02.10, June 1986 |

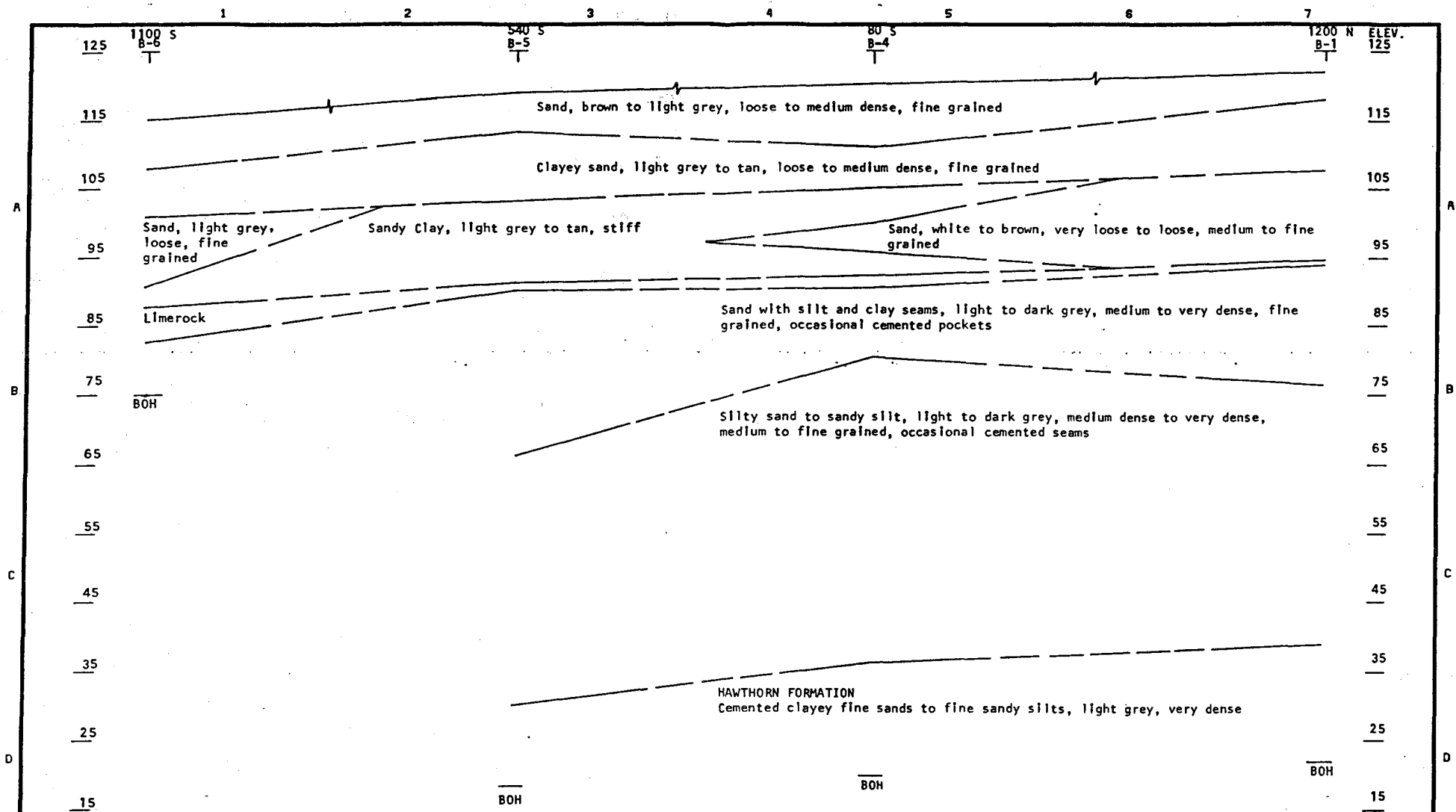
Laboratory Testing

- | | |
|-------------------------|--|
| 1. Moisture Content | D2216 |
| 2. Density | D653 |
| 3. Atterberg Limits | D4318 |
| 4. Sieve Analysis | D2217 |
| 5. Hydrometer | D422 |
| 6. Permeability | US Department of the Army EM 1110-2-1906 |
| 7. Organic Content | D2974 |
| 8. Triaxial Compression | D2850 |
| 9. Consolidation | D2435 |

DESCRIPTION OF GROUND-TRUTHING FEATURES

1. Depression, 2-3 feet deep. Vegetation: dead water hyacinths; and grasses; very soggy center.
2. Depression, 1 foot deep. Vegetation: dead water hyacinths; dry; hog wallows nearby.
3. Depression, 1-2 feet deep. Vegetation: water hyacinth with a reed like grass in the center. I was expecting this depression to have standing water in the center but is it located close to the mining operations and may have been dewatered. Power lines to the east and pipe on ground near east edge of sink. Very small area which looks like a possible sink near the east edge of orange grove an west of this depression.
4. Depression, 3-4 feet deep. Vegetation: water hyacinth with cattails in center. Standing water in center.
5. Depression, 4 feet deep. Vegetation: mature water oaks and other lowland vegetation, marijuana.
6. Could not verify due to mining operations.
7. Depression, 10-12 feet deep. Vegetation: water lillies and other water vegetation. Standing water in bottom.
8. Depression, 4 feet deep. Vegetation: dead water hyacinth, standing water in center.
9. Depression, 6+ feet deep. Vegetation: unidentified reeds and water grasses. Standing water. Wetland.
10. Depression, 4+ feet deep. Vegetation: unidentified; some water lillies; standing water, wetland. Alligator droppings.
11. Depression, continuation of 10, not as deep.
12. Depression, 1-2 feet deep. Vegetation: dead water hyacinths.
13. Depression, 4 feet deep.
14. Depression, 2+ feet deep.
15. Depression, unknown depth, northwest side has scarp could not tell if this was depression rim or just drainage. Drainage developed within trees to a marsh area in center. Center very wet. Vegetation: mature trees, with some wetland vegetation in center. Hard to tell extent of marshy area due to thick vegetation.

16. Depression, 1/2-1 foot in drainage area. Dry possibly due to mine dewatering. Hog wallows nearby.
17. Could not verify due to mining operations.
18. Could not verify because inaccessible.
19. Depression, 1-2 feet deep. Vegetation: mature trees and underbrush, dry.
20. Depression, 2-3 feet deep. Vegetation: mature trees and underbrush, dry.
21. Dragline Pit - man made.
22. Depression, part of it is very disturbed and there is evidence that this was used as a dragline pit. Other parts look like a natural depression. The only way to tell is to obtain old photography (pre-mining) and see if a depression was there originally.



										 BLACK & VEATCH ENGINEERS-ARCHITECTS		SEMINOLE ELECTRIC COOPERATIVE INC. COMBUSTION TURBINE PROJECT		PROJECT 14845-SK-122088-01		DRAWING NUMBER 14845-SK-122088-01		REV 	
										ENGINEER PLN		DRAWN MRJ		SOIL STATIGRAPHY FIGURE		CODE 		FIGURE 3-1	
NO DATE REVISIONS AND RECORD OF ISSUE BY CHK APP FLM										CHECKED DATE				AREA					

11.5 SUPPORTING HYDROLOGICAL INFORMATION

11.5.1 PRECIPITATION DATA

Table A-1. Monthly and Annual Precipitation at Wauchula, Florida (Page 1 of 2)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1933	0.85	2.23	1.95	5.44	2.54	7.64	11.60	4.52	12.19	1.08	1.74	0.14	51.92
1934	1.09	2.23	1.71	6.36	7.53	12.98	4.00	5.52	7.28	0.77	1.07	0.21	50.75
1935	0.27	1.65	0.20	2.79	4.71	8.11	7.66	7.92	6.83	2.93	0.79	3.16	47.02
1936	4.53	8.92	3.17	1.21	2.09	9.23	5.77	8.46	8.31	4.02	2.76	1.89	60.36
1937	1.99	5.26	4.20	3.77	4.38	12.22	8.02	6.34	6.40	3.03	3.91	0.63	60.15
1938	1.02	1.11	1.17	0.55	3.99	10.82	11.32	2.97	5.73	9.38	1.79	0.11	49.96
1939	0.96	1.04	0.57	4.21	7.17	18.42	10.78	13.99	7.18	2.13	0.61	1.17	68.23
1940	3.61	4.46	3.43	1.53	2.41	8.17	7.84	7.25	8.54	0.00	0.02	4.20	51.46
1941	3.44	2.55	2.45	4.19	0.55	10.78	7.82	4.59	4.24	2.50	3.13	2.21	48.45
1942	3.46	5.34	4.50	3.29	2.34	8.98	6.19	6.77	7.04	0.62	0.25	2.04	50.82
1943	1.27	0.63	4.52	1.48	6.08	15.11	11.74	12.54	4.72	3.36	0.66	0.87	62.98
1944	0.92	0.63	4.30	1.79	2.23	9.29	7.91	6.16	4.35	1.52	0.23	0.39	39.72
1945	2.85	0.19	0.18	0.22	0.29	15.24	13.62	5.58	7.99	5.55	0.42	1.77	53.90
1946	1.08	3.03	0.60	0.68	3.54	7.22	15.54	4.95	6.90	1.74	0.43	0.33	46.04
1947	1.75	3.64	6.76	7.75	6.86	10.63	9.86	9.52	18.06	2.64	2.78	1.85	82.10
1948	4.19	0.80	2.26	2.38	1.65	3.02	13.29	10.02	13.91	0.82	0.38	1.29	54.01
1949	0.26	0.45	0.75	3.41	0.56	10.40	12.29	15.53	7.88	2.69	3.29	0.00	57.51
1950	0.08	0.33	3.43	1.09	3.01	4.97	4.06	9.89	5.22	6.85	0.52	4.13	43.58
1951	0.45	1.90	1.10	8.26	2.28	5.04	8.84	4.21	8.37	4.10	2.48	0.96	47.99
1952	1.29	5.24	4.16	1.16	6.72	2.40	6.44	6.29	7.43	9.67	3.02	1.54	55.36
1953	2.98	2.46	3.30	6.55	0.43	16.03	8.89	12.46	14.38	6.21	6.43	3.36	83.48
1954	1.62	2.77	1.19	4.14	11.32	11.87	6.61	8.08	6.00	2.87	2.23	2.10	60.80
1955	2.57	1.32	2.10	2.14	1.49	10.62	7.35	8.64	6.87	1.39	0.83	1.11	46.43
1956	0.54	1.25	0.94	4.25	5.65	3.69	5.63	12.11	6.99	2.79	0.24	0.12	44.20
1957	3.42	4.47	5.28	4.14	11.31	5.39	7.83	3.75	9.41	2.96	1.71	2.70	62.37
1958	7.20	4.26	7.72	2.95	5.11	3.48	7.87	3.30	7.09	2.82	2.99	4.77	59.56
1959	2.33	2.54	9.22	2.49	3.43	13.97	12.12	8.08	8.97	3.86	0.80	1.32	69.13
1960	0.62	5.46	4.47	3.39	2.86	3.72	14.60	8.40	13.83	5.11	0.08	1.37	63.91
1961	2.19	3.35	2.21	1.96	5.30	4.27	5.57	8.20	1.19	0.57	0.36	1.76	36.93
1962	1.07	0.58	3.77	6.94	6.27	14.77	2.80	7.93	11.41	0.96	2.30	0.43	59.23
1963	2.24	7.37	0.90	0.03	10.61	9.91	7.29	5.86	8.62	0.27	5.89	2.58	61.57
1964	3.13	5.04	4.34	3.39	2.68	3.26	6.20	4.84	8.17	2.78	0.86	1.16	45.85
1965	1.51	3.86	6.85	0.96	0.01	8.92	13.76	4.17	6.03	3.96	1.20	2.77	54.00
1966	6.49	4.95	0.84	2.52	1.82	5.37	7.16	5.48	6.70	1.33	0.24	0.76	43.66
1967	0.52	2.98	0.08	0.00	0.77	11.87	10.91	7.51	3.79	0.93	0.03	2.67	42.06
1968	0.73	1.79	1.16	0.65	7.82	15.85	10.18	6.50	5.01	3.43	2.32	0.37	55.81
1969	2.91	2.05	6.53	2.05	1.65	7.88	6.40	8.67	9.77	5.14	1.97	2.70	57.72
1970	2.89	2.60	5.80	0.13	5.01	5.91	12.31	4.24	5.96	2.16	0.84	0.89	48.74
1971	0.35	4.01	1.46	0.05	5.80	5.65	8.24	7.86	7.09	4.08	1.23	0.94	46.76
1972	0.67	4.70	4.41	2.11	7.42	9.05	5.40	8.83	1.44	1.65	4.75	2.68	53.11
1973	7.26	2.64	5.09	3.49	1.27	4.81	10.91	4.76	8.44	0.59	0.76	1.78	51.80

Table A-1. Monthly and Annual Precipitation at Wauchula, Florida (Page 2 of 2)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1974	0.03	1.12	0.30	1.56	2.74	14.97	10.05	7.92	3.58	0.10	0.16	2.32	44.85
1975	0.50	1.62	0.88	0.23	6.87	7.02	8.45	5.41	9.41	10.36	0.36	0.60	51.71
1976	1.04	0.69	0.35	1.60	8.39	10.74	9.09	6.33	3.26	1.57	1.26	2.56	46.88
1977	2.41	1.77	0.84	0.28	4.05	8.06	12.46	5.34	5.38	1.55	2.66	4.83	49.63
1978	2.93	3.59	2.09	0.00	5.68	7.25	10.40	6.41	2.70	1.43	0.97	2.90	46.35
1979	7.84	1.41	1.52	1.72	7.08	8.00	7.16	8.62	11.56	0.45	0.72	1.91	57.99
1980	2.25	2.37	1.70	4.66	6.39	10.05	4.17	6.02	2.00	1.24	3.08	0.78	44.71
1981	0.58	4.37	1.35	0.08	2.91	8.09	2.21	6.91	8.12	0.22	0.44	1.38	36.66
1982	1.13	3.08	5.35	4.32	6.50	15.96	9.08	2.66	10.95	1.73	0.82	0.98	62.56
1983	4.29	7.99	7.45	2.75	1.79	8.25	9.66	9.49	7.42	3.14	2.22	3.79	68.24
1984	0.72	2.44	3.45	1.73	6.13	3.82	7.70	6.85	5.10	0.36	1.30	0.47	40.07
1985	0.96	0.84	2.08	2.63	4.95	7.33	3.63	10.27	7.51	2.81	1.25	0.75	45.01
1986	2.66	1.88	5.78	0.73	2.22	11.65	9.08	7.06	4.79	3.84	0.82	5.51	56.02
1987	2.96	1.99	7.03	0.16	3.02	4.47	8.56	5.16	3.35	4.51	11.18	0.74	53.13
1988	1.77	2.56	5.55	0.70	3.24	4.48	12.45	8.06	7.16				45.97
AVG	2.15	2.85	3.12	2.48	4.30	8.88	8.69	7.24	7.29	2.81	1.74	1.76	53.33
MAX	7.84	8.92	9.22	8.26	11.32	18.42	15.54	15.53	18.06	10.36	11.18	5.51	83.48
MIN	0.03	0.19	0.08	0.00	0.01	2.40	2.21	2.66	1.19	0.00	0.02	0.00	36.66

Sources: Southwest Florida Water Management District, 1988
NOAA, 1988

11.5.2 STREAMFLOW DATA

Table B. Water Level on Payne Creek (Station PC-2): Daily Averages

Date	Level (ft)	Discharge (cfs)	Date	Level (ft)	Discharge (cfs)
11-Oct-88	2.55	11.35	24-Nov-88	2.52	10.85
12-Oct-88	2.45	9.76	25-Nov-88	2.54	11.18
13-Oct-88	2.31	7.81	26-Nov-88	2.47	10.06
14-Oct-88	2.21	6.61	27-Nov-88	2.37	8.61
15-Oct-88	2.15	5.95	28-Nov-88	2.31	7.81
16-Oct-88	2.19	6.38	29-Nov-88	2.25	7.07
17-Oct-88	2.39	8.88	30-Nov-88	2.15	5.95
18-Oct-88	2.25	7.07	01-Dec-88	2.08	5.25
19-Oct-88	2.06	5.06	02-Dec-88	2.02	4.70
20-Oct-88	1.99	4.44	03-Dec-88	1.98	4.36
21-Oct-88	1.96	4.20	04-Dec-88	1.95	4.11
22-Oct-88	1.94	4.04	05-Dec-88	1.94	4.04
23-Oct-88	1.93	3.96	06-Dec-88	2.04	4.88
24-Oct-88	1.93	3.96	08-Dec-88	1.99	4.44
25-Oct-88	1.92	3.88	09-Dec-88	1.96	4.20
26-Oct-88	1.91	3.80	10-Dec-88	1.94	4.04
27-Oct-88	1.88	3.58	11-Dec-88	1.92	3.88
28-Oct-88	1.86	3.44	12-Dec-88	2.04	4.88
29-Oct-88	1.84	3.30	13-Dec-88	2.04	4.88
31-Oct-88	1.83	3.24	14-Dec-88	2.00	4.53
01-Nov-88	1.83	3.24	15-Dec-88	1.97	4.28
02-Nov-88	1.84	3.30	16-Dec-88	1.96	4.20
03-Nov-88	1.82	3.17	17-Dec-88	1.94	4.04
04-Nov-88	2.19	6.38	18-Dec-88	1.92	3.88
05-Nov-88	2.49	10.37	19-Dec-88	1.91	3.80
06-Nov-88	2.52	10.85	20-Dec-88	1.91	3.80
07-Nov-88	2.56	11.52	21-Dec-88	1.91	3.80
08-Nov-88	2.45	9.76	22-Dec-88	1.90	3.73
08-Nov-88	2.35	8.33	23-Dec-88	1.90	3.73
09-Nov-88	2.27	7.31	24-Dec-88	1.90	3.73
10-Nov-88	2.21	6.61	25-Dec-88	1.90	3.73
11-Nov-88	2.14	5.85	26-Dec-88	1.90	3.73
12-Nov-88	2.08	5.25	27-Dec-88	1.89	3.66
13-Nov-88	2.06	5.06	28-Dec-88	1.89	3.66
14-Nov-88	2.03	4.79	29-Dec-88	1.90	3.73
15-Nov-88	2.01	4.61	30-Dec-88	1.91	3.80
16-Nov-88	1.98	4.36	31-Dec-88	1.90	3.73
17-Nov-88	1.96	4.20	01-Jan-89	1.89	3.66
18-Nov-88	1.95	4.11	02-Jan-89	1.88	3.58
19-Nov-88	1.94	4.04	03-Jan-89	1.87	3.51
20-Nov-88	1.93	3.96	04-Jan-89	1.76	2.79
21-Nov-88	1.92	3.88	05-Jan-89	1.74	2.67
22-Nov-88	2.18	6.27	06-Jan-89	1.77	2.85

Table B. Water Level on Payne Creek (Station PC-2): Daily Averages

Date	Level (ft)	Discharge (cfs)	Date	Level (ft)	Discharge (cfs)
07-Jan-89	1.79	2.98	19-Feb-89	1.78	2.91
08-Jan-89	1.79	2.98	20-Feb-89	1.76	2.79
09-Jan-89	1.79	2.98	21-Feb-89	1.74	2.67
10-Jan-89	1.79	2.98	22-Feb-89	1.72	2.56
11-Jan-89	1.79	2.98	23-Feb-89	1.70	2.45
12-Jan-89	1.78	2.91	24-Feb-89	1.69	2.39
13-Jan-89	1.74	2.67	25-Feb-89	1.68	2.34
14-Jan-89	1.69	2.39	26-Feb-89	1.67	2.29
15-Jan-89	2.03	4.79	27-Feb-89	1.67	2.29
16-Jan-89	2.37	8.61	28-Feb-89	1.66	2.24
17-Jan-89	2.35	8.33	01-Mar-89	1.66	2.24
18-Jan-89	2.21	6.61	02-Mar-89	1.73	2.62
19-Jan-89	2.15	5.95	03-Mar-89	2.11	5.54
20-Jan-89	2.17	6.17	04-Mar-89	2.36	8.47
21-Jan-89	2.28	7.43	05-Mar-89	2.26	7.19
22-Jan-89	2.76	15.31	06-Mar-89	2.16	6.06
23-Jan-89	3.18	26.16	07-Mar-89	2.09	5.35
24-Jan-89	3.49	37.19	08-Mar-89	2.13	5.75
25-Jan-89	3.50	37.60	09-Mar-89	2.05	4.97
26-Jan-89	3.25	28.41	10-Mar-89	1.96	4.20
27-Jan-89	3.06	22.62	11-Mar-89	1.88	3.58
28-Jan-89	2.88	17.98	12-Mar-89	1.82	3.17
29-Jan-89	2.97	20.20	13-Mar-89	1.77	2.85
30-Jan-89	2.92	18.95	14-Mar-89	1.74	2.67
31-Jan-89	2.72	14.49	15-Mar-89	1.80	3.04
01-Feb-89	2.67	13.51	16-Mar-89	1.80	3.04
02-Feb-89	2.61	12.39	17-Mar-89	1.91	3.80
03-Feb-89	2.55	11.35	18-Mar-89	1.74	2.67
04-Feb-89	2.49	10.37	19-Mar-89	1.69	2.39
05-Feb-89	2.43	9.46	20-Mar-89	1.72	2.56
06-Feb-89	2.37	8.61	21-Mar-89	1.69	2.39
07-Feb-89	2.31	7.81	22-Mar-89	1.68	2.34
08-Feb-89	2.26	7.19	23-Mar-89	1.67	2.29
09-Feb-89	2.20	6.49	24-Mar-89	1.66	2.24
10-Feb-89	2.14	5.85	25-Mar-89	1.64	2.14
11-Feb-89	2.08	5.25	26-Mar-89	1.61	1.99
12-Feb-89	2.02	4.70	27-Mar-89	1.69	2.39
13-Feb-89	1.96	4.20	28-Mar-89	1.85	3.37
14-Feb-89	1.90	3.73	29-Mar-89	1.80	3.04
15-Feb-89	1.83	3.24	30-Mar-89	1.70	2.45
16-Feb-89	1.80	3.04	31-Mar-89	1.66	2.24
17-Feb-89	1.79	2.98	01-Apr-89	1.63	2.09
18-Feb-89	1.79	2.98	02-Apr-89	1.64	2.14

Table B. Water Level on Payne Creek (Station PC-2): Daily Averages

Date	Level (ft)	Discharge (cfs)
03-Apr-89	1.98	4.36
04-Apr-89	1.85	3.37
05-Apr-89	1.72	2.56
06-Apr-89	1.65	2.19
07-Apr-89	1.61	1.99
08-Apr-89	1.57	1.81
09-Apr-89	1.55	1.73
10-Apr-89	1.53	1.64
11-Apr-89	1.52	1.60
12-Apr-89	1.52	1.60
13-Apr-89	1.52	1.60

Table C-1. Discharge of Payne Creek (station 2): 11-October-1988 @ 17:30

Distance from Initial Point (ft)	Total Depth (ft)	Observation Depth (ft)	Velocity (fps)		Area Discharge (ft ²) (cfs)	
			----- Point	Vert. Mean		
1	0.9	0.54	0.00 0.00	0.00	1.8	0.00
3	1.5	0.9	0.00 0.00	0.00	3	0.00
5	2.4	1.44	0.07 0.07	0.07	4.8	0.32
7	2.5	1.5	0.50 0.50	0.50	5	2.50
9	2	1.2	0.87 0.87	0.87	4	3.47
11	1.65	0.99	0.90 0.90	0.90	3.3	2.97
13	1.5	0.9	0.83 0.83	0.83	3	2.50
15	0.9	0.54	0.27 0.27	0.27	1.8	0.48
16	0	0	0.00 0.00	0.00	0	0.00
Total					26.7	12.2

Source: Applied Technology and Management, Inc., 1989

Table C-2. Discharge of Payne Creek (station 2): 8-November-1988 @ 15:21

Distance from Initial Point (ft)	Total Observation		Velocity (fps)		Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point	Vert. Mean		
1	0	0	0.03	0.03	0	0.00
			0.03			
3	1	0.6	0.40	0.40	2	0.79
		0	0.40			
5	2	1.2	0.62	0.62	4	2.47
		0	0.62			
7	2.25	1.35	0.91	0.91	4.5	4.10
		0	0.91			
9	2.25	1.35	0.54	0.54	4.5	2.45
		0	0.54			
1	2	1.2	0.25	0.25	4	0.99
		0	0.25			
13	1.5	0.9	0.17	0.17	3	0.52
		0	0.17			
15	1.25	0.75	0.10	0.10	2.5	0.25
		0	0.10			
17	0	0	0.03	0.03	0	0.00
		0	0.03			
19	0	0	0.03	0.03	0	0.00
		0	0.03			
20.5	0	0	0.03	0.03	0	0.00
		0	0.03			
Total					24.5	11.6

Source: Applied Technology and Management, Inc., 1989

Table C-3. Discharge of Payne Creek (station 2): 12-December-1988 @ 8:40

Distance from Initial Point (ft)	Total Observation		Velocity (fps)		Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	Point	Vert. Mean		
1	0	0	0.03	0.03	0	0.00
			0.03			
3	1	0.6	0.32	0.32	2	0.64
		0	0.32			
5	1.7	1.02	0.47	0.47	3.4	1.60
		0	0.47			
7	1.9	1.14	0.47	0.47	3.8	1.78
		0	0.47			
9	1.5	0.9	0.14	0.14	3	0.41
		0	0.14			
11	1	0.6	0.10	0.10	2	0.20
		0	0.10			
13	0.5	0.3	0.10	0.10	1	0.10
		0	0.10			
15	0	0	0.03	0.03	0	0.00
		0	0.03			
17	0	0	0.03	0.03	0	0.00
		0	0.03			
19	0	0	0.03	0.03	0	0.00
		0	0.03			
20.5	0	0	0.03	0.03	0	0.00
		0	0.03			
Total					15.2	4.7

Source: Applied Technology and Management, Inc., 1989

Table C-4. Discharge of Payne Creek (station 2): 11-January-1989 @ 17:05

Distance from Initial Point (ft)	Total Observation		Velocity (fps)		Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point Vert. Mean			
2	0.5	0.3	0.00 0.00	0.00	1.25	0.00
3	0.7	0.42 0	0.07 0.07	0.07	0.7	0.05
4	0.9	0.54 0	0.03 0.03	0.03	0.9	0.03
5	1.1	0.66 0	0.20 0.20	0.20	1.1	0.22
6	1.2	0.72 0	0.32 0.32	0.32	1.2	0.38
7	1	0.6 0	0.33 0.33	0.33	1	0.33
8	0.8	0.48 0	0.45 0.45	0.45	0.8	0.36
9	0.8	0.48 0	0.45 0.45	0.45	0.8	0.36
10	0.5	0.3 0	0.48 0.48	0.48	0.5	0.24
11	0.25	0.15 0	0.50 0.50	0.50	0.25	0.13
12	0.15	0.09 0	0.50 0.50	0.50	0.375	0.19
14	0	0 0	0.00 0.00	0.00	0	0.00
Total					8.9	2.3

Source: Applied Technology and Management, Inc., 1989

Table C-5. Discharge of Payne Creek (station 4): 8-December-1988 @ 12:20

Distance from Initial Point (ft)	Total Depth (ft)	Observation Depth (ft)	Velocity (fps)		Area Discharge (ft ²) (cfs)	
			----- Point	Vert. Mean		
6.5	0.75	0.45	0.99	0.99	1.125	1.11
			0.99			
9.5	1.5	0.9	1.21	1.21	2.25	2.72
		0	1.21			
12.5	1.8	1.08	1.50	1.50	2.7	4.06
		0	1.50			
15.5	2	1.2	1.43	1.43	3	4.28
		0	1.43			
18.5	2	1.2	1.43	1.43	3	4.28
		0	1.43			
21.5	2	1.2	1.32	1.32	3	3.95
		0	1.32			
24.5	2.2	1.32	1.32	1.32	3.3	4.35
		0	1.32			
27.5	2.2	1.32	1.21	1.21	3.3	3.98
		0	1.21			
30.5	1	0.6	1.21	1.21	1.5	1.81
		0	1.21			
32	0	0	0.03	0.03	0	0.00
		0	0.03			
Total					23.2	30.5

Source: Applied Technology and Management, Inc., 1989

Table C-6. Discharge of Payne Creek (station 4): 11-January-1988 @ 10:25

Distance from Initial Point (ft)	Total Observation		Velocity (fps)		Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point Vert. Mean			
1	0.45	0.27	0.63 0.63	0.63	0.9	0.57
3	0.8	0.48 0	0.63 0.63	0.63	1.6	1.01
5	1.47	0.88 0	0.77 0.77	0.77	2.94	2.25
7	1.8	1.08 0	0.80 0.80	0.80	3.6	2.88
9	1.92	1.15 0	0.90 0.90	0.90	3.84	3.46
11	2.1	1.26 0	0.87 0.87	0.87	4.2	3.64
13	2.1	1.26 0	0.83 0.83	0.83	4.2	3.50
15	2.2	1.32 0	0.77 0.77	0.77	4.4	3.37
17	2.2	1.32 0	0.70 0.70	0.70	4.4	3.08
19	2.35	1.41 0	0.60 0.60	0.60	4.7	2.82
21	2.25	1.35 0	0.63 0.63	0.63	4.5	2.85
23	2.3	1.38 0	0.57 0.57	0.57	4.6	2.61
25	1.1	0.66 0	0.63 0.63	0.63	2.2	1.39
26	0	0	0.00	0.00	0	0.0
Total					46.1	33.4

Source: Applied Technology and Management, Inc., 1989

Table C-7. Discharge of Peace River (station 1): 13-October-1988 @ 11:00

Distance from Initial Point (ft)	Total Depth (ft)	Observation Depth (ft)	Velocity (fps)		Area Discharge (ft ²) (cfs)	
			----- Point	Vert. Mean		
2	1	0.6	0.17 0.17	0.17	4	0.70
6	2	1.2 0	0.32 0.32	0.32	8	2.58
10	2.75	1.65 0	0.62 0.62	0.62	11	6.79
14	4	0.8 3.2	0.47 0.62	0.54	16	8.69
18	5	1 4	0.62 0.65	0.64	20	12.71
22	5.5	1.1 4.4	0.99 0.91	0.95	22	20.88
26	5.5	1.1 4.4	1.21 1.21	1.21	22	26.55
30	3.5	2.1 0	1.21 1.21	1.21	14	16.90
34	3.5	2.1 0	1.43 1.43	1.43	14	20.00
38	3.5	2.1 0	1.35 1.35	1.35	14	18.96
42	3	1.8	1.21 1.21	1.21	12	14.48
46	2.5	1.5	1.28 1.28	1.28	10	12.81
50	2	1.2	1.06 1.06	1.06	8	8.48
54	1	0.6	0.84 0.84	0.84	4	3.35
56	0	0	0.00	0.00	0	0.00
Total					179.0	173.9

Source: Applied Technology and Management, Inc., 1989

Table C-8. Discharge of Peace River (station 1): 8-November-1988 @ 17:25

Distance from Initial Point (ft)	Total Depth (ft)	Observation Depth (ft)	Velocity (fps)			Area (ft ²)	Discharge (cfs)
			Point	Vert.	Mean		
2.5	1.25	0.75	0.25	0.25	0.25	6.25	1.55
7.5	2	1.2	0.25	0.25	0.25	10	2.48
12.5	4	0.8	0.69	0.69	0.69	20	13.82
17.5	5	1	0.84	0.76	0.69	25	19.11
22.5	5.1	1	1.06	1.17	1.28	25.5	29.84
27.5	5.1	1	1.43	1.50	1.58	25.5	38.30
32.5	3.8	0.76	1.72	1.61	1.50	19	30.64
37.5	3.2	0.6	1.87	1.83	1.80	16	29.34
42.5	3	1.8	1.80	1.80	1.80	15	26.95
47.5	1.9	1.15	1.43	1.43	1.43	9.5	13.57
52.5	1.2	0.7	0.91	0.91	0.91	3	2.74
54.5	0.75	0.45	0.76	0.76	0.76	1.875	1.43
57	0	0	0.00	0.00	0.00	0	0.00
Total						176.6	209.8

Source: Applied Technology and Management, Inc., 1989

Table C-9. Discharge of Peace River (station 1): 7-December-1988 @ 17:59

Distance from Initial Point (ft)	Total Observation		Velocity (fps)		Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point Vert. Mean			
3	1	0.6	0.84	0.84	6	5.03
			0.84			
9	1.9	1.14	1.43	1.43	11.4	16.28
		0	1.43			
15	3	1.8	1.87	1.87	18	33.67
		0	1.87			
21	3.2	1.9	2.09	2.09	19.2	40.17
		0	2.09			
27	3.5	2.1	1.94	1.94	21	40.83
		0	1.94			
33	4	2.4	1.65	1.65	24	39.59
		0	1.65			
39	5	3	0.91	0.91	30	27.36
		0	0.91			
45	4.2	2.5	0.58	0.58	25.2	14.62
		0	0.58			
51	2	1.2	0.65	0.65	12	7.85
		0	0.65			
57	1.2	0.9	0.40	0.40	7.2	2.85
		0	0.40			
Total					174.0	228.3

Source: Applied Technology and Management, Inc., 1989

Table C-10. Discharge of Peace River (station 1): 11-January-1989 @ 13:00

Distance from Initial Point (ft)	Total Observation		Velocity (fps)			Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point	Vert.	Mean		
2.5	0.5	0	0.03	0.03		2.5	0.00
			0.03				
7.5	1.5	0.9	0.76	0.76		7.5	5.73
		0	0.76				
12.5	2.5	1.5	0.99	0.99		12.5	12.32
		0	0.99				
17.5	2.6	1.5	1.13	1.13		13	14.73
		0	1.13				
22.5	3.1	1.9	1.13	1.13		15.5	17.57
		0	1.13				
27.5	3.5	2.1	1.06	1.06		17.5	18.54
		0	1.06				
32.5	3.7	2.96	0.80	0.86		18.5	15.85
		0.74	0.91				
37.5	4.4	3.52	0.51	0.62		22	13.58
		0.88	0.73				
42.5	3.5	2.1	0.43	0.43		17.5	7.57
		1.2	0.43				
47.5	2	0.9	0.40	0.40		10	3.96
		0	0.40				
52.5	1.5	0	0.21	0.21		7.5	1.59
		0	0.21				
55	0	0	0.00	0		0	0.00
Total						144.0	111.4

Source: Applied Technology and Management, Inc., 1989

Table C-11. Discharge of Peace River (station 4): 7-December-1988 @ 15:40

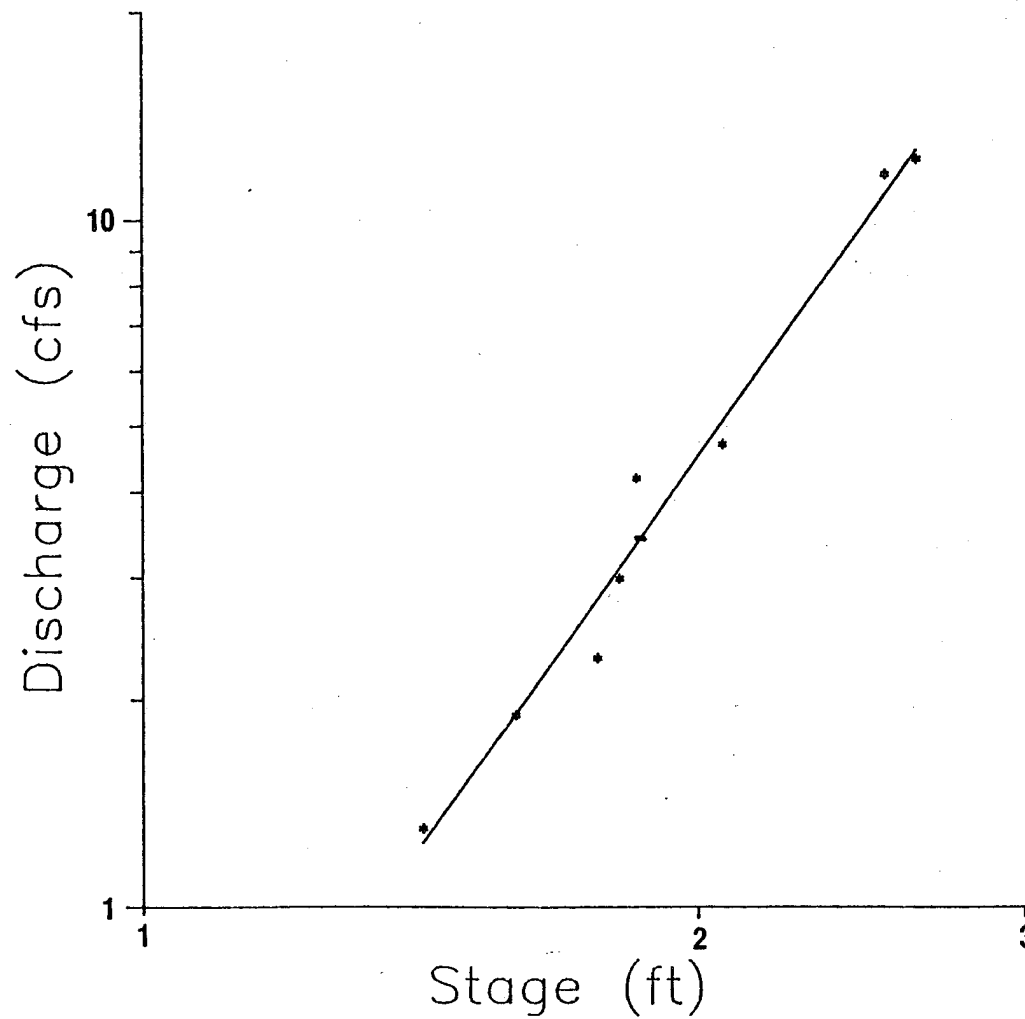
Distance from Initial Point (ft)	Total Observation		Velocity (fps)			Area Discharge (ft ²) (cfs)	
	Depth (ft)	Depth (ft)	----- Point	Vert.	Mean		
3	1.5	0.9	0.21		0.21	9	1.90
			0.21				
9	3	1.8	0.25		0.25	18	4.47
		0	0.25				
15	4	2.4	0.69		0.69	24	16.58
		0	0.69				
21	5	3	0.99		0.99	30	29.57
		0	0.99				
27	5.8	3.5	1.28		1.28	34.8	44.57
		0	1.28				
33	6.3	3.8	1.28		1.28	37.8	48.41
		0	1.28				
39	7	4.2	1.17		1.17	42	49.15
		0	1.17				
45	7	4.2	1.06		1.06	42	44.50
		0	1.06				
51	7	4.2	1.32		1.32	42	55.34
		0	1.32				
57	6.2	3.7	1.21		1.21	37.2	44.90
		0	1.21				
62.5	5.4	3.2	0.91		0.91	27	24.63
		0	0.91				
65	0	0	0.00		0	0	0
Total						343.8	364.0

Source: Applied Technology and Management, Inc., 1989

Table C-12. Discharge of Peace River (station 4): 11-January-1989 @ 08:16

Distance from Initial Point (ft)	Total Depth (ft)	Observation Depth (ft)	Velocity (fps)		Area (ft ²)	Discharge (cfs)
			----- Point	Vert. Mean		
3	4	3.2	0.32	0.29	24	6.85
		0.8	0.25			
9	5.5	4.4	0.65	0.52	33	17.32
		1.1	0.40			
15	6	4.8	0.54	0.47	36	16.91
		1.2	0.40			
21	6	4.8	0.76	0.58	36	20.89
		1.2	0.40			
27	5.6	4.5	0.69	0.73	33.6	24.45
		1.1	0.76			
33	5.1	4.1	0.69	0.76	30.6	23.40
		1	0.84			
39	4.5	3.6	0.54	0.64	27	17.16
		0.9	0.73			
45	3.6	2.9	0.40	0.51	21.6	10.94
		0.7	0.62			
51	3.1	1.9	0.40	0.40	18.6	7.36
		0	0.40			
57	2.4	1.4	0.40	0.40	19.2	7.60
		0	0.40			
Total					279.6	152.9

Source: Applied Technology and Management, Inc., 1989



STAGE DISCHARGE CURVE FOR PAYNE CREEK NEAR THE HARDEE POWER STATION

SOURCE: APPLIED TECHNOLOGY AND MANAGEMENT, 1989.

**Hardee
Power Station**

11.5.3 HISTORICAL WATER QUALITY DATA

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Silicon								
AG-1	--	--	--	--	2.36	--	--	1.20
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	3.84	--	--	2.60
Total Suspended Solids								
AG-1	--	--	--	--	4.34	--	--	4.12
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	2.54	--	--	3.22
Flouride (Mg/L)								
AG-1	--	--	--	--	1.18	--	--	1.79
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	1.03	--	--	1.45
Turbidity (NTU)								
AG-1	--	--	--	--	2.12	--	--	2.32
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	10	9	--	--	1.84	--	--	1.72
pH								
AG-1	--	--	--	--	7.10	--	--	7.41
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	7.38	--	--	7.68
Flow (cfs)								
AG-1	--	--	--	--	7.27	--	--	2.01
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	73.68	--	--	10.58
Dissolved Oxygen								
AG-1	--	--	0.68	0.56	1.16	0.63	1.07	1.08
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	5.20	6.23	7.01	7.70	7.92	7.92
Temperature (F)								
AG-1	--	--	83.0	81.1	78.4	75.2	74.3	72.6
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	78.8	76.6	75.0	73.4	72.8	70.0

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Alkalinity								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Ammonia (NH3)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Arsenic								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.002	<0.001	--	--	--	--	--	--
Barium								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Beryllium								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Bicarbonate (HCO3)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Biological Oxygen Demand								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	1.4	7.1	--	--	--	--	--	--

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Cadmium								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.003	<0.002	--	--	--	--	--	--
Carbonate (CO₃)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Chromium								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.03	<0.02	--	--	--	--	--	--
Copper								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.01	0.03	--	--	--	--	--	--
Total Dissolved Solids								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	170	190	--	--	--	--	--	--
Gross Alpha (AGi/l)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Iron								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.32	0.26	--	--	--	--	--	--

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Kjeidahl Nitrogen								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	2.7	0.28	--	--	--	--	--	--
Lead								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.008	0.01	--	--	--	--	--	--
Manganese								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Nitrate (NO3)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Nitrite (NO2)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Specific Conductivity (UMHOS)								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Sulfate								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Total Nitrogen								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Total Phosphate								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Total Phosphorus								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--
Zinc								
AG-1	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--
AG-4	0.1	0.04	--	--	--	--	--	--
Total Hardness								
AG-4	65	134	--	--	--	--	--	--
Sulfide								
AG-4	0.04	0	--	--	--	--	--	--
Chloride								
AG-4	13	17	--	--	--	--	--	--
Chemical Oxygen Demand								
AG-4	47	12	--	--	--	--	--	--
Calcium								
AG-4	15	34	--	--	--	--	--	--
Magnesium								
AG-4	6.9	12	--	--	--	--	--	--
Nickel								
AG-4	0.01	<0.002	--	--	--	--	--	--

Table D-1. Payne Creek - Agrico Ft. Green Reclamation Report -
1975 through 1982

Parameter/Location	9/75	1/76	7/82	8/82	9/82	10/82	11/82	12/82
Sodium								
AG-4	7.1	<9	- -	- -	- -	- -	- -	- -
Selenium								
AG-4	0.014	5	- -	- -	- -	- -	- -	- -
Phenols								
AG-4	0.03	0	- -	- -	- -	- -	- -	- -
MBAS								
AG-4	<0.25	0.01	- -	- -	- -	- -	- -	- -
Fecal Strep (per 100 ml)								
AG-4	360	5	- -	- -	- -	- -	- -	- -
Hexane Solubles								
AG-4	20	24	- -	- -	- -	- -	- -	-

Table D-2. Payne Creek - Agrico Ft. Green Reclamation Report -
January 1983 through November 1983

Parameter/Location	1/83	2/83	3/83	4/83	5/83	6/83	7/83	8/83	11/83
Silicon									
AG-1	--	--	2.02	--	--	3.30	--	--	--
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	--
AG-4	--	--	2.72	--	--	2.92	--	--	--
Total Suspended Solids									
AG-1	--	--	5.26	--	--	5.36	--	--	--
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	--
AG-4	--	--	3.56	--	--	2.86	--	--	--
Flouride (Mg/L)									
AG-1	--	--	0.85	--	--	1.74	--	1.76	1.78
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	0.59
AG-4	--	--	0.80	--	--	1.50	--	1.75	1.52
Turbidity (NTU)									
AG-1	--	--	4.04	--	--	3.04	--	3.5	0.5
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	0.8
AG-4	--	--	2.40	--	--	0.80	--	1.5	0.5
pH									
AG-1	--	--	6.76	--	--	7.00	--	7.2	7.4
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	7.2
AG-4	--	--	6.90	--	--	7.38	--	7.5	7.5
Flow (cfs)									
AG-1	--	--	12.47	--	--	6.22	--	--	--
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	--
AG-4	--	--	105.21	--	--	33.67	--	--	--
Dissolved Oxygen									
AG-1	2.18	3.33	3.49	2.60	1.95	1.22	1.00	1.80	--
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	5.5
AG-4	8.26	8.66	8.39	7.53	7.40	6.55	6.60	7.20	--
Temperature (F)									
AG-1	66.6	64.4	65.2	71.3	76.1	81.8	84.2	82.4	--
AG-2	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	58
AG-4	64.4	61.6	63.0	69.8	74.6	80.0	80.6	78.8	--

Table D-2. Payne Creek - Agrico Ft. Green Reclamation Report -
January 1983 through November 1983

[illegible]

Table D-2. Payne Creek - Agrico Ft. Green Reclamation Report -
January 1983 through November 1983

[illegible]

[illegible]

Table D-2. Payne Creek - Agrico Ft. Green Reclamation Report -
January 1983 through November 1983

[illegible]

Table D-2. Payne Creek - Agrico Ft. Green Reclamation Report -
January 1983 through November 1983

[illegible]

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report -
1984 through 1986

Parameter/Location	2/84	6/84	8/84	10/84	2/85	5/85	8/85	11/85	2/86	5/86
Silicon										
AG-1	--	--	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids										
AG-1	--	--	8	3.4	3.7	4.6	4.9	3.6	10.4	9.8
AG-2	--	--	5.1	2.6	4.9	26.3	3.2	1.2	4.3	3.6
AG-3	--	--	1.8	1.3	2	28.3	2.2	1	2.6	1.5
AG-4	--	--	4.2	3.3	1	1	2.2	1	2.6	1.5
Flouride (Mg/L)										
AG-1	1.69	1.88	0.74	1.17	1.31	1.21	1.01	1.01	0.93	1.07
AG-2	--	--	0.53	0.61	0.58	0.76	1.88	1.2	0.5	0.46
AG-3	1.67	1.18	0.58	0.62	0.64	0.76	1.91	1.21	0.64	0.56
AG-4	1.78	0.37	0.65	1.16	0.93	1.11	1.64	1.33	0.95	0.6
Turbidity (NTU)										
AG-1	1.1	4	2.5	2.2	1.5	3	2.4	4.4	4	6.2
AG-2	--	--	2.5	1.2	1	15	1.3	1.3	2	4.5
AG-3	1.1	2.8	1	1	1	18	0.9	2.5	0.8	2.5
AG-4	1.2	1.8	1.8	1.5	0.8	0.5	1.6	1	1.2	1.5
pH										
AG-1	6.8	6.9	6.8	7.8	7.2	7.1	6.6	7.2	7.1	7.1
AG-2	--	--	6.8	6.8	6.7	6.3	7.1	6.9	6.6	7.1
AG-3	7.2	7.1	7	6.9	7.2	7	7.1	6.9	6.9	6.5
AG-4	7.6	7.8	6.9	7.7	7.7	7.4	7.2	7.6	7.3	7.6
Flow (cfs)										
AG-1	--	--	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--	--	--
AG-3	--	--	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--	--	--
Dissolved Oxygen										
AG-1	--	--	0.1	2	2.2	4.2	0.1	1.5	3	0.5
AG-2	--	--	1	4.2	5	0.4	1.8	2	1.5	1.1
AG-3	9.5	1.7	1	4	5.7	0.1	1.8	2.2	2.6	1
AG-4	--	--	4.5	9	8.8	6.2	4.4	5.6	7.2	7.4
Temperature (F)										
AG-1	--	--	78	60	68	78	80	72	66	70
AG-2	--	--	82	63	59	80	85	75	66	73
AG-3	65	80	81	63	59	80	85	76	66	72
AG-4	--	--	77	63	58	80	82	73	64	70

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report -
1984 through 1986

Parameter/Location	2/84	6/84	8/84	10/84	2/85	5/85	8/85	11/85	2/86	5/86
Alkalinity										
AG-1	--	--	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--	--	--
AG-3	46	50	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--	--	--
Ammonia (NH3)										
AG-1	--	--	0.07	0.16	0.51	0.17	0.1	0.11	<0.02	0.17
AG-2	--	--	0.51	0.34	0.03	0.28	0.2	0.03	0.03	0.9
AG-3	--	--	0.36	0.24	0.23	0.12	0.18	0.04	0.02	0.03
AG-4	--	--	0.09	0.02	0.03	0.04	0.02	0.04	0.02	0.05
Arsenic										
AG-1	--	--	<0.002	<0.001	<0.001	<0.03	--	--	--	--
AG-2	--	--	<0.002	<0.001	<0.001	<0.03	--	--	--	--
AG-3	--	--	<0.002	<0.001	<0.001	<0.03	--	--	--	--
AG-4	--	--	<0.002	<0.001	<0.001	<0.03	--	--	--	--
Barium										
AG-1	--	--	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--	--	--
AG-3	<0.01	<0.01	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--	--	--
Beryllium										
AG-1	--	--	--	--	--	--	--	--	--	--
AG-2	--	--	--	--	--	--	--	--	--	--
AG-3	<0.01	<0.01	--	--	--	--	--	--	--	--
AG-4	--	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO3)										
AG-1	--	--	71	283	81	160	56	191	191	203
AG-2	--	--	52	62	70	72	60	63	57	50
AG-3	--	--	56	65	72	90	52	64	64	62
AG-4	--	--	29	75	69	98	52	69	50	61
Biological Oxygen Demand										
AG-1	--	--	6.7	3.9	2.8	5.0	4.9	3.6	6.7	5.4
AG-2	--	--	1.5	1.1	1.1	4.0	1.1	1.7	0.9	1.5
AG-3	1.2	3	0.5	0.6	0.8	2.0	1.5	1.6	0.6	1.3
AG-4	--	--	1.6	1.8	1.1	2.0	0.8	5.8	1.5	1.5

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report -
1984 through 1986

Parameter/Location	2/84	6/84	8/84	10/84	2/85	5/85	8/85	11/85	2/86	5/86
Cadmium										
AG-1	-	-	0.02	<0.005	<0.01	<0.005	-	-	-	-
AG-2	-	-	0.02	<0.005	<0.01	<0.005	-	-	-	-
AG-3	-	-	0.01	<0.005	<0.01	<0.005	-	-	-	-
AG-4	-	-	0.01	<0.005	<0.01	<0.005	-	-	-	-
Carbonate (CO3)										
AG-1	-	-	0.0	0.0	0.0	0.0	-	-	-	-
AG-2	-	-	0.0	0.0	0.0	0.0	-	-	-	-
AG-3	-	-	0.0	0.0	0.0	0.0	-	-	-	-
AG-4	-	-	0.0	0.0	0.0	0.0	-	-	-	-
Chromium										
AG-1	-	-	-	-	-	-	-	-	-	-
AG-2	-	-	-	-	-	-	-	-	-	-
AG-3	<0.10	<0.01	-	-	-	-	-	-	-	-
AG-4	-	-	-	-	-	-	-	-	-	-
Copper										
AG-1	-	-	-	-	-	-	-	-	-	-
AG-2	-	-	-	-	-	-	-	-	-	-
AG-3	<0.01	<0.01	-	-	-	-	-	-	-	-
AG-4	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids										
AG-1	-	-	188.0	374.0	278.6	248.3	201.0	273.0	291.8	331.4
AG-2	-	-	141.0	164.0	148.5	205.0	248.0	179.0	252.0	191.0
AG-3	284	202	154.0	176.0	182.0	185.0	214.0	170.0	120.0	192.9
AG-4	-	-	177.0	181.0	171.4	186.3	244.0	190.0	125.7	221.4
Gross Alpha (AGi/l)										
AG-1	-	-	0.30	14.00	0.50	<0.10	8.20	2.60	<0.10	11.60
AG-2	-	-	0.10	<0.10	<0.10	1.20	1.00	1.50	0.70	7.50
AG-3	0.7	1.3	0.60	0.40	0.10	0.10	0.80	3.40	2.90	8.40
AG-4	-	-	1.10	2.40	0.70	0.10	8.20	2.60	0.10	10.20
Iron										
AG-1	-	-	1.51	0.22	0.67	0.94	2.94	0.92	1.02	1.48
AG-2	-	-	1.63	0.40	0.73	5.60	0.32	0.38	0.48	0.85
AG-3	0.19	1.56	0.50	0.32	0.20	4.77	0.16	0.36	0.18	0.65
AG-4	-	-	1.01	0.10	0.20	0.20	0.48	0.14	0.28	0.26

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report -
1984 through 1986

Parameter/Location	2/84	6/84	8/84	10/84	2/85	5/85	8/85	11/85	2/86	5/86
Kjeidahl Nitrogen										
AG-1	--	--	0.37	0.81	1.06	0.37	1.14	0.76	0.73	1.06
AG-2	--	--	0.69	0.56	1.44	0.53	0.31	0.29	0.17	0.95
AG-3	--	--	0.38	0.63	0.42	0.2	0.22	0.28	0.16	0.42
AG-4	--	--	0.5	0.29	0.59	0.22	0.41	0.28	0.31	0.31
Lead										
AG-1	--	--	<0.01	<0.03	<0.05	0.01	--	--	--	--
AG-2	--	--	<0.01	<0.03	<0.05	<0.01	--	--	--	--
AG-3	<0.20	<0.01	<0.01	<0.03	<0.05	<0.01	--	--	--	--
AG-4	--	--	<0.01	<0.03	<0.05	0.01	--	--	--	--
Manganese										
AG-1	--	--	0.05	0.02	0.02	<0.05	0.02	0.03	0.03	0.05
AG-2	--	--	0.06	0.01	0.02	<0.05	<0.02	0.01	0.02	0.02
AG-3	--	--	0.03	0.01	0.01	0.05	0.02	0.02	0.02	0.02
AG-4	--	--	0.02	0.01	0.01	0.05	0.02	0.01	0.02	0.01
Nitrate (NO3)										
AG-1	1.61	5.9	1.1	<0.01	0.75	<0.02	<0.02	<0.02	<0.02	<0.02
AG-2	--	--	0.36	<0.01	0.31	<0.02	0.15	0.15	0.19	<0.02
AG-3	0.39	1.25	0.65	<0.01	0.22	<0.02	0.05	0.05	0.12	0.02
AG-4	0.03	0.5	<0.02	<0.01	0.08	<0.02	1	0.02	0.13	0.02
Nitrite (NO2)										
AG-1	--	--	<0.01	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
AG-2	--	--	0.39	0.02	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
AG-3	--	--	0.05	0.03	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
AG-4	--	--	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Specific Conductivity (UMHOS)										
AG-1	--	--	206	577	343	318	191	398	431	314
AG-2	--	--	177	219	217	232	256	258	216	142
AG-3	302	244	180	218	225	232	262	259	228	156
AG-4	--	--	135	255	243	247	246	271	264	162
Sulfate										
AG-1	--	--	12	5	68	<1	--	--	--	--
AG-2	--	--	18	30	32	59	--	--	--	--
AG-3	--	--	17	28	33	50	--	--	--	--
AG-4	--	--	15	38	35	61	--	--	--	--

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report -
1984 through 1986

[illegible]

Table D-3. Payne Creek - Agrico Ft. Green Reclamation Report - 1984 through 1986

[illegible]

11.5.4 PAYNE CREEK WATER QUALITY DATA
OCTOBER 1988 - MARCH 1989

OCTOBER 1988

ENVIRONMENTAL LABORATORIES, INC.

November 11, 1988

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607

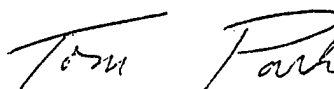
Dear John:

Enclosed are the results of our analyses of your samples which we received on October 7, 1988.

All data were determined in accordance with published procedures (EPA-600/14-79-020, Methods for Chemical Analysis of Water and Wastes, Revised March 1983). Our laboratory is certified by the Florida DHRS (Lab Nos. 82282 and E82001). Please note the coliform analyses were performed by P.E. LaMoreaux and Associates, Inc., of Lakeland, Florida (Lab Nos. 84183 and E84098). The chlorophyll analyses were performed by CH2M Hill of Gainesville, Florida (Lab Nos. 82112 and E82124). The gross alpha, gross beta, radium 228, and radium 226 analyses were performed by ESE, Inc. of Gainesville, Florida (Lab Nos. 82138 and E82067). The strontium 90 analyses were performed by CEP, Inc. of Santa Fe, New Mexico (Lab No. 87239).

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,



Tom Park
Project Manager

TP:jlm

Enclosure

cc: Dr. Jim Newman
KBN Engineering & Applied Sciences
P.O. Box 14288
Gainesville, FL 32604

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 11/11/88

YOUR REF/PO#: Verbal

Table 1. (Page 1 of 2)

	Station ID: PC-1 PPB #: 30013	PC-2 30014	PC-3 30015
Alkalinity, mg/L as CaCO ₃	48	44	44
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.6	0.9	1.2
Methylene Blue Active Substances, mg/L	<0.025	<0.025	<0.025
Total Kjeldahl Nitrogen, mg/L	0.864	0.737	1.53
Ammonia Nitrogen, mg/L	0.121	0.030	<0.005
Organic Nitrogen, mg/L	0.743	0.707	1.53
Nitrate+Nitrite-Nitrogen, mg/L	0.190	0.617	0.625
Total Nitrogen, mg/L	1.05	1.35	2.16
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	1.0	1.2
Chemical Oxygen Demand, mg/L	31	47	70
Orthophosphorus, mg/L	0.500	0.509	0.572
Total Phosphorus, mg/L	0.573	0.624	0.703
Sulfate, mg/L	9.2	17.4	16.9
Turbidity, NTU	1.5	2.0	6.1
Aluminum, ug/L	137	220	169
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	<0.4	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<6	<6	<6
Iron, ug/L	648	542	440
Lead, ug/L	<5	<5	<5
Mercury, ug/L	<0.2	<0.2	<0.2
Nickel, ug/L	<15	<15	<15
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	6.3	6.8	7.5
Zinc, ug/L	<5	10	<5
Total Coliforms, colonies/100 ml	209	600	2,000
Fecal Coliforms, colonies/100 ml	18	36	118

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM
DATE: 11/11/88
YOUR REF/PO#: Verbal

Table 1. (Page 2 of 2)

Station ID: PC-4
PPB #: 30016

Alkalinity, mg/L as CaCO ₃	56
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.4
Methylene Blue Active Substances, mg/L	<0.025
Total Kjeldahl Nitrogen, mg/L	0.896
Ammonia Nitrogen, mg/L	<0.005
Organic Nitrogen, mg/L	0.896
Nitrate+Nitrite-Nitrogen, mg/L	0.994
Total Nitrogen, mg/L	1.89
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1
Chemical Oxygen Demand, mg/L	69
Orthophosphorus, mg/L	0.478
Total Phosphorus, mg/L	0.578
Sulfate, mg/L	30.2
Turbidity, NTU	2.9
Aluminum, ug/L	365
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	<6
Iron, ug/L	332
Lead, ug/L	<5
Mercury, ug/L	<0.2
Nickel, ug/L	<15
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	8.6
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	400
Fecal Coliforms, colonies/100 ml	146

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 11/11/88

YOUR REF/PO#: Verbal

Table 2.

	ID No.:	PC-1	PC-2	PC-3	PC-4
	PPB #:	30013	30014	30015	30016
Alpha, Gross (pC/L)		0.9	2.5	2.2	0.5
Alpha, Gross, Ct. Error +/- (pC/L)		1.2	1.2	1.6	2.2
Beta, Gross (pC/L)		2.3	5.5	6.1	5.1
Beta, Gross, Ct. Error +/- (pC/L)		1.4	1.5	1.6	1.9
Radium 226 (pC/L)		0.7	0.5	1.1	1.0
Radium 226 Ct. Error +/- (pC/L)		0.1	0.1	0.1	0.1
Radium 228 (pC/L)		0.0	0.0	0.2	0.0
Radium 228, Ct. Error (pC/L)		0.5	0.5	0.4	0.5
Strontium-90 (pC/L)		<0.5	<0.5	<0.5	<0.5
Chlorophyll-a, mg/m ³		ND*	ND	29.9	1.28

*ND=None detected.

Tom Paul
Project Manager

DECEMBER 1988

ppb
E N V I R O N M E N T A L L A B O R A T O R I E S , I N C.

January 19, 1989

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607

Dear John:

Enclosed are the results of our analyses of your samples which we received on December 9, 1988.

All data were determined in accordance with published procedures (EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, Revised March 1983). Our laboratory is certified by the Florida DHRS (Lab Nos. 82282 and E82001). Please note the coliform analyses were performed by P.E. LaMoreaux and Associates, Inc., of Lakeland, Florida (Lab Nos. 84183 and E84098). The chlorophyll analyses were performed by CH2M Hill of Gainesville, Florida (Lab Nos. 82112 and E82124). The gross alpha, gross beta, radium 228, and radium 226 analyses were performed by ESE, Inc. of Gainesville, Florida (Lab Nos. 82138 and E82067). The strontium 90 analyses were performed by CEP, Inc. of Santa Fe, New Mexico (Lab No. 87239).

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,

Tom Park
Tom Park
Project Manager

TP:jlh

Enclosure

cc: Dr. Jim Newman
KBN Engineering & Applied Sciences
P.O. Box 14288
Gainesville, FL 32604

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 1/19/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 1 of 2)

	Station ID: PC-1 PPB #: 31083	PC-2 31084	PC-3 31085
Alkalinity, mg/L as CaCO ₃	50	60	58
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.8	0.8	0.8
Methylene Blue Active Substances, mg/L	<0.025	<0.025	<0.025
Total Kjeldahl Nitrogen, mg/L	0.809	0.883	1.22
Ammonia Nitrogen, mg/L	0.345	0.325	0.486
Organic Nitrogen, mg/L	0.464	0.558	0.734
Nitrate+Nitrite-Nitrogen, mg/L	0.608	0.845	0.951
Total Nitrogen, mg/L	1.42	1.73	2.17
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	<1	<1
Chemical Oxygen Demand, mg/L	66	75	78
Orthophosphorus, mg/L	0.308	0.307	0.392
Total Phosphorus, mg/L	0.318	0.311	0.430
Sulfate, mg/L	21.5	22.3	23.2
Turbidity, NTU	1.6	1.6	2.3
Aluminum, ug/L	70	81	96
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	<0.4	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<6	<6	<6
Iron, ug/L	181	164	192
Lead, ug/L	<5	<5	<5
Mercury, ug/L	0.5	0.5	0.4
Nickel, ug/L	<15	<15	<15
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	7.9	7.9	8.5
Zinc, ug/L	<5	<5	<5
Total Coliforms, colonies/100 ml	109	164	291
Fecal Coliforms, colonies/100 ml	36	164	182

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 1/19/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 2 of 2)

Station ID: PC-4
PPB #: 31086

Alkalinity, mg/L as CaCO ₃	65
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.7
Methylene Blue Active Substances, mg/L	<0.025
Total Kjeldahl Nitrogen, mg/L	0.698
Ammonia Nitrogen, mg/L	0.034
Organic Nitrogen, mg/L	0.664
Nitrate+Nitrite-Nitrogen, mg/L	2.77
Total Nitrogen, mg/L	3.47
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1
Chemical Oxygen Demand, mg/L	171
Orthophosphorus, mg/L	0.364
Total Phosphorus, mg/L	0.378
Sulfate, mg/L	43.9
Turbidity, NTU	1.6
Aluminum, ug/L	111
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	<6
Iron, ug/L	118
Lead, ug/L	<5
Mercury, ug/L	0.3
Nickel, ug/L	<15
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	9.1
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	709
Fecal Coliforms, colonies/100 ml	346

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 1/19/89

YOUR REF/PO#: Verbal

Table 2. Radiation and Chlorophyll-a Data

	ID No.: PPB #:	PC-1 31083	PC-2 31084	PC-3 31085	PC-4 31086
Alpha, Gross (pC/L)		3.8	0.4	2.0	4.6
Alpha, Gross, Ct. Error +/- (pC/L)		2.1	1.5	1.9	3.0
Beta, Gross (pC/L)		0.2	1.7	4.1	2.8
Beta, Gross, Ct. Error +/- (pC/L)		1.6	1.7	2.6	3.6
Radium 226 (pC/L)		0.6	0.1	0.9	0.6
Radium 226 Ct. Error +/- (pC/L)		0.0	0.0	0.0	0.0
Radium 228 (pC/L)		0.5	0.1	1.1	1.2
Radium 228, Ct. Error (pC/L)		0.9	0.7	0.7	0.7
Strontium-90 (pC/L)		<0.5	<0.5	<0.5	<0.5
Chlorophyll-a, mg/m ³		<1	<1	<1	<1

*ND=None detected.

Tom Pank
Project Manager

ENVIRONMENTAL LABORATORIES, INC.

January 31, 1989

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607

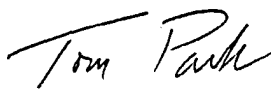
Dear John:

Enclosed are the results of our analyses of your samples which we received on November 10, 1988.

All data were determined in accordance with published procedures (EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, Revised March 1983). Our laboratory is certified by the Florida DHRS (Lab Nos. 82282 and E82001). Please note the coliform analyses were performed by P.E. LaMoreaux and Associates, Inc., of Lakeland, Florida (Lab Nos. 84183 and E84098). The chlorophyll analyses were performed by CH2M Hill of Gainesville, Florida (Lab Nos. 82112 and E82124). The gross alpha, gross beta, radium 228, and radium 226 analyses were performed by ESE, Inc. of Gainesville, Florida (Lab Nos. 82138 and E82067). The strontium 90 analyses were performed by CEP, Inc. of Santa Fe, New Mexico (Lab No. 87239). The organics analyses were performed by Southeastern Environmental Laboratories, Inc. of Orange Park, Florida (Lab Nos. 82315 and E82179).

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,



Tom Park
Project Manager

TP:jlm

Enclosure

cc: Dr. Jim Newman
KBN Engineering & Applied Sciences
P.O. Box 14288
Gainesville, FL 32604

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 1/31/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 1 of 2)

	Station ID: PC-1 PPB #: 30732	PC-2 30733	PC-3 30734
Alkalinity, mg/L as CaCO ₃	42	44	36
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.6	0.6	0.5
Methylene Blue Active Substances, mg/L	<0.025	<0.025	<0.025
Total Kjeldahl Nitrogen, mg/L	0.770	0.747	0.566
Ammonia Nitrogen, mg/L	<0.005	<0.005	0.019
Organic Nitrogen, mg/L	0.770	0.747	0.547
Nitrate+Nitrite-Nitrogen, mg/L	0.218	0.258	0.516
Total Nitrogen, mg/L	0.988	1.00	1.08
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	1.7	<1
Chemical Oxygen Demand, mg/L	<10	<10	<10
Orthophosphorus, mg/L	0.404	0.416	0.510
Total Phosphorus, mg/L	0.318	0.332	0.444
Sulfate, mg/L	25.0	25.3	34.4
Turbidity, NTU	1.1	0.8	1.9
Aluminum, ug/L	67	116	157
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	<0.4	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<6	<6	<6
Iron, ug/L	224	210	229
Lead, ug/L	6.7	<5	<5
Mercury, ug/L	<0.2	<0.2	<0.2
Nickel, ug/L	<15	<15	<15
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	7.6	7.8	8.6
Zinc, ug/L	<5	<5	<5
Total Coliforms, colonies/100 ml	364	418	809
Fecal Coliforms, colonies/100 ml	73	64	291

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 1/31/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 2 of 2)

Station ID: PC-4
PPB #: 30735

Alkalinity, mg/L as CaCO ₃	66
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.3
Methylene Blue Active Substances, mg/L	<0.025
Total Kjeldahl Nitrogen, mg/L	0.702
Ammonia Nitrogen, mg/L	0.006
Organic Nitrogen, mg/L	0.696
Nitrate+Nitrite-Nitrogen, mg/L	1.03
Total Nitrogen, mg/L	1.73
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1
Chemical Oxygen Demand, mg/L	<10
Orthophosphorus, mg/L	0.510
Total Phosphorus, mg/L	0.465
Sulfate, mg/L	50.1
Turbidity, NTU	1.9
Aluminum, ug/L	214
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	<6
Iron, ug/L	133
Lead, ug/L	5.9
Mercury, ug/L	<0.2
Nickel, ug/L	<15
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	9.4
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	700
Fecal Coliforms, colonies/100 ml	73

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 1/31/89

YOUR REF/PO#: Verbal

Table 2. Radiation and Chlorophyll Data

	ID No.: PPB #:	PC-1 30732	PC-2 30733	PC-3 30734	PC-4 30735
Alpha, Gross (pC/L)		0.5	3.0	1.2	3.9
Alpha, Gross, Ct. Error +/- (pC/L)		1.2	1.7	1.5	2.3
Beta, Gross (pC/L)		0.8	3.2	2.3	1.2
Beta, Gross, Ct. Error +/- (pC/L)		1.7	2.0	1.8	1.8
Radium 226 (pC/L)		1.0	1.2	0.9	0.7
Radium 226 Ct. Error +/- (pC/L)		0.1	0.1	0.1	0.1
Radium 228 (pC/L)		0.8	0.0	0.8	1.0
Radium 228, Ct. Error (pC/L)		0.7	0.7	0.7	0.6
Strontium-90 (pC/L)		<0.5	<0.5	<0.5	<0.5
Chlorophyll-a, mg/m ³		ND*	ND	ND	ND

*ND=None detected.

Tom Park
Project Manager

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 1/31/89

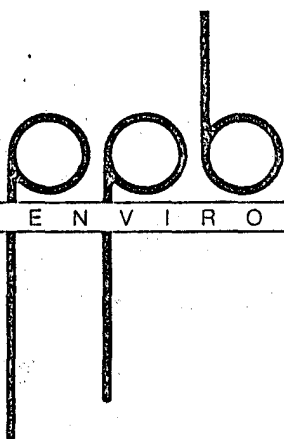
YOUR REF/PO#: Verbal

Table 3. Organics Data (all results as ug/L, micrograms per liter) (Page 1 of 2)

ID No.: PPB #:	PC-1 30732	PC-2 30733	PC-3 30734	PC-4 30735
Phenols	<5	<5	<5	<5
Aldrin	<0.003	<0.003	<0.003	<0.003
Dieldrin	<0.003	<0.003	<0.003	<0.003
Chlordane	<0.01	<0.01	<0.01	<0.01
4,4'DDT	<0.001	<0.001	<0.001	<0.001
Demeton	<0.1	<0.1	<0.1	<0.1
Endrin	<0.004	<0.004	<0.004	<0.004
Endosulfan	<0.003	<0.003	<0.003	<0.003
Guthion	<0.01	<0.01	<0.01	<0.01
Heptachlor	<0.001	<0.001	<0.001	<0.001
Lindane	<0.01	<0.01	<0.01	<0.01
Malathion	<0.1	<0.1	<0.1	<0.1
Methoxychlor	<0.03	<0.03	<0.03	<0.03
Myrex	<0.001	<0.001	<0.001	<0.001
Parathion	<0.04	<0.04	<0.04	<0.04
2,4-D	<10	<10	<10	<10
Silvex	<20	<20	<20	<20
Toxaphene	<0.005	<0.005	<0.005	<0.005
PCB-1016	<0.001	<0.001	<0.001	<0.001
PCB-12217	<0.001	<0.001	<0.001	<0.001
PCB-1232	<0.001	<0.001	<0.001	<0.001
PCB-1242	<0.001	<0.001	<0.001	<0.001
PCB-1248	<0.001	<0.001	<0.001	<0.001
PCB-1254	<0.001	<0.001	<0.001	<0.001
PCB-1260	<0.001	<0.001	<0.001	<0.001

*ND=None detected.

Tom Park
Project Manager



E N V I R O N M E N T A L L A B O R A T O R I E S , I N C .

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

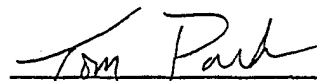
DATE: 1/31/89

YOUR REF/PO#: Verbal

Table 3. Organics Data (all results as ug/L, micrograms per liter) (Page 2 of 2)

	ID No.:	PC-1	PC-2	PC-3	PC-4
	PPB #:	30732	30733	30734	30735
Chlorinated Hydrocarbons					
2-Chloronapthalene		<10	<10	<10	<10
1,2-Dichlorobenzene		<10	<10	<10	<10
1,3-Dichlorobenzene		<10	<10	<10	<10
1,4-Dichlorobenzene		<10	<10	<10	<10
Hexachlorobenzene		<10	<10	<10	<10
Hexachlorobutadiene		<10	<10	<10	<10
Hexachlorocyclopentadiene		<10	<10	<10	<10
Hexachloroethane		<10	<10	<10	<10
1,2,4-Trichlorobenzene		<10	<10	<10	<10

*ND=None detected.


Project Manager

JANUARY 1989

ENVIRONMENTAL LABORATORIES, INC.

February 24, 1989

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607

Dear John:

Enclosed are the results of our analyses of your samples which we received on January 13, 1989.

All data were determined in accordance with published procedures (EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, Revised March 1983). Our laboratory is certified by the Florida DHRS (Lab Nos. 82282 and E82001). Please note the coliform analyses were performed by P.E. LaMoreaux and Associates, Inc., of Lakeland, Florida (Lab Nos. 84183 and E84098). The chlorophyll analyses were performed by CH2M Hill of Gainesville, Florida (Lab Nos. 82112 and E82124). The gross alpha, gross beta, radium 228, and radium 226 analyses were performed by ESE, Inc. of Gainesville, Florida (Lab Nos. 82138 and E82067). The strontium 90 analyses were performed by CEP, Inc. of Santa Fe, New Mexico (Lab No. 87239).

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,

Kelly Sugdall for Tom Park

Tom Park
Project Manager

TP:jlm

Enclosure

cc: Dr. Jim Newman
KBN Engineering & Applied Sciences
P.O. Box 14288
Gainesville, FL 32604

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 2/24/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 1 of 2)

	Station ID: PC-1 PPB #: 31649	PC-2 31650	PC-3 31651
Alkalinity, mg/L as CaCO ₃	56	52	60
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.6	0.6	1.3
Methylene Blue Active Substances, mg/L	<0.025	<0.025	<0.025
Total Kjeldahl Nitrogen, mg/L	0.519	0.579	0.647
Ammonia Nitrogen, mg/L	0.013	0.014	0.061
Organic Nitrogen, mg/L	0.506	0.565	0.586
Nitrate+Nitrite-Nitrogen, mg/L	0.441	0.420	0.591
Total Nitrogen, mg/L	0.960	0.999	1.24
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	<1	<1
Chemical Oxygen Demand, mg/L	36	38	55
Orthophosphorus, mg/L	0.288	0.243	0.378
Total Phosphorus, mg/L	0.352	0.353	0.483
Sulfate, mg/L	22.4	23.3	49.7
Turbidity, NTU	0.95	0.90	1.0
Aluminum, ug/L	78	140	94
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	<0.4	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<6	<6	<6
Iron, ug/L	259	246	240
Lead, ug/L	<5	8.9	9.6
Mercury, ug/L	<0.2	<0.2	<0.2
Nickel, ug/L	<15	<15	<15
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	8.7	8.8	11
Zinc, ug/L	<5	<5	7.1
Total Coliforms, colonies/100 ml	27	55	45
Fecal Coliforms, colonies/100 ml	<1	9	36

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 2/24/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 2 of 2)

Station ID: PC-4
PPB #: 31652

Alkalinity, mg/L as CaCO ₃	72
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.6
Methylene Blue Active Substances, mg/L	<0.025
Total Kjeldahl Nitrogen, mg/L	0.664
Ammonia Nitrogen, mg/L	0.019
Organic Nitrogen, mg/L	0.645
Nitrate+Nitrite-Nitrogen, mg/L	3.02
Total Nitrogen, mg/L	3.68
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1
Chemical Oxygen Demand, mg/L	55
Orthophosphorus, mg/L	0.378
Total Phosphorus, mg/L	0.469
Sulfate, mg/L	62.6
Turbidity, NTU	0.50
Aluminum, ug/L	63.0
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	<6
Iron, ug/L	49.3
Lead, ug/L	<5
Mercury, ug/L	<0.2
Nickel, ug/L	<15
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	10.2
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	55
Fecal Coliforms, colonies/100 ml	18

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 2/24/89

YOUR REF/PO#: Verbal

Table 2. Radiation and Chlorophyll-a Data

	ID No.: PPB #:	PC-1 31649	PC-2 31650	PC-3 31651	PC-4 31652
Alpha, Gross (pC/L)		0.8	0.2	0.0	3.9
Alpha, Gross, Ct. Error +/- (pC/L)		1.1	1.3	1.4	2.3
Beta, Gross (pC/L)		2.2	1.0	2.9	3.9
Beta, Gross, Ct. Error +/- (pC/L)		1.6	1.4	1.5	2.9
Radium 226 (pC/L)		0.6	0.4	0.7	1.4
Radium 226 Ct. Error +/- (pC/L)		0.0	0.0	0.0	0.1
Radium 228 (pC/L)		0.0	0.0	0.0	0.0
Radium 228, Ct. Error (pC/L)		1.9	1.6	1.6	1.6
Strontium-90 (pC/L)		<0.5	<0.5	<0.5	1.5 <u>+1.3</u>
Chlorophyll-a, mg/m ³		<1	<1	<1	<1

*ND=None detected.

Kelly Beardsall for
Project Manager *Tom Park*

FEBRUARY 1989

ppb
E N V I R O N M E N T A L L A B O R A T O R I E S , I N C.

March 27, 1989

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607

Dear John:

Enclosed are the results of our analyses of your samples which we received on February 17, 1989.

All data were determined in accordance with published procedures (EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, Revised March 1983). Our laboratory is certified by the Florida DHRS (Lab Nos. 82282 and E82001). Please note the coliform analyses were performed by P.E. LaMoreaux and Associates, Inc., of Lakeland, Florida (Lab Nos. 84183 and E84098). The chlorophyll analyses were performed by CH2M Hill of Gainesville, Florida (Lab Nos. 82112 and E82124). The gross alpha, gross beta, radium 228, and radium 226 analyses were performed by ESE, Inc. of Gainesville, Florida (Lab Nos. 82138 and E82067). The strontium 90 analyses were performed by CEP, Inc. of Santa Fe, New Mexico (Lab No. 87239). The organics analyses were performed by Southeastern Environmental Laboratories, Inc. of Orange Park, Florida (Lab Nos. 82315 and E82179).

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,

Tom Park

Tom Park
Project Manager

TP:jlh

Enclosure

cc: Dr. Jim Newman
KBN Engineering & Applied Sciences
P.O. Box 14288
Gainesville, FL 32604

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 3/27/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 1 of 2)

DHRS#: 82282, E82001

	Station ID: PC-1 PPB #: 32096	PC-2 32097	PC-3 32098
Alkalinity, mg/L as CaCO ₃	48	68	60
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.8	0.8	0.7
Methylene Blue Active Substances, mg/L	0.050	0.054	0.033
Total Kjeldahl Nitrogen, mg/L	0.338	0.245	0.657
Ammonia Nitrogen, mg/L	0.015	0.006	<0.005
Organic Nitrogen, mg/L	0.323	0.239	0.657
Nitrate+Nitrite-Nitrogen, mg/L	0.434	0.386	0.400
Total Nitrogen, mg/L	0.772	0.631	1.06
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	<1	2.4
Chemical Oxygen Demand, mg/L	<10	<10	<10
Orthophosphorus, mg/L	0.326	0.309	0.558
Total Phosphorus, mg/L	0.327	0.342	0.578
Sulfate, mg/L	23.0	23.1	28.2
Turbidity, NTU	0.8	2.3	2.8
Aluminum, ug/L	45	32	74
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	0.5	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<7	12	<7
Iron, ug/L	310	260	215
Lead, ug/L	<5	9.8	<5
Mercury, ug/L	<0.2	<0.2	<0.2
Nickel, ug/L	<17	35	<17
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	7.9	7.9	9.7
Zinc, ug/L	7.0	36	8.8
Total Coliforms, colonies/100 ml	164	182	691
Fecal Coliforms, colonies/100 ml	9	36	327

Tom Paul

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: John Good

PROJECT NO.: 87-008 ATM

DATE: 3/27/89

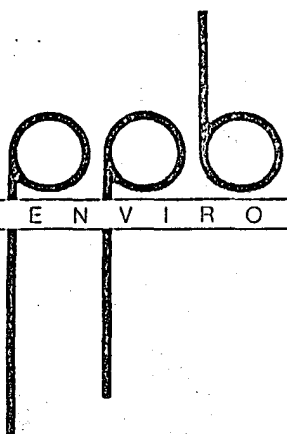
YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 2 of 2)

DHRS#: 82282, E82001

Station ID: PC-4
PPB #: 32099

Alkalinity, mg/L as CaCO ₃	76
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.8
Methylene Blue Active Substances, mg/L	0.026
Total Kjeldahl Nitrogen, mg/L	0.615
Ammonia Nitrogen, mg/L	<0.005
Organic Nitrogen, mg/L	0.615
Nitrate+Nitrite-Nitrogen, mg/L	1.54
Total Nitrogen, mg/L	2.16
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	1.4
Chemical Oxygen Demand, mg/L	<10
Orthophosphorus, mg/L	0.629
Total Phosphorus, mg/L	0.670
Sulfate, mg/L	55
Turbidity, NTU	1.9
Aluminum, ug/L	49
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	11
Iron, ug/L	157
Lead, ug/L	<5
Mercury, ug/L	<0.2
Nickel, ug/L	<17
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	10.3
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	500
Fecal Coliforms, colonies/100 ml	118



REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATMDATE: 3/27/89YOUR REF/PO#: VerbalDHRS#: 82282, E82001

Table 2. Radiation, Chlorophyll, and Additional Water Quality Data

ID No.:	PC-1	PC-2	PC-3	PC-4
PPB #:	32458	32459	32460	32461

Alpha, Gross (pC/L)
Alpha, Gross, Ct. Error +/- (pC/L)
Beta, Gross (pC/L)
Beta, Gross, Ct. Error +/- (pC/L)
Radium 226 (pC/L)
Radium 226 Ct. Error +/- (pC/L)
Radium 228 (pC/L)
Radium 228, Ct. Error (pC/L)
Strontium-90 (pC/L)

Chlorophyll-a, mg/m ³	<1	<1	<1	<1
Chloride, mg/L				
Total Dissolved Solids, mg/L	126	125	149	199
Silica, dissolved reactive, mg/L	3.1	2.8	4.8	2.3

*ND=None detected.

Tony Park
Project Manager

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 3/27/89

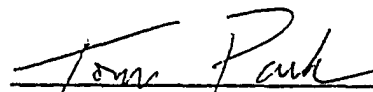
YOUR REF/PO#: Verbal

Table 2. Radiation and Chlorophyll Data

DHRS#: 82282, E82001

	ID No.:	PC-1	PC-2	PC-3	PC-4
	PPB #:	32096	32097	32098	32099
Alpha, Gross (pC/L)		3.6	2.4	2.5	0.8
Alpha, Gross, Ct. Error +/- (pC/L)		2.1	1.6	2.4	1.7
Beta, Gross (pC/L)		0.0	1.1	3.9	0.1
Beta, Gross, Ct. Error +/- (pC/L)		1.7	1.5	1.8	1.8
Radium 226 (pC/L)		0.3	0.6	0.6	0.5
Radium 226 Ct. Error +/- (pC/L)		0.0	0.0	0.0	0.0
Radium 228 (pC/L)		0.0	0.0	0.0	1.1
Radium 228, Ct. Error (pC/L)		0.8	0.7	0.7	0.9
Strontium-90 (pC/L)		<0.5	<0.5	<0.5	<0.5
Chlorophyll-a, mg/m ³		<1	<1	<1	<1

*ND=None detected.


Project Manager

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 3/27/89

YOUR REF/PO#: Verbal

DHRS#: 82282, E82001

Table 3. Organics Data (all results as ug/L, micrograms per liter) (Page 1 of 2)

ID No.: PPB #:	PC-1 32096	PC-2 32097	PC-3 32098	PC-4 32099
Phenols	<5	<5	<5	<5
Aldrin	<0.003	<0.003	<0.003	<0.003
Dieldrin	<0.003	<0.003	<0.003	<0.003
Chlordane	<0.01	<0.01	<0.01	<0.01
4,4'DDT	<0.001	<0.001	<0.001	<0.001
Demeton	<0.1	<0.1	<0.1	<0.1
Endrin	<0.004	<0.004	<0.004	<0.004
Endosulfan	<0.003	<0.003	<0.003	<0.003
Guthion	<0.01	<0.01	<0.01	<0.01
Heptachlor	<0.001	<0.001	<0.001	<0.001
Lindane	<0.01	<0.01	<0.01	<0.01
Malathion	<0.1	<0.1	<0.1	<0.1
Methoxychlor	<0.03	<0.03	<0.03	<0.03
Myrex	<0.001	<0.001	<0.001	<0.001
Parathion	<0.04	<0.04	<0.04	<0.04
2,4-D	<10	<10	<10	<10
Silvex	<20	<20	<20	<20
Toxaphene	<0.005	<0.005	<0.005	<0.005
PCB-1016	<0.001	<0.001	<0.001	<0.001
PCB-12217	<0.001	<0.001	<0.001	<0.001
PCB-1232	<0.001	<0.001	<0.001	<0.001
PCB-1242	<0.001	<0.001	<0.001	<0.001
PCB-1248	<0.001	<0.001	<0.001	<0.001
PCB-1254	<0.001	<0.001	<0.001	<0.001
PCB-1260	<0.001	<0.001	<0.001	<0.001

*ND=None detected.

Tom Fark

REPORT OF ANALYSES

Mr. John Good
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 3/27/89

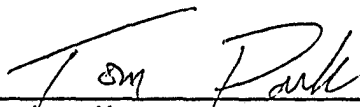
YOUR REF/PO#: Verbal

DHRS#: 82282, E82001

Table 3. Organics Data (all results as ug/L, micrograms per liter) (Page 2 of 2)

	ID No.:	PC-1	PC-2	PC-3	PC-4
	PPB #:	32096	32097	32098	32099
Chlorinated Hydrocarbons					
2-Chloronapthalene		<10	<10	<10	<10
1,2-Dichlorobenzene		<10	<10	<10	<10
1,3-Dichlorobenzene		<10	<10	<10	<10
1,4-Dichlorobenzene		<10	<10	<10	<10
Hexachlorobenzene		<10	<10	<10	<10
Hexachlorobutadiene		<10	<10	<10	<10
Hexachlorocyclopentadiene		<10	<10	<10	<10
Hexachloroethane		<10	<10	<10	<10
1,2,4-Trichlorobenzene		<10	<10	<10	<10

*ND=None detected.


Project Manager

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/19/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 1 of 2)

DHRS#: 82282, E82001

	Station ID: PC-1 PPB #: 32458	PC-2 32459	PC-3 32460
Alkalinity, mg/L as CaCO ₃	60	60	60
Cyanide, mg/L	<0.004	<0.004	<0.004
Fluoride, mg/L	0.8	0.8	0.7
Methylene Blue Active Substances, mg/L	0.116	0.084	0.090
Total Kjeldahl Nitrogen, mg/L	0.638	0.676	0.599
Ammonia Nitrogen, mg/L	<0.005	0.017	0.057
Organic Nitrogen, mg/L	0.638	0.659	0.542
Nitrate+Nitrite-Nitrogen, mg/L	0.254	0.209	0.628
Total Nitrogen, mg/L	0.892	0.885	1.23
Oil and Grease, mg/L	<5	<5	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1	<1	1.2
Chemical Oxygen Demand, mg/L	24	<10	19
Orthophosphorus, mg/L	0.452	0.424	0.480
Total Phosphorus, mg/L	0.464	0.429	0.537
Sulfate, mg/L	18.8	22.1	28.1
Turbidity, NTU	0.9	1.6	1.3
Aluminum, ug/L	102	81	116
Antimony, ug/L	<10	<10	<10
Arsenic, ug/L	<5	<5	<5
Beryllium, ug/L	<3	<3	<3
Cadmium, ug/L	<0.4	<0.4	<0.4
Chromium, ug/L	<10	<10	<10
Copper, ug/L	<7	10	<7
Iron, ug/L	409	254	253
Lead, ug/L	<5	8.9	6.2
Mercury, ug/L	<0.2	<0.2	<0.2
Nickel, ug/L	<12	<12	<12
Selenium, ug/L	<5	<5	<5
Silver, ug/L	<0.08	<0.08	<0.08
Sodium, mg/L	8.3	8.4	9.6
Zinc, ug/L	<5	<5	<5
Total Coliforms, colonies/100 ml	46	<1	355
Fecal Coliforms, colonies/100 ml	36	9	63

Tom Park

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/19/89

YOUR REF/PO#: Verbal

Table 1. Water Quality Data (Page 2 of 2)

DHRS#: 82282, E82001

Station ID: PC-4
PPB #: 32461

Alkalinity, mg/L as CaCO ₃	66
Cyanide, mg/L	<0.004
Fluoride, mg/L	1.6
Methylene Blue Active Substances, mg/L	0.088
Total Kjeldahl Nitrogen, mg/L	0.676
Ammonia Nitrogen, mg/L	0.013
Organic Nitrogen, mg/L	0.663
Nitrate+Nitrite-Nitrogen, mg/L	1.52
Total Nitrogen, mg/L	2.20
Oil and Grease, mg/L	<5
Carbonaceous Biochemical Oxygen Demand, mg/L	<1
Chemical Oxygen Demand, mg/L	<10
Orthophosphorus, mg/L	0.596
Total Phosphorus, mg/L	0.632
Sulfate, mg/L	58
Turbidity, NTU	0.8
Aluminum, ug/L	132
Antimony, ug/L	<10
Arsenic, ug/L	<5
Beryllium, ug/L	<3
Cadmium, ug/L	<0.4
Chromium, ug/L	<10
Copper, ug/L	<7
Iron, ug/L	85
Lead, ug/L	6.4
Mercury, ug/L	<0.2
Nickel, ug/L	<12
Selenium, ug/L	<5
Silver, ug/L	<0.08
Sodium, mg/L	10.3
Zinc, ug/L	<5
Total Coliforms, colonies/100 ml	282
Fecal Coliforms, colonies/100 ml	36

Tom Park

REPORT OF ANALYSES

Mr. Fred Ramsey
Applied Technology and Management, Inc.
502 N.W. 75th Street, Suite 95
Gainesville, Florida 32607

PROJECT NO.: 87-008 ATM

DATE: 4/19/89

YOUR REF/PO#: Verbal

DHRS#: 82282, E82001

Table 2. Radiation, Chlorophyll, and Additional Water Quality Data

ID No.:	PC-1	PC-2	PC-3	PC-4
PPB #:	32458	32459	32460	32461
Alpha, Gross (pC/L)	2.2	1.6	1.6	0.0
Alpha, Gross, Ct. Error +/- (pC/L)	1.4	1.6	1.1	1.4
Beta, Gross (pC/L)	0.0	1.9	1.8	2.9
Beta, Gross, Ct. Error +/- (pC/L)	2.1	1.4	1.7	1.8
Radium 226 (pC/L)	0.8	0.3	0.0	0.9
Radium 226 Ct. Error +/- (pC/L)	0.1	0.0	0.0	0.0
Radium 228 (pC/L)	1.3	0.0	1.7	1.4
Radium 228, Ct. Error (pC/L)	1.1	0.9	1.0	1.0
Strontium-90 (pC/L)	NA**	NA	NA	NA
Chlorophyll-a, mg/m ³	<1	<1	<1	<1
Chloride, mg/L	12.6	11.6	15.2	16.1
Total Dissolved Solids, mg/L	126	125	149	199
Silica, dissolved reactive, mg/L	3.1	2.8	4.8	2.3

*ND=None detected.

**NA=Not Available.

Tony Park
Project Manager

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 1. October 1988 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 30013	PC-2 30014	PC-3 30015	PC-4 30016
Calcium, mg/L	12.3	14.9	16.1	22.1
Magnesium, mg/L	7.0	7.6	7.7	10.9
Manganese, ug/L	16	16	15	18
Potassium, mg/L	NA*	NA	NA	NA
Hardness, mg equiv. CaCO ₃ /L	59.5	68.5	71.9	100
Bicarbonate alkalinity, as mg CaCO ₃ /L	48	44	44	56
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

*NA=Not available.

Tom Paul
PROJECT MANAGER

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 2. November 1988 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 30732	PC-2 30733	PC-3 30734	PC-4 30735
Calcium, mg/L	14.6	15.3	16.0	25.8
Magnesium, mg/L	8.3	8.5	8.8	13.2
Manganese, ug/L	5.0	5.6	7.9	8.5
Potassium, mg/L	0.9	0.9	2.3	2.1
Hardness, mg equiv. CaCO ₃ /L	70.6	73.2	76.2	119
Bicarbonate alkalinity, as mg CaCO ₃ /L	42	44	36	66
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

Tom Pank
PROJECT MANAGER

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 3. December 1988 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 31083	PC-2 31084	PC-3 31085	PC-4 31086
Calcium, mg/L	15.4	15.6	15.7	26.3
Magnesium, mg/L	9.1	9.1	8.8	12.8
Manganese, ug/L	4.1	3.2	7.0	6.7
Potassium, mg/L	0.7	0.9	1.7	1.8
Hardness, mg equiv. CaCO ₃ /L	75.9	77.5	75.4	118
Bicarbonate alkalinity, as mg CaCO ₃ /L	50	60	58	65
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

Tom Park
PROJECT MANAGER

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 4. January 1989 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 31649	PC-2 31650	PC-3 31651	PC-4 31652
Calcium, mg/L	16.3	16.2	24.9	28.6
Magnesium, mg/L	9.0	9.0	12.0	13.9
Manganese, ug/L	4.4	6.8	9.9	4.7
Potassium, mg/L	0.7	0.7	2.0	0.1
Hardness, mg equiv. CaCO ₃ /L	77.8	77.5	112	129
Bicarbonate alkalinity, as mg CaCO ₃ /L	56	52	60	72
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

Tom Paul
PROJECT MANAGER

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 5. February 1989 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 32096	PC-2 32097	PC-3 32098	PC-4 32099
Calcium, mg/L	16.2	16.7	19.2	28.1
Magnesium, mg/L	9.8	9.9	10.2	14.3
Manganese, ug/L	3.0	5.5	8.9	5.7
Potassium, mg/L	0.5	0.6	2.6	1.5
Hardness, mg equiv. CaCO ₃ /L	80.8	82.5	89.9	129
Bicarbonate alkalinity, as mg CaCO ₃ /L	48	68	60	76
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

Tom Paul
PROJECT MANAGER

REPORT OF ANALYSES

Applied Technology and Management, Inc.
502 N.W. 75th Street
Suite 95
Gainesville, Florida 32607
Attn: Fred Ramsey

PROJECT NO.: 87-008 ATM

DATE: 4/13/89

YOUR REF/PO#: Verbal

Table 6. March 1989 Sampling Trip

DHRS#: 82282, E82001

Station ID: PPB #:	PC-1 32458	PC-2 32459	PC-3 32460	PC-4 32461
Calcium, mg/L	17.4	17.1	20.0	29.7
Magnesium, mg/L	10.2	10.2	10.8	14.2
Manganese, ug/L	6.7	5.7	11	7.1
Potassium, mg/L	0.7	0.8	2.4	1.5
Hardness, mg equiv. CaCO ₃ /L	85.4	84.7	94.4	133
Bicarbonate alkalinity, as mg CaCO ₃ /L	60	60	60	66
Carbonate alkalinity, as mg CaCO ₃ /L	<0.5	<0.5	<0.5	<0.5

Tom Park
PROJECT MANAGER

11.5.5 CHEMICAL MIXING ZONE ANALYSES

Table 1. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Cadmium

Payne Creek Conditions											
River Channel Width	20 feet										
Average River Depth	2.5 feet										
River Discharge	22 feet ³ /second										
Average Flow Velocity	0.500 feet/second										
Flow Shear Velocity	0.259 feet/second										
Transverse Mixing Coeff.	0.389 feet ² /second										
Background Water Quality	<0.4 ug/L										
Reservoir Water Discharge Conditions											
Discharge Flow Rate	0.33 feet ³ /second										
Discharge Water Quality	2.6 ug/L										
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	2.6	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
50	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
100	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
150	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
200	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
250	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
300	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
350	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
400	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
450	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
500	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
550	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
600	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
650	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
700	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
750	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
800	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
850	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
900	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
950	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,000	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,050	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,100	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,150	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,200	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1,250	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Table 2. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Cyanide

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
<4 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
10 ug/L											
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	10.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
50	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	<4.0
100	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
150	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
200	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
250	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
300	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
350	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
400	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
450	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
500	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
550	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
600	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
650	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
700	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
750	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
800	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
850	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
900	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
950	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,000	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,050	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,100	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,150	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,200	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
1,250	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1

Table 3. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Mercury

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
<0.1 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
0.5 ug/L											
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
50	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
100	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
150	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
200	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
250	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
300	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
350	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
400	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
450	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
500	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
550	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
600	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
650	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
700	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
750	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
800	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
850	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
900	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
950	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,000	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,050	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,100	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,150	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,200	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
1,250	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1

Table 4. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Selenium

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
<5.0 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
32.0 ug/L											
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	32	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
50	6	6	6	6	6	6	6	5	5	5	5
100	5	5	5	5	5	5	5	5	5	5	5
150	5	5	5	5	5	5	5	5	5	5	5
200	5	5	5	5	5	5	5	5	5	5	5
250	5	5	5	5	5	5	5	5	5	5	5
300	5	5	5	5	5	5	5	5	5	5	5
350	5	5	5	5	5	5	5	5	5	5	5
400	5	5	5	5	5	5	5	5	5	5	5
450	5	5	5	5	5	5	5	5	5	5	5
500	5	5	5	5	5	5	5	5	5	5	5
550	5	5	5	5	5	5	5	5	5	5	5
600	5	5	5	5	5	5	5	5	5	5	5
650	5	5	5	5	5	5	5	5	5	5	5
700	5	5	5	5	5	5	5	5	5	5	5
750	5	5	5	5	5	5	5	5	5	5	5
800	5	5	5	5	5	5	5	5	5	5	5
850	5	5	5	5	5	5	5	5	5	5	5
900	5	5	5	5	5	5	5	5	5	5	5
950	5	5	5	5	5	5	5	5	5	5	5
1,000	5	5	5	5	5	5	5	5	5	5	5
1,050	5	5	5	5	5	5	5	5	5	5	5
1,100	5	5	5	5	5	5	5	5	5	5	5
1,150	5	5	5	5	5	5	5	5	5	5	5
1,200	5	5	5	5	5	5	5	5	5	5	5
1,250	5	5	5	5	5	5	5	5	5	5	5

Table 5. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Silver

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
<0.04 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
<0.80 ug/L											
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	0.80	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
50	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	<0.04
100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
150	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
250	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
300	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
350	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
400	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
450	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
500	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
550	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
600	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
650	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
700	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
750	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
800	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
850	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
900	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
950	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,050	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,150	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1,250	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 6. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Turbidity

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
1.5 NTU											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
31 NTU											
Mixed Concentration (ug/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	31.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
50	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	1.8	1.6
100	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.7
150	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8
200	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
250	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
300	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
350	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
400	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
450	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
500	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
550	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
600	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
650	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
700	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
750	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
800	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
850	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
900	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
950	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,000	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,050	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,100	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,150	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,200	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
1,250	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8

Table 7. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Gross Alpha

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.388 feet ² /second											
Background Water Quality											
1.7 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
22.2 ug/L											
Mixed Concentration (pC/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	22.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
50	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.8
100	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9
150	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9
200	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
250	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
300	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
350	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
400	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
450	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
500	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
550	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
600	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
650	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
700	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
750	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
800	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
850	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
900	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
950	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,000	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,050	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,100	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,150	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,200	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1,250	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9

Table 8. Hardee Power Station Cooling Reservoir Water Discharge and Payne Creek Dispersion Modeling - Radium 226

Payne Creek Conditions											
River Channel Width											
20 feet											
Average River Depth											
2.5 feet											
River Discharge											
22 feet ³ /second											
Average Flow Velocity											
0.500 feet/second											
Flow Shear Velocity											
0.259 feet/second											
Transverse Mixing Coeff.											
0.389 feet ² /second											
Background Water Quality											
0.5 ug/L											
Reservoir Water Discharge Conditions											
Discharge Flow Rate											
0.33 feet ³ /second											
Discharge Water Quality											
6.2 ug/L											
Mixed Concentration (pC/L) at Various Distances (feet) Across Payne Creek											
Distance Downstream (feet)	0	0.5	1	1.5	2	2.5	3	4	5	10	20
0	6.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
50	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5
100	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5
150	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
200	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
250	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
300	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
350	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
400	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
450	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
500	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
550	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
600	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
650	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
700	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
750	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
800	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
850	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
900	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
950	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,000	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,050	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,100	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,150	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,200	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1,250	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6

11.5.6 SWFWMD PERMIT INFORMATION

*This application has been prepared for information purposes
only as required by FDER Form 17-1.211(1).
Refer to Applicant Information in the SCA.*

APPLICATION TO THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SURFACE WATER MANAGEMENT PERMIT

TO: SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
2379 Broad Street
Brooksville, Florida 34609-6899
Telephone: (904) 796-7211

(For Use By SWFWMD Only)
Date Rec'd: _____
App. No.: _____

GENERAL INSTRUCTIONS: Please provide complete information below. Attach additional information if necessary. A processing fee of \$10.00 is required with this application. Please submit four (4) copies of application, drawings, calculations, etc.
Note: Project may also require State or Federal permits.

Please check appropriate box.

APPLICATION FOR: (X) CONCEPTUAL APPROVAL PERMIT
() CONSTRUCTION/OPERATION PERMIT
() MODIFICATION OF EXISTING PERMIT, NO.: _____

Owner(s) of land upon which surface water management system will be constructed/operated:

NAME: _____ Refer to Applicant Information in SCA/EA Chapter 1

ADDRESS: _____

TELEPHONE: () _____

Signature of owner or authorized agent

Description of Land: Total Land Area (acres): 1300 Acres

County: Polk & Hardee

Section: see SCA/EA Chapter 1 Township: _____ Range: _____

Person who prepared the plans and specifications of construction:

Conceptual hydrologic/hydraulic analyses only:

Name: Frederick V. Ramsey, P.E. Vice President

Address: Applied Technology & Management, Inc., 502 N.W. 75th St., Suite 95
Gainesville, Florida 32607

Telephone: (904) 375-8700

Construction Plans and Specifications: Submit drawings, calculations and engineering details sufficient to define the nature, scope, intent and functioning of work proposed. Reference Rule 40D-4/40D-40.

Person who will construct the proposed work:

Name: _____ Refer to Applicant Information in SCA/EA Chapter 1

Address: _____

Telephone: () _____

General purpose of proposed work:

Project Name: Hardee Power Station

Project Size (acres): 1300 Acres Zoning: see SCA/EA Chapter 2
(if different from total land area)

EXHIBIT A

The following information may be required in support of the application. The applicant should submit as much of the information listed as the complexity of the project and the sensitivity of the area necessitates.

If there are any questions or further assistance is required, please contact the Surface Water Permitting Division in vicinity of the project.

Note: The application must be signed by the owner or his authorized agent, and submitted to the District with FOUR (4) copies of all information required. However, for conceptual approval, Items A.8., A.10., B.5. and B.6. will not be necessary.

A. SITE INFORMATION:

1. ___ Detailed location sketch.
2. ___ Topographic map of the site and adjacent hydrologically related areas, which shall include location and description of bench marks (minimum of one per major water control structure).
3. ___ Overall map of the area showing existing runoff patterns and size, location, topography, and land use of off-site areas which drain through, onto, and from the project.
4. ___ Identification of wet season high water table elevations.
5. ___ If the project is in the known floodway of a stream, or other watercourse, the floodway should be identified and approximate flooding elevations determined. The 100 year flood plain elevations and limits should be identified, if applicable.
6. ___ Description of vegetative cover, wetland areas in and adjacent to the project area and limits of waters of the state if activities are proposed for these areas.
7. ___ Recent areal photography of a scale no smaller than 1" equals 800', encompassing the project area with project boundaries delineated.
8. ___ The construction drawings for the paving, grading and drainage plans, with special attention to perimeter site grading.
9. ___ Percolation tests, if percolation or exfiltration systems are proposed. Percolation tests shall be representative of design conditions.
10. ___ Complete description of measures to be implemented during the construction period to mitigate adverse quantity and quality impacts off-site.

B. MASTER DRAINAGE PLAN:

1. ___ Location of all water bodies with details of size, side slopes, elevations and depths.
2. ___ Location and details of all major water control structures. Control elevations of the control structures must be included along with any seasonal water level regulation schedules.
3. ___ Drainage basin boundaries showing direction of flow, taking into account off-site runoff being routed through or around the project.
4. ___ Locations of roads and buildings along with their proposed elevations.
5. ___ Right-of-way and easement locations for the drainage system including all areas to be reserved for water management purposes.
6. ___ Location and size of internal minor water management facilities.
7. ___ Nearby existing off-site water resource facilities which might be affected by the proposed construction or development. The names and addresses of the owners of such facilities should also be submitted.

C. DRAINAGE CALCULATIONS:

1. ___ Design storms used including depth, duration and distribution.
2. ___ Off-site inflow.
3. ___ Stage-storage computations for the project and stage-discharge computations for the outfall structure(s).
4. ___ Acreages and percentage of property proposed as:
 - ___ Impervious surfaces (excluding water bodies)
 - ___ Pervious surfaces (green areas)
 - ___ Lakes, canals, retention areas, etc.
5. ___ Total acreage of project
6. ___ Runoff calculations showing discharges, elevations, and volumes retained and/or detained during applicable storm events. Mathematical computations may be required to demonstrate that the proposed development will not significantly alter net storage from the project area for events up to the 100 year frequency.
7. ___ Calculations required for determination of minimum building flood and road elevations.

D. LEGAL/INSTITUTIONAL INFORMATION:

1. ___ Identification of the entity responsible for operation and maintenance of the surface water management system.
2. ___ A letter of other evidence of potential, acceptance from the public body, if the operation and maintenance entity is to be a public body such as a city drainage district. Documents verifying the existence of such an organization and its ability to accept operation and maintenance responsibility, if the entity is a homeowners association.
3. ___ Indication of how water and wastewater service will be supplied. Letters of commitment from off-site suppliers must be included.
4. ___ Identification of agencies and organization contacted in connection with the project. Include meeting summaries and/or responses. Give status of local approvals indicating if site plan and/or subdivisions approval has been granted, final plats recorded and building or construction permits issued.
5. ___ Present and proposed zoning: Evidence of current density and classification under local government zoning or comprehensive plan must be submitted; include the status under the DRI process, if applicable. The number of proposed dwelling units and/or square feet of commercial area must be supplied. If the project is an approved DRI then a copy of the final approved development order must be supplied.
6. ___ A copy of a boundary survey and evidence of ownership or control; if the Applicant is a contractual buyer then a copy of the executed contract must be provided.
7. ___ Documentation of legal and physical availability of receiving water system to receive project discharge if such is not evident.

EXHIBIT A CONTINUED ON FOLLOWING PAGE

EXHIBIT A (CONTINUED)

A. SITE INFORMATION

A.1. Information regarding the site location is presented in Section 1.2.2 of the SCA.

A.2. A topographic map of the site and related topographic information is presented in Section 2.3.4.1 of the SCA.

A.3. Information regarding the site runoff patterns is presented in Section 2.3.4.1 of the SCA. Information regarding the vegetation and land use of adjacent lands is presented in Section 2.3.5 of the SCA.

A.4. A description of the water table (shallow) aquifer system and elevations is presented in Section 2.3.2.1 of the SCA.

A.5. Information regarding the flood plain elevations is presented in Section 2.3.4.1 of the SCA.

A.6. A description of the vegetative cover and wetlands on and near the site is presented in Section 2.3.6 of the SCA.

A.7. Recent aerial photography is provided as part of the SCA.

A.8. This application is for conceptual approval of the proposed surface water management plans; therefore, no construction drawings are provided or required.

A.9. Information on the water table (shallow) aquifer soils and hydraulic properties is presented in Section 2.3.2. of the SCA.

A.10. Information on the measures to be implemented during construction to mitigate or avoid adverse water quality and quality impacts is presented in Section 4.2 of the SCA.

B. MASTER DRAINAGE PLAN

B.1. Relevant details regarding all major water bodies are presented in the Site Drainage Plan, attached as Exhibit B-1.

B.2. Relevant details regarding all major water control structures are presented in the Site Drainage Plan, attached as Exhibit B-1.

B.3. Site drainage basin boundaries and directions of flow are presented in Site Drainage Basin Map, attached as Exhibit B-3.

B.4. Available information regarding road and building locations are presented in Section 3.0 of the SCA and the Site Drainage Plan, attached as Exhibit B-1.

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

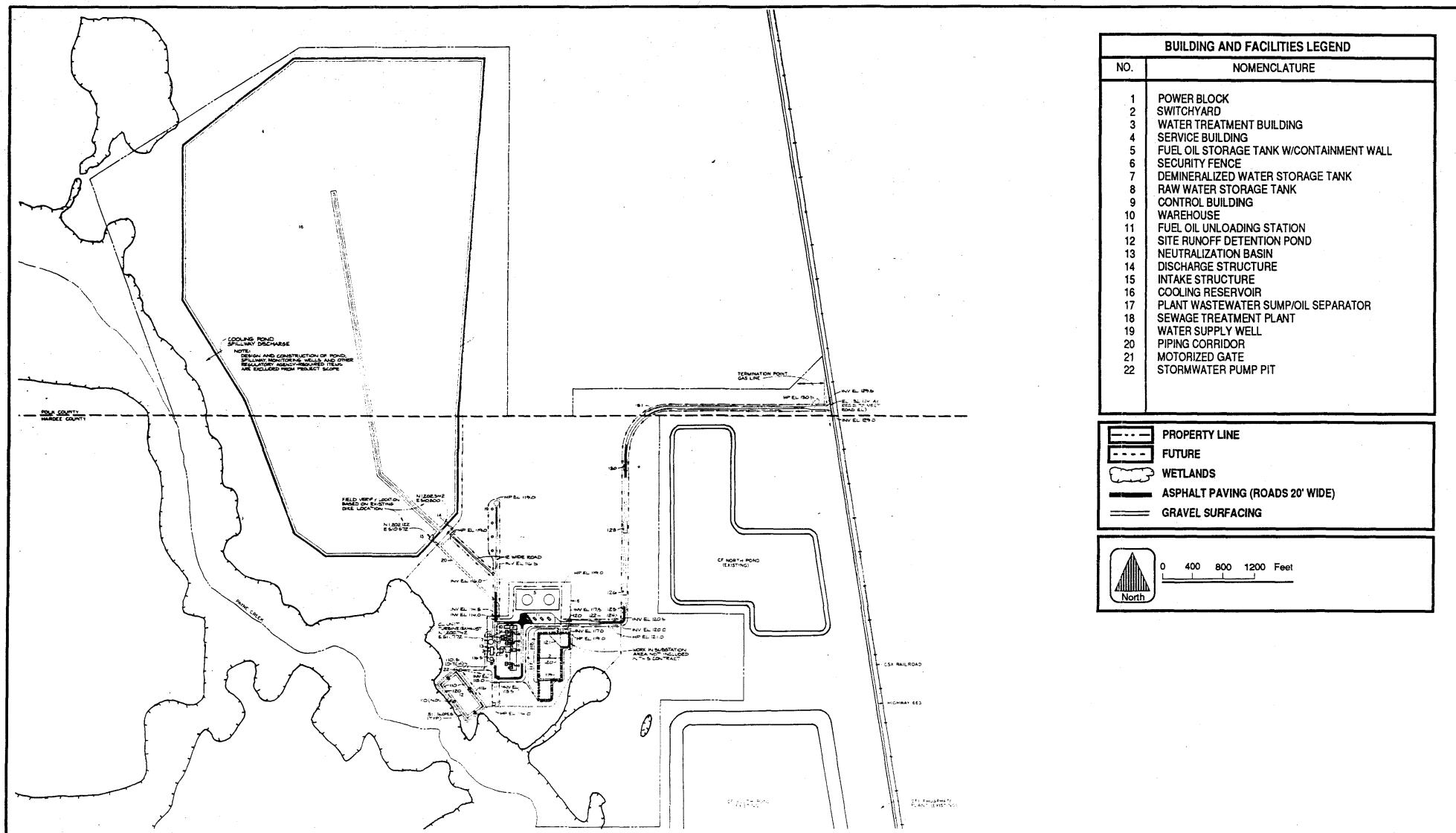


Exhibit B-1

**Hardee
Power Station**

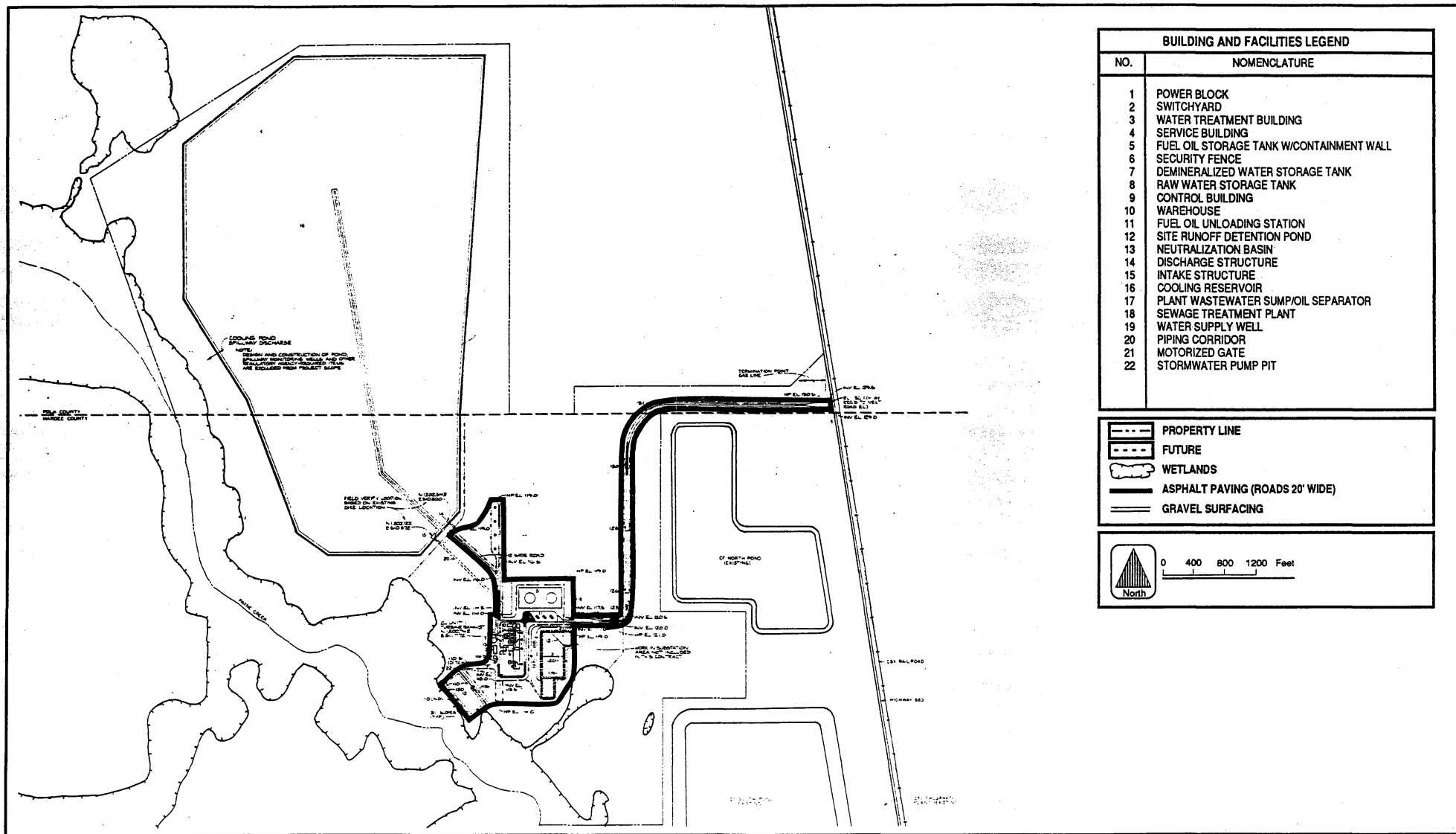


Exhibit B-3

**Hardee
Power Station**

B.5. Not required for conceptual approval.

B.6. Not required for conceptual approval.

B.7. A detailed evaluation of off site water resources impacts is presented in Section 5.1 of the SCA.

C. DRAINAGE CALCULATIONS

C.1. Water quantity and discharge evaluations were conducted using a 25-year 24-hour rainfall of 9.0 inches, distributed based on the SCS Type IIa rainfall distribution. Water quality control volumes were calculated based on a 1 inch rainfall.

C.2. As shown in the Site Drainage Basin Map (attached as Exhibit B-2), drainage from areas adjacent to the plant site will be routed around the plant site. Off site areas upstream of the cooling reservoir (i.e. part of the 470 acre watershed to the cooling reservoir) will be routed to the cooling reservoir and have been considered in the analysis.

C.3. Stage storage computations for the site stormwater detention pond and the cooling reservoir are presented in Exhibit C-3. Discharges from the plant site stormwater detention pond and the cooling reservoir were calculated based on the standard rectangular weir formula.

C.4. Post development subbasin #1 is the plant site and is approximately 72.9 acres. Approximately 75 % of the total plant site area will be paved or otherwise developed. It is estimated that this plant site area will have a SCS runoff curve number of 93. The site stormwater detention pond serving this site will be approximately 3.1 acres.

Post development subbasin #2 is the entrance road and is approximately 14.1 acres. Of this total area of 14.1 acres, 24% or 3.4 acres will be paved road surface and the SCS runoff curve number is estimated to be 98. The remaining 76% of the basin or 10.7 acres will be grassed and will have a SCS runoff curve number of 80.

The cooling reservoir watershed is approximately 470 acres and, after restoration, will be grassed pasture or replanted forested uplands with a curve number of 80. This watershed will contribute to the 570 acre cooling reservoir.

C.5 Runoff calculations for the pre- and post development plant site and entrance road subbasins for the 25-year 24-hour rainfall are summarized in attached Exhibit C-5. Evaluation of detention volumes and side drain filtration calculations for the water quality control for the plant site for the 1 inch rainfall are summarized in attached Exhibit C-5. An evaluation of discharge from the cooling reservoir for the 25-year 24-hour rainfall is presented in Section 5.1 of the SCA.

D. LEGAL/INSTITUTIONAL INFORMATION

D.1. The entity responsible for the operation and maintenance of these surface water management systems is described in Section 1.0 of the SCA.

D.2. Not Applicable.

D.3. Water and wastewater service to the plant site is summarized in Section 3.5 and 3.6 of the SCA

D.4. Coordination with federal, state, regional and local agencies is summarized in detail in Section 9.0 of the SCA.

D.5. Current and future zone of the project site are discussed in Section 2.2.2 of the SCA.

D.6. Information regarding site ownership and control is presented in Section 1.0 of the SCA.

D.7. A detailed evaluation of potential receiving water system impacts is presented in Section 5.1 of the SCA.

Exhibit C-3

Table 1. Stage-Storage and Discharge Information for the Plant Site Detention Pond

Weir Length	2.5 feet
Weir Elevation	113 feet MSL

Elevation (feet MSL)	Total Storage (acre-ft)	Weir Discharge (cfs)
110	0	0
111	3.1	0
112	6.2	0
113	9.3	0
114	12.4	8.3
115	15.5	23.5
116	18.6	43.3
117	21.7	66.6
118	24.8	93.1
119	27.9	122.4

Exhibit C-3

Table 2. Stage-Storage and Discharge Information for the Cooling Reservoir

Reservoir Area	570 acres
Weir Length	10 feet
Weir Elevation	124 feet MSL

Elevation (feet MSL)	Total Storage (acre-ft)	Weir Discharge (cfs)
-------------------------	-------------------------------	----------------------------

124.0	0	0
124.1	57	1.1
124.2	114	3.0
124.3	171	5.5
124.4	228	8.4
124.5	285	11.8
124.6	342	15.5
124.7	399	19.5
124.8	456	23.8
124.9	513	28.4
125.0	570	33.3

Exhibit C-5

Table 1. Summary of Runoff Analysis for the 25-Year, 24-Hour Rainfall (9.0 inches) for the Reservoir and Plant Site/Entrance Road

Basin	Total Area (acres)	Total Retention Area (acres)	Peak Discharge (cfs)
PLANT SITE AND ENTRANCE ROAD ¹			
Pre-Development	1040	-	374
Plant Site	72.9	-	79.3
Entrance Road	14.1	-	8.6
Total	87.0	-	87.9
Post Development			
Plant Site	72.9	3.1	68.1
Entrance Road	14.1	-	10.5
Total	87.0	3.1	78.6
COOLING RESERVOIR ²			
Pre-Development	880	-	317
Post Development	880	570	0.33

Note: 1. Plant site and entrance road runoff analyses were performed using SCS runoff techniques and are attached.

2. Cooling reservoir runoff analyses were conducted using the HEC-1 model, as described in Section 5.1.1 of the SCA. Pre-development basin peak runoff was estimated based on the unit peak runoff (cfs/square mile) for Payne Creek as determined by the HEC-1 modeling analysis.

Table 2
HARDEE POWER STATION

SUBWATERSHED NAME = PLANT SITE - PRE-DEVELOPMENT
 TOTAL AREA = 72.9 ACRES
 HYDRAULIC LENGTH = 3312 FEET
 WATERSHED SLOPE = 0.26 %
 SOIL STORAGE CAPACITY = 2.50 INCHES
 CURVE NUMBER = 80.0
 TIME OF CONCENTRATION = 2.71 HOURS
 RETURN FREQUENCY = 25 YEARS
 RAINFALL DURATION = 24 HOURS
 TOTAL RAINFALL DEPTH = 9.00 INCHES

TIME (HR)	RAINFALL (IN)	RUNOFF (CFS)	INFLOW (CFS)	PUMP-OUT (CFS)	DISCHARGE (CFS)	STAGE (FT)
0.00	0.00	0.0	0.0	0.0	0.0	0.00
4.00	0.49	0.0	0.0	0.0	0.0	0.00
6.00	0.80	0.6	0.0	0.0	0.6	0.00
7.00	0.99	1.5	0.0	0.0	1.5	0.00
8.00	1.21	2.7	0.0	0.0	2.7	0.00
9.00	1.48	4.4	0.0	0.0	4.4	0.00
10.00	1.81	6.9	0.0	0.0	6.9	0.00
10.50	2.03	8.8	0.0	0.0	8.8	0.00
11.00	2.32	11.6	0.0	0.0	11.6	0.00
11.50	2.77	16.6	0.0	0.0	16.6	0.00
12.00	5.46	57.0	0.0	0.0	57.0	0.00
12.50	6.47	78.2	0.0	0.0	78.2	0.00
13.00	6.81	76.3	0.0	0.0	76.3	0.00
14.00	7.26	62.8	0.0	0.0	62.8	0.00
15.00	7.58	50.3	0.0	0.0	50.3	0.00
16.00	7.83	40.2	0.0	0.0	40.2	0.00
17.00	8.04	32.3	0.0	0.0	32.3	0.00
18.00	8.22	26.2	0.0	0.0	26.2	0.00
20.00	8.53	18.2	0.0	0.0	18.2	0.00
22.00	8.78	13.3	0.0	0.0	13.3	0.00
24.00	9.00	10.3	0.0	0.0	10.3	0.00
30.00	9.00	1.2	0.0	0.0	1.2	0.00
36.00	9.00	0.1	0.0	0.0	0.1	0.00
40.00	9.00	0.0	0.0	0.0	0.0	0.00
44.00	9.00	0.0	0.0	0.0	0.0	0.00
48.00	9.00	0.0	0.0	0.0	0.0	0.00

FLOW ROUTING SUMMARY

MAXIMUM DISCHARGE WAS 79.3 CFS AT 12.75 HOURS
 TOTAL DISCHARGE VOLUME WAS 0.0 ACRE-Feet

HARDEE POWER STATION

SUBWATERSHED NAME = PLANT SITE - POST DEVELOPMENT
 TOTAL AREA = 72.9 ACRES
 HYDRAULIC LENGTH = 3312 FEET
 WATERSHED SLOPE = 0.27 %
 SOIL STORAGE CAPACITY = 0.75 INCHES
 CURVE NUMBER = 93.0
 TIME OF CONCENTRATION = 1.64 HOURS
 RETURN FREQUENCY = 25 YEARS
 RAINFALL DURATION = 24 HOURS
 TOTAL RAINFALL DEPTH = 9.00 INCHES

TIME (HR)	RAINFALL (IN)	RUNOFF (CFS)	INFLOW (CFS)	PUMP-OUT (CFS)	DISCHARGE (CFS)	STAGE (FT)
0.00	0.00	0.0	0.0	0.0	0.0	110.00
4.00	0.49	2.7	0.0	0.0	0.0	110.07
6.00	0.80	6.0	0.0	0.0	0.0	110.30
7.00	0.99	7.9	0.0	0.0	0.0	110.49
8.00	1.21	10.0	0.0	0.0	0.0	110.73
9.00	1.48	13.0	0.0	0.0	0.0	111.03
10.00	1.81	16.8	0.0	0.0	0.0	111.42
10.50	2.03	19.9	0.0	0.0	0.0	111.67
11.00	2.32	24.4	0.0	0.0	0.0	111.96
11.50	2.77	33.0	0.0	0.0	0.0	112.34
12.00	5.46	105.8	0.0	0.0	0.7	113.20
12.50	6.47	181.1	0.0	0.0	18.9	114.73
13.00	6.81	115.6	0.0	0.0	42.8	115.98
14.00	7.26	78.5	0.0	0.0	66.8	117.01
15.00	7.58	53.4	0.0	0.0	65.4	116.95
16.00	7.83	37.5	0.0	0.0	55.3	116.53
17.00	8.04	27.4	0.0	0.0	44.6	116.06
18.00	8.22	20.9	0.0	0.0	35.6	115.64
20.00	8.53	14.2	0.0	0.0	23.6	115.00
22.00	8.78	10.7	0.0	0.0	16.7	114.59
24.00	9.00	8.6	0.0	0.0	12.8	114.33
30.00	9.00	0.2	0.0	0.0	3.3	113.55
36.00	9.00	0.0	0.0	0.0	1.0	113.25
40.00	9.00	0.0	0.0	0.0	0.6	113.17
44.00	9.00	0.0	0.0	0.0	0.3	113.12
48.00	9.00	0.0	0.0	0.0	0.2	113.09

FLOW ROUTING SUMMARY

MAXIMUM STAGE WAS 117.06 FEET AT 14.25 HOURS
 MAXIMUM DISCHARGE WAS 68.1 CFS AT 14.25 HOURS
 TOTAL DISCHARGE VOLUME WAS 49.6 ACRE-Feet

EXHIBIT C-5 TABLE 4

HARDEE POWER STATION

SUBWATERSHED NAME = ENTRANCE ROAD - PRE-DEVELOPMENT
 TOTAL AREA = 14.1 ACRES
 HYDRAULIC LENGTH = 6144 FEET
 WATERSHED SLOPE = 0.15 %
 SOIL STORAGE CAPACITY = 2.50 INCHES
 CURVE NUMBER = 80.0
 TIME OF CONCENTRATION = 5.85 HOURS
 RETURN FREQUENCY = 25 YEARS
 RAINFALL DURATION = 24 HOURS
 TOTAL RAINFALL DEPTH = 9.00 INCHES

TIME (HR)	RAINFALL (IN)	RUNOFF (CFS)	INFLOW (CFS)	PUMP-OUT (CFS)	DISCHARGE (CFS)	STAGE (FT)
0.00	0.00	0.0	0.0	0.0	0.0	0.00
4.00	0.49	0.0	0.0	0.0	0.0	0.00
6.00	0.80	0.1	0.0	0.0	0.1	0.00
7.00	0.99	0.2	0.0	0.0	0.2	0.00
8.00	1.21	0.3	0.0	0.0	0.3	0.00
9.00	1.48	0.5	0.0	0.0	0.5	0.00
10.00	1.81	0.8	0.0	0.0	0.8	0.00
10.50	2.03	1.0	0.0	0.0	1.0	0.00
11.00	2.32	1.3	0.0	0.0	1.3	0.00
11.50	2.77	1.9	0.0	0.0	1.9	0.00
12.00	5.46	5.8	0.0	0.0	5.8	0.00
12.50	6.47	8.2	0.0	0.0	8.2	0.00
13.00	6.81	8.6	0.0	0.0	8.6	0.00
14.00	7.26	8.2	0.0	0.0	8.2	0.00
15.00	7.58	7.6	0.0	0.0	7.6	0.00
16.00	7.83	7.0	0.0	0.0	7.0	0.00
17.00	8.04	6.3	0.0	0.0	6.3	0.00
18.00	8.22	5.7	0.0	0.0	5.7	0.00
20.00	8.53	4.7	0.0	0.0	4.7	0.00
22.00	8.78	3.8	0.0	0.0	3.8	0.00
24.00	9.00	3.1	0.0	0.0	3.1	0.00
30.00	9.00	1.1	0.0	0.0	1.1	0.00
36.00	9.00	0.4	0.0	0.0	0.4	0.00
40.00	9.00	0.2	0.0	0.0	0.2	0.00
44.00	9.00	0.1	0.0	0.0	0.1	0.00
48.00	9.00	0.1	0.0	0.0	0.1	0.00

FLOW ROUTING SUMMARY

MAXIMUM DISCHARGE WAS 8.6 CFS AT 13.00 HOURS
 TOTAL DISCHARGE VOLUME WAS 0.0 ACRE-FEET

HARDEE POWER STATION

SUBWATERSHED NAME = ENTRANCE ROAD - POST DEVELOPMENT
 TOTAL AREA = 14.1 ACRES
 HYDRAULIC LENGTH = 6144 FEET
 WATERSHED SLOPE = 0.15 %
 SOIL STORAGE CAPACITY = 1.86 INCHES
 CURVE NUMBER = 84.3
 TIME OF CONCENTRATION = 5.08 HOURS
 RETURN FREQUENCY = 25 YEARS
 RAINFALL DURATION = 24 HOURS
 TOTAL RAINFALL DEPTH = 9.00 INCHES

TIME (HR)	RAINFALL (IN)	RUNOFF (CFS)	INFLOW (CFS)	PUMP-OUT (CFS)	DISCHARGE (CFS)	STAGE (FT)
0.00	0.00	0.0	0.0	0.0	0.0	0.00
4.00	0.49	0.0	0.0	0.0	0.0	0.00
6.00	0.80	0.2	0.0	0.0	0.2	0.00
7.00	0.99	0.3	0.0	0.0	0.3	0.00
8.00	1.21	0.5	0.0	0.0	0.5	0.00
9.00	1.48	0.8	0.0	0.0	0.8	0.00
10.00	1.81	1.2	0.0	0.0	1.2	0.00
10.50	2.03	1.5	0.0	0.0	1.5	0.00
11.00	2.32	1.9	0.0	0.0	1.9	0.00
11.50	2.77	2.5	0.0	0.0	2.5	0.00
12.00	5.46	7.3	0.0	0.0	7.3	0.00
12.50	6.47	10.1	0.0	0.0	10.1	0.00
13.00	6.81	10.4	0.0	0.0	10.4	0.00
14.00	7.26	9.7	0.0	0.0	9.7	0.00
15.00	7.58	8.8	0.0	0.0	8.8	0.00
16.00	7.83	7.8	0.0	0.0	7.8	0.00
17.00	8.04	7.0	0.0	0.0	7.0	0.00
18.00	8.22	6.2	0.0	0.0	6.2	0.00
20.00	8.53	4.9	0.0	0.0	4.9	0.00
22.00	8.78	3.8	0.0	0.0	3.8	0.00
24.00	9.00	3.1	0.0	0.0	3.1	0.00
30.00	9.00	1.0	0.0	0.0	1.0	0.00
36.00	9.00	0.3	0.0	0.0	0.3	0.00
40.00	9.00	0.1	0.0	0.0	0.1	0.00
44.00	9.00	0.1	0.0	0.0	0.1	0.00
48.00	9.00	0.0	0.0	0.0	0.0	0.00

FLOW ROUTING SUMMARY

MAXIMUM DISCHARGE WAS 10.5 CFS AT 12.75 HOURS
 TOTAL DISCHARGE VOLUME WAS 0.0 ACRE-FEET

EXHIBIT C-5 TABLE 6

STORMWATER DETENTION WITH FILTRATION (FDER CHAPTER 17-25)

SIDE DRAIN FILTER DRAWDOWN ANALYSIS (USING DARCY'S LAW)

BASIN NAME = HARDEE POWER STATION - PLANT SITE
 AVERAGE POND AREA = 135000 square feet
 CONTROL STRUCTURE CREST ELEVATION = 113 feet MSL
 POND BOTTOM OR FILTER DRAIN ELEVATION = 110 feet MSL
 TOTAL RETENTION DEPTH = 3 feet
 FILTER MEDIA HYDRAULIC CONDUCTIVITY, K = 164 feet/day
 REQUIRED DETENTION (WITH FILTRATION) VOLUME = 132300 cubic feet
 MAXIMUM ALLOWABLE FILTRATION TIME (TO SATISFY FDER 17-25) = 36 hours
 LENGTH OF SIDE DRAIN = 400 feet

WATER LEVEL (MSL)	TOTAL HEAD (ft)	DELTA HEAD (ft)	TOTAL VOLUME (ft ³)	DELTA VOLUME (ft ³)	FLOW LENGTH THRU FILTER (ft)			HYDRAULIC GRADIENT (ft/ft)	FILTER AREA (ft ²)	FLOW (cfs)	AVE FLOW (cfs)	DELTA TIME (hrs)	TOTAL TIME (hrs)	FILTERED VOLUME (ft ³)
					MAX	MIN	AVE							
113.00	3.00		405000		8.2	2.0	4.3	0.693	1200.0	5684.4			0.0	0
		0.38		50625							5018.3	10.1		
112.63	2.63		354375		8.2	2.0	4.3	0.607	1050.0	4352.1			10.1	50625
		0.38		50625							3774.8	13.4		
112.25	2.25		303750		8.2	2.0	4.3	0.520	900.0	3197.5			23.5	101250
		0.38		50625							2644.8	19.1		
111.88	1.88		253125		8.2	2.0	4.6	0.408	750.0	2092.2			42.6	151875
		0.38		50625							1626.3	31.1		
111.50	1.50		202500		8.2	2.7	5.3	0.283	600.0	1160.5			73.8	202500
		0.38		50625							867.4	58.4		
111.13	1.13		151875		8.2	3.9	6.0	0.187	450.0	574.4			132.1	253125
		0.38		50625							401.0	126.3		
110.75	0.75		101250		8.2	5.3	6.8	0.111	300.0	227.6			258.4	303750
		0.38		50625							139.4	363.1		
110.38	0.38		50625		8.2	6.8	7.5	0.050	150.0	51.3			621.5	354375
		0.38		50625							25.6	1975.2		
110.00	0.00		0		8.2	8.2	8.2	0.000	0.0	0.0			2596.8	405000

BASED ON THE ABOVE STORMWATER SYSTEM PARAMETERS, THE REQUIRED DETENTION
 OF 132300 CUBIC FEET WILL BE RESTORED, BY FILTRATION THROUGH A 400 FOOT
 SIDE DRAIN, IN APPROXIMATELY 35.2 HOURS

11.6 SUPPORTING AQUATIC ECOLOGY INFORMATION

Table 1. Phylogenetic listing of all Taxa Identified from Payne Creek, October/November 1988 and February/March, 1989.

Phylum Class Order Family <u>Genus species</u>	SAMPLE		TYPE	
	Ponar	Hester	Dendy	DipNet
Coelenterata				
Hydrozoa				
Hydrida				
Hydridae				
<u>Hydra</u> sp.			X	
Turbellaria	X		X	X
Nemertea				
<u>Prostoma rubrum</u>	X			X
Nematoda	X			
Annelida				
Oligochaeta				
Haplotaxida				
Naididae				
<u>Dero flabelliger</u>	X			
<u>D. furcata</u>	X			
<u>D. nivea</u>			X	
<u>Nais communis</u>	X		X	
<u>N. pardalis</u>	X			
<u>N. variabilis</u>	X			
<u>Pristina leidyi</u>	X		X	
<u>P. synclites</u>	X		X	
<u>Slavena appendiculata</u>	X		X	
Opistocystidae				
<u>Trieminentia corderoi</u>				
Tubificidae				X
<u>Aulodrilus piqueti</u>	X			
<u>Limnodrilus hoffmeisteri</u>	X			
<u>Psammoryctides convolutus</u>	X			
Immature with Capil. Setae	X			
Immature w/o Capil. Setae	X			
Lumbriculida				
Lumbriculidae	X			X

Table 2. Macroinvertebrates Collected Using Artificial Substrates
from Payne Creek Station PC-1, October-November, 1988

Taxa	Replicates			Total
	1	2	3	
<u>Turbellaria</u>	92	31	23	146
<u>Pristina leidyi</u>		62		62
<u>P. synclites</u>			8	8
<u>Slavena appendiculata</u>	123			123
<u>Hyaella azteca</u>	92			92
<u>Baetis propinquus</u>	62		31	92
<u>Caenis diminuta</u>	92	154	185	431
<u>Stenacron interpunctatum</u>			31	31
<u>Stenonema exiguum</u>	31	62	62	154
<u>Tricorythodes albilineatus</u>	31			31
<u>Nehallenia</u> sp.	31			31
<u>Cheumatopsyche</u> sp.	1600	923	984	3507
<u>Polycentropus</u> sp.		31		31
<u>Lepidoptera</u>	31		8	38
<u>Heterelmis vulnerata</u>	8			8
<u>Stenelmis fuscata</u>		62		62
<u>Corydalis corneutus</u>			8	8
<u>Ablabesmyia mallochi</u>	62		92	154
<u>Corynoneura taris</u> group	31	62	123	215
<u>Endochironomus</u> group	308	185	1415	1907
<u>Pentaneura inconspicua</u>	554	431	215	1200
<u>Polypedilum convictum</u>	123	646	246	1015
<u>P. fallax</u>		31		31
<u>P. illinoense</u>	62		31	92
<u>P. scalaenum</u>	154	1015	185	1353
<u>Rheocricotopus robacki</u>	31		31	62
<u>Rheotanytarsus exiguus</u> group	185	1169	154	1507
<u>Tanytarsus guerlus</u> group	215		461	677
<u>T. sp. XI Rutter</u>		277		277
<u>Thienemanniella fusca</u> group	31	800	31	861
<u>Simulium</u> sp.		31		31
<u>Hebetancylus excentricus</u>	62			62

TOTAL NUMBER OF SPECIES	23	17	20	32
TOTAL NUMBER OF INDIVIDUALS	4,006	5,967	4,322	14,296
DIVERSITY ($\bar{d}$)	3.27	3.25	3.07	3.62

Table 3. Macroinvertebrates Collected Using Artificial Substrates
from Payne Creek Station PC-2, October-November, 1988

Taxa	Replicates			Total
	1	2	3	
<u>Hydra</u> sp.	31			31
<u>Nais communis</u>		62		62
<u>Pristina leidy</u>			277	277
<u>Slavena appendiculata</u>	308	31	123	461
<u>Hyaella azteca</u>	31	15		46
<u>Neoperla carlsoni</u>	31	8	23	62
<u>Baetis propinquus</u>		23	15	38
<u>Caenis diminuta</u>	62		38	100
<u>Stenacron interpunctatum</u>	92	15	31	138
<u>Stenonema exiguum</u>	92	8	23	123
<u>S. smithae</u>			15	15
<u>Cheumatopsyche</u> sp.	15	177	15	208
<u>Neotrichia</u> sp.	62		8	69
<u>Polycentropus</u> sp.	62		8	69
<u>Neureclipsis</u> sp.		15		15
<u>Nyctiophylax</u> sp.	185	46	38	269
Hydroptilidae	8			8
<u>Drypos</u> sp.		8		8
<u>Stenelmis fuscata</u>	62	62	15	138
<u>Heterelmis vulnerata</u>	92			92
<u>Corydalus cornutus</u>		8		8
Ceratopogonidae			31	31
<u>Ablabesmyia mallochi</u>	215		31	246
<u>Corynoneura celeripes</u>	62	62	31	154
<u>Endochironomus</u> group	1507		1107	2615
<u>Nanocladius minimus</u> ?	31			31
<u>Nilotanytus</u> sp.	31		123	154
<u>Pentaneura inconspicua</u>		123	123	246
<u>Polypedilum convictum</u>	4460	3999	1784	10243
<u>P. fallax</u>	277		154	431
<u>P. illinoense</u>		1230		1230
<u>P. scalaenum</u>	646	277	1077	1999
<u>P. simulans</u>	123			123
<u>Rheocricotopus robacki</u>	92	92	123	308
<u>Rheotanytarsus exiguus</u> group	62	92	123	277
<u>Tanytarsus glabrescens</u> group	400	15	246	661
<u>Thienemanniella fusca</u> group	1015	646	554	2215
<u>Hebetancylus excentricus</u>	31	8		38
<u>Physella cubensis</u>		8		8

TOTAL NUMBER OF SPECIES	28	24	26	39
TOTAL NUMBER OF INDIVIDUALS	10,082	7,029	6,137	23,247
DIVERSITY ($\bar{d}$)	2.99	2.23	3.22	3.14

Table 4. Macroinvertebrates Collected Using Artificial Substrates
from Payne Creek Station PC-1, February-March, 1989

Taxa	Replicates			Total
	1	3	4	
<u>Batracobdella phalera</u>	8	31		38
<u>Hydracarina</u>			54	54
<u>Hyalella azteca</u>			31	31
<u>Caenis diminuta</u>	54	31	123	208
<u>Stenacron interpunctatum</u>	8			8
<u>Argia sedula</u>	46	123	185	354
<u>Corydalis cornutus</u>	8	8	8	23
Homoptera		8		8
<u>Cheumatopsyche</u> sp.	1038	1753	2384	5175
<u>Nectopsyche</u> sp.			31	31
<u>Dubiraphia</u> sp.			31	31
<u>Stenelmis fuscata</u>	15		54	69
<u>Heterelmis vulnerata</u>		31		31
<u>Dineutus</u> sp. (larvae)		62		62
Ceratopogonidae	62			62
<u>Ablabesmyia mallochi</u>		31		31
<u>Cladotanytarsus vanderwulpi</u> gr.		62		62
<u>Corynoneura taris</u> group	492	523	800	1815
<u>Cricotopus bicinctus</u> group	123			123
<u>Demicryptochironomus</u> sp.		54		54
<u>Pentaneura inconspicua</u>	62	492	484	1038
<u>Polypedilum convictum</u>	3753	6783	4122	14657
<u>P. fallax</u>		123		123
<u>P. illinoense</u>		69		69
<u>P. scalaenum</u>		815	246	1061
<u>P. simulans</u>		62		62
<u>Rheocricotopus robacki</u>		1107		1107
<u>Rheosmittia</u> sp.		54		54
<u>Rheotanytarsus exiguus</u> group	492	615	431	1538
<u>Tanytarsus glabrescens</u> group		92		92
<u>T. guerlus</u> group		77	123	200
<u>Thienemanniella fusca</u> group	677	2030	738	3445
<u>Simulium</u> sp.	31	62		92
<u>Planorbella scalaris</u>			15	15

TOTAL NUMBER OF SPECIES	15	25	17	34
TOTAL NUMBER OF INDIVIDUALS	6,867	15,095	9,859	31,821
DIVERSITY ($\bar{d}$)	2.18	2.79	2.59	2.74

Table 5. Macroinvertebrates Collected Using Artificial Substrates
from Payne Creek Station PC-2, February-March, 1989

Taxa	Replicates			Total
	1	2	3	
<u>Dero nivea</u>			31	31
<u>Slavena appendiculata</u>		31		31
<u>Collembola</u>			31	31
<u>Baetis pygmaeus</u>		62	77	138
<u>Caenis diminuta</u>	123		31	154
<u>Stenacron interpunctatum</u>	277	38	77	392
<u>Stenonema exiguum</u>	92	46	8	146
<u>Argia sedula</u>	15			15
<u>Cheumatopsyche</u> sp.			31	31
<u>Cyrnellus</u> sp.			38	38
<u>Nyctiophylax</u> sp.		31		31
<u>Polycentropus</u> sp.	31	23	8	62
<u>Dubiraphia</u> sp. (larva)	92		8	100
<u>Stenelmis fuscata</u> group	38	23	92	154
<u>Dineutus</u> sp. (larva)	31	23	15	69
<u>Gyrinus</u> sp. (larva)			15	15
Ceratopogonidae	31			31
<u>Ablabesmyia mallochi</u>	123	123	31	277
<u>A. monilis</u>			185	185
<u>Corynoneura taris</u> group	369	1415	1846	3630
<u>Cricotopus bicinctus</u> group	62	123		185
<u>Endochironomus</u> sp.	123			123
<u>Labrundinea virescens</u>	31	62	277	369
<u>Nanocladius minimus</u> ?	185		308	492
<u>Nilothauma babilii</u>	62			62
<u>Orthocladius</u> sp.	62			62
<u>Parakiefferiella</u> sp.	92			92
<u>Pentaneura inconspicua</u>	169	185	92	446
<u>Polypedilum convictum</u>	185	1384	1246	2815
<u>P. fallax</u>	615	92	200	907
<u>P. scalaenum</u>	400	123	338	861
<u>Rheocricotopus robacki</u>		92		92
<u>Rheotanytarsus exiguus</u> group	62	554	354	969
<u>Tanytarsus glabrescens</u> group			185	185
<u>T. guerlus</u> group	1600	892	1561	4053
<u>Thienemanniella fusca</u> group	62	4060	1476	5598
<u>Hebetancylus excentricus</u>	415	15		431
<u>Micromenetus dilatatus avus</u>	54			54
<u>Physella cubensis</u>	31			31

TOTAL NUMBER OF SPECIES	28	21	26	39
TOTAL NUMBER OF INDIVIDUALS	5,429	9,397	8,559	23,385
DIVERSITY ($\bar{d}$)	3.80	2.69	3.34	3.58

Table 6. Macroinvertebrates Collected Using Artificial Substrates
from Payne Creek Station PC-3, February- March, 1989

Taxa	Replicates			Total
	1	2	3	
<u>Helobdella fusca</u>			8	8
<u>Hyalella azteca</u>		8	300	308
<u>Callibaetis floridanus</u>	8		8	15
<u>Caenis diminuta</u>	269	62	177	508
<u>Stenacron interpunctatum</u>	38	8		46
<u>Argia sedula</u>	8			8
<u>Corydalis cornutus</u>		8		8
<u>Cheumatopsyche</u> sp.	23			23
<u>Cyrnellus</u> sp.		8		8
<u>Dubiraphia</u> sp.			85	85
<u>Stenelmis fuscata</u>	31		31	62
<u>Dineutus</u> sp. (larvae)	8			8
<u>Ceratopogonidae</u>			8	8
<u>Ablabesmyia mallochi</u>		131	92	223
<u>Corynoneura taris</u> group	38	23		62
<u>Cryptotendipes</u> nr. <u>pseudotener</u>			154	154
<u>Dicrotendipes</u> sp.			308	308
<u>D. simpsoni</u>			738	738
<u>Endochironomus</u> group	400	315	408	1123
<u>Glyptotendipes lobiferous</u>			85	85
<u>Kiefferulus dux</u>			38	38
<u>Nilothauma babiyi</u>	8	31		38
<u>Nanocladius minimus?</u>	31	100		131
<u>Paralauterborniella nigrohalteralis</u>			100	100
<u>Pentaneura inconspicua</u>	54			54
<u>Polypedilum fallax</u>	115	469	215	800
<u>P. illinoense</u>		154		154
<u>P. scalaenum</u> group	215		31	246
<u>Rheotanytarsus exiguus</u> group		31		31
<u>Tanytarsus glabrescens</u> group	523			523
<u>T. guerlus</u> group		308	461	769
<u>T. sp.XI</u> Rutter		31		31
<u>Hebetancylus excentricus</u>		15	38	54
<u>Laevipex floridana</u>			8	8
<u>Amnicola dalli johnsoni</u>	8		15	23
<u>Micromenetus dilatatus avus</u>	123	38	8	169
<u>Physella cubensis</u>	46			46
<u>Byssanodonta cubensis</u>			8	8

TOTAL NUMBER OF SPECIES	18	17	23	38
TOTAL NUMBER OF INDIVIDUALS	1,946	1,738	3,322	7,006
DIVERSITY ($\bar{d}$)	3.14	3.11	3.56	4.11

Table 7. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-1, October, 1988

Taxa	Replicates				Total
	2	3	4	5	
<u>Turbellaria</u>			91		91
<u>Prostoma rubrum</u>			91		91
<u>Dero furcata</u>			45		45
<u>Nais communis</u>			45		45
<u>N. variabilis</u>				45	45
<u>Pristina synclites</u>			136		136
<u>Limnodrilus hoffmeisteri</u>	227		136	682	1045
<u>Psammoryctides convolutus</u>		591	45		636
Immature Tubific. w/o Capil. Setae	364	182	136	818	1500
Immature Tubific. w/ Capil. Setae		136	91		227
<u>Helobdella triserialis</u>			91	45	136
<u>Myzobdella lugubris</u>			273		273
<u>Batrachobdella phalera</u>				91	91
<u>Palaemonetes paludosus</u>			45		45
<u>Baetis fondalis</u>			45		45
<u>Caenis diminuta</u>			1045		1045
<u>Gomphus minutus</u>			45	45	91
<u>Cheumatopsyche</u> sp.		45	45	45	136
<u>Nectopsyche</u> sp.			45		45
<u>Dubiraphia</u> sp.			318		318
<u>Ablabesmyia monilis</u>			45	45	91
<u>A. mallochi</u>			182	45	227
<u>Chironomus</u> sp.			45		45
<u>Clinotanypus pinguis</u>			45	91	136
<u>Cryptochironomus blarina</u> group			45		45
<u>C. fulvus</u> group		45			45
<u>Endochironomus</u> group			91		91
<u>Polypedilum scalaenum</u>		45	91		136
<u>P. simulans</u>		45	45		91
<u>Hebetancylus exentricus</u>			227		227
<u>Micromenetus d. avus</u>			91		91
<u>Planorbella duryi</u>			45	45	91
<u>Corbicula fluminea</u>	818	364	1182	3136	5499
<u>Sphaerium</u> sp.	45		45		91
<u>Elliptio buckleyi</u>	45			45	91

TOTAL NUMBER OF SPECIES	5	8	31	13	35
TOTAL NUMBER OF INDIVIDUALS	1,500	1,454	4,954	5,181	13,090
DIVERSITY ($\bar{d}$)	1.69	2.35	3.93	1.93	3.38

Table 8. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-2, October, 1988 (Page 1 of 2)

Taxa	Replicates				Total
	1	3	4	6	
<u>Turbellaria</u>	136	500			636
<u>Dero flabelliger</u>		45			45
<u>D. furcata</u>		136			136
<u>Pristina synclites</u>		91	91	45	227
<u>P. leidy</u>			91		91
<u>Slavena appendiculata</u>	91				91
<u>Limnodrilus hoffmeisteri</u>	45	136			182
<u>Psammoryctides convolutus</u>	182		91	45	318
Immature Tubific. w/o Capil. S	45	136	136	91	409
<u>Batrachobdella phalera</u>	91	45			136
<u>Hellobdella fusca</u>	136				136
<u>H. triserialis</u>	136	91			227
<u>Collembola</u>				91	91
<u>Baetis</u> sp.				45	45
<u>Caenis diminuta</u>	1000	591	45	45	1682
<u>Stenacron interpunctatum</u>		45			45
<u>Stenonema smithae</u>			45		45
<u>Chloroterpes hubbelli</u>	364	182			545
<u>Gomphus minutus</u>		45			45
<u>Stylarus plagiatus</u>		45			45
<u>Macromia taeniolata</u>	45	91			136
<u>Oecetis</u> sp.		45			45
<u>Polycentropus</u> sp.		45			45
<u>Dubiraphia</u> sp.	45	136			182
<u>Dineutus</u> sp. (larvae)	91				91
Ceratopogonidae		91		91	182
<u>Ablabesmyia monilis</u>	182	45		45	273
<u>A. mallochi</u>	182	45		45	273
<u>Clinotanypus pinguis</u>		45			45
<u>Cryptochironomus fulvus</u> group	91		45		136
<u>Labrundinea</u> sp. 4 Roback	45				45
<u>Larsia lurida</u>	45				45
<u>Phaenopsectra</u> sp.	91		45		136
<u>Polypedilum convictum</u>			45		45
<u>P. scalaenum</u>	545	273			818
<u>P. simulans</u>	45	227		136	409
<u>Rheosmittia</u> sp.				45	45
<u>Rheotanytarsus exiguus</u> group		45			45
<u>Tanytarsus glabrescens</u> group	45	45	45		136
<u>T. guerlus</u> group			45		45
<u>Hebetancylus exentricus</u>			91		91
<u>Laevipex peninsulae</u>	636	954	136		1727
<u>Micromenetes d. avus</u>			45		45

Table 8. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-2, October, 1988 (Page 2 of 2)

Taxa	Replicates				Total
	1	3	4	6	
<u>Corbicula fluminea</u>	136	1182	91	136	1545
<u>Sphaerium</u> sp.		136	45	0	182
<u>Elliptio buckleyi</u>	45			45	91
<u>Physella cubensis</u>		45			45

TOTAL NUMBER OF SPECIES	25	29	16	14	47
TOTAL NUMBER OF INDIVIDUALS	4,500	5,545	1,136	909	12,090
DIVERSITY ($\bar{d}$)	3.89	3.92	3.86	3.55	4.50

Table 9. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-3, October 1988

Taxa	Replicates				Total
	2	3	4	5	
<u>Slavena appendiculata</u>				45	45
<u>Aulodrilus pigueti</u>	727	227	954		1909
<u>Limnodrilus hoffmeisteri</u>				45	45
Immature Tubific.w/o capil. setae	136	45	45		227
<u>Macromia taeniolata</u>				45	45
<u>Clinotanypus pinguis</u>			91		91
<u>Cryptotendipes</u> nr. <u>pseudotener</u>			45		45
<u>Paratendipes</u> sp.			45		45
<u>Polypedilum simulans</u>			45		45
<u>Tanytarsus</u> sp. 1 Cantrell	45	45	91		182
<u>Corbicula fluminea</u>		909		45	954

TOTAL NUMBER OF SPECIES	3	4	7	4	11
TOTAL NUMBER OF INDIVIDUALS	909	1,227	1,318	182	3,636
DIVERSITY ($\bar{d}$)	0.88	1.12	1.54	2.00	2.07

Table 10. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-1, February 1989

Taxa	Replicates				Total
	1	3	5	6	
<u>Nais pardalis</u>	45				45
<u>Pristina synclites</u>		91			91
<u>Limnodrilus hoffmeisteri</u>	91		136	727	954
<u>Psammoryctides convolutus</u>		273	91	182	545
Immature Tubific. w/o Capil. Setae	227	545	273	1273	2318
<u>Hyalella azteca</u>	136	273			409
<u>Caenis diminuta</u>	45	273			318
<u>Stenonema exiguum</u>				364	364
<u>Tricorythodes albilineatus</u>				182	182
<u>Gomphus minutus</u>	45	45		182	273
<u>Stylarus plagiatus</u>				91	91
<u>Cheumatopsyche</u> sp.	227	545			773
<u>Dubiraphia</u> sp.	136	182	45	1273	1636
<u>Stenelmis fuscata</u> group				182	182
Ceratopogonidae	91	455	136	727	1409
<u>Cladotanytarsus vanderwulpi</u> group	318	455	773	1454	3000
<u>Cryptochironomus fulvus</u> group		636	91		727
<u>Nanocladius minimus</u> ?	182	364		182	727
<u>Orthocladius</u> sp.	545	91	91		727
<u>Pentaneura inconspicua</u>	91				91
<u>Polypedilum convictum</u>	91			182	273
<u>P. illinoense</u>	455		727	545	1727
<u>P. scalaenum</u>	1364	1454	364	2182	5363
<u>Rheocricotopus</u> nr. <u>effusus</u>	45				45
<u>Rheotanytarsus exiguus</u> group		91			91
<u>Stenochironomus</u> sp.	45				45
<u>Tanytarsus glabrescens</u> group	45				45
<u>T. guerlus</u> group	45	182	227	364	818
<u>Simulium</u> sp.				545	545
<u>Sphaerium</u> sp.			136		136
<u>Corbicula fluminea</u>	1227	864		1136	3227
<u>Elliptio buckleyi</u>	91				91

TOTAL NUMBER OF SPECIES	22	17	12	18	32
TOTAL NUMBER OF INDIVIDUALS	5,590	6,818	3,091	11,772	27,270
DIVERSITY ($\bar{d}$)	3.51	3.64	3.07	3.67	4.02

Table 11. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-2, February 1989

Taxa	Replicates				Total
	1	2	3	4	
<u>Lumbriculidae</u>		273			273
<u>Limnodrilus hoffmeisteri</u>	182	91	136	364	773
Immature Tubific.w/o capil. setae		91	136	364	591
<u>Acroneura</u> sp.			91		91
<u>Baetis</u> sp.			136	182	318
<u>Caenis diminuta</u>	182				182
<u>Choroterpes hubbelli</u>	182				182
<u>Stenacron interpunctatum</u>			364		364
<u>Stenonema exiguum</u>			91		91
<u>Argia moesta</u>	45				45
<u>A. sedula</u>			91		91
<u>Hetaerina</u> sp.	45				45
<u>Gomphus minutus</u>	45				45
<u>Cyrnellus</u> sp.			136		136
<u>Polycentropus</u> sp.	545		182		727
<u>Dubiraphia</u> sp.	1636		227		1863
<u>Stenelmis fuscata</u> group	182		136	364	682
<u>Ceratopogonidae</u>		45	409	2182	2636
<u>Ablabesmyia mallochi</u>			954		954
<u>A. monilis</u>	1454		682		2136
<u>Cladotanytarsus vanderwulpi</u> group				4590	4590
<u>Cryptochironomus fulvus</u> group		91	136	545	773
<u>Polypedilum convictum</u>				182	182
<u>P. fallax</u>			136		136
<u>P. illinoense</u>				364	364
<u>P. scalaenum</u>			273	3818	4091
<u>P. simulans</u>		182		909	1091
<u>Procladius</u> sp.		91			91
<u>Stenochironomus</u> sp.			409		409
<u>Tanytarsus guerlus</u> group	364	273	409	182	1227
<u>Laevipex floridana</u>	182		136		318
<u>Micromenetus d. avus</u>			136		136
<u>Corbicula fluminea</u>		45	227	682	954
<u>Elliptio buckleyi</u>			45		45
<u>Sphaerium</u> sp.			273		273

TOTAL NUMBER OF SPECIES	12	9	24	13	35
TOTAL NUMBER OF INDIVIDUALS	5,045	1,182	5,954	14,726	26,906
DIVERSITY ($\bar{d}$)	2.71	2.89	4.20	2.83	4.14

Table 12. Macroinvertebrates Collected Using Ponar Grab Samples from
Payne Creek Station PC-3, February, 1989.

Taxa	Replicates				Total
	3	4	5	6	
Nematoda			45		45
<u>Dero furcata</u>			45		45
<u>Pristina synclites</u>		45			45
<u>Limnodrilus hoffmeisteri</u>		182	45	45	273
Immature Tub. w/o Capil. Setae	136	136	45	45	364
<u>Baetis</u> sp.			45		45
Ceratopogonidae	45		91		136
<u>Ablabesmyia mallochi</u>			91		91
<u>A. monilis</u>				91	91
<u>Chironomus</u> sp.	227	91		45	364
<u>Clinotanypus pinguis</u>			45		45
<u>Cryptochironomus fulvus</u> group	182	45	182		409
<u>Cryptotendipes</u> nr. <u>pseudotener</u>	45	45	136		227
<u>Polypedilum scalaenum</u>			182		182
<u>Procladius</u> sp.		45			45
<u>Tanytarsus guerlus</u> gr.			182		182
<u>T.</u> sp. XI Rutter		45	136		182
<u>Elliptio buckleyi</u>			45		45

TOTAL NUMBER OF SPECIES	5	8	14	4	18
TOTAL NUMBER OF INDIVIDUALS	636	636	1,318	227	2,818
DIVERSITY ($\bar{d}$)	2.07	2.75	3.56	1.92	3.75

11.7 SUPPORTING NOISE INFORMATION

NOISECALC MODEL DESCRIPTION AND PROGRAM OUTPUTS

The computer program, NOISECALC, was developed by the New York Department of Public Service (NYPDS, 1986) to aid in calculating sound propagation from major noise sources. Source data is input as octave band sound pressure levels. All noise sources are assumed to be point sources; line sources may be simulated by several point sources. Ambient or background noise levels at user-defined receptors (sites) are optional inputs to the model. Both sources and receptors can be input as either polar or rectangular coordinates. Sound propagation is calculated by hemispherical spreading and three user selected attenuation options: Atmospheric attenuation, path specific attenuation and barrier attenuation. Atmospheric attenuation is calculated using the data specified by the American National Standards Institute method for the Calculation of the Absorption of Sound by the Atmosphere (ANSI, 1978). Path specific attenuation can be requested to take into account the attenuating effects of ground cover, foliage and wind shadow. Sound attenuation due to barriers can be specified by providing the barrier's coordinates. Each barrier's attenuation contribution is calculated by assuming an indefinitely long barrier perpendicular to the source-receptor path. Both total and A-weighted SPLs are calculated for each receptor.

* RESULTS *

SEMINOLE NOISE STUDY
PROPOSED FACILITY & BACKGROUND MINIMUMS

AT RECEIVER #1 SITE #1

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +71.0 DB SOUND LEVEL = +49.5 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +71.0 DB SOUND LEVEL = +49.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+70.1	+63.1	+55.1	+49.1	+45.1	+42.1	+42.1	+38.1	+31.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.3 DB SOUND LEVEL = +44.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.3	+58.3	+50.3	+44.3	+40.3	+37.3	+37.3	+33.3	+26.3	+0.0	

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.3 DB SOUND LEVEL = +44.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.3	+58.3	+50.3	+44.3	+40.3	+37.3	+37.3	+33.3	+26.3	+0.0	

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.2 DB SOUND LEVEL = +44.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.2	+58.2	+50.2	+44.2	+40.2	+37.2	+37.2	+33.2	+26.2	+0.0	

AT RECEIVER # 2 SITE #2

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +75.1 DB SOUND LEVEL = +53.5 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +75.1 DB SOUND LEVEL = +53.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+74.1	+67.1	+59.1	+53.1	+49.1	+46.1	+46.1	+42.1	+35.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.4 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0	

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.3 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0	

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.3 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0	

AT RECEIVER # 3 SITE #3

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +70.0 DB SOUND LEVEL = +48.5 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +70.0 DB SOUND LEVEL = +48.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+69.0	+62.0	+54.0	+48.0	+44.0	+41.0	+41.0	+37.0	+30.0	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.3 DB SOUND LEVEL = +43.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+64.3	+57.3	+49.3	+43.3	+39.3	+36.3	+36.3	+32.3	+25.3	+0.0	

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.2 DB SOUND LEVEL = +43.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+64.3	+57.3	+49.3	+43.3	+39.3	+36.3	+36.3	+32.3	+25.3	+0.0	

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.2 DB SOUND LEVEL = +43.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+64.2	+57.2	+49.2	+43.2	+39.2	+36.2	+36.2	+32.2	+25.2	+0.0	

AT RECEIVER # 4 SITE #4

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.5 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+88.1	+81.1	+73.1	+67.1	+63.1	+60.1	+60.1	+56.1	+49.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1, CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.7 DB SOUND LEVEL = +63.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+83.8	+76.8	+68.8	+62.8	+58.8	+55.8	+55.8	+51.8	+44.8	+0.0	

SOURCE # 2, CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.3 DB SOUND LEVEL = +62.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+83.3	+76.3	+68.3	+62.3	+58.3	+55.3	+55.3	+51.3	+44.3	+0.0	

SOURCE # 3, CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +83.9 DB SOUND LEVEL = +62.2 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+82.9	+75.9	+67.9	+61.9	+57.9	+54.9	+54.9	+50.9	+43.9	+0.0	

AT RECEIVER # 5 SITE #5

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+88.1	+81.1	+73.1	+67.1	+63.1	+60.1	+60.1	+56.1	+49.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1, CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.4 DB SOUND LEVEL = +62.8 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+83.4	+76.4	+68.4	+62.4	+58.4	+55.4	+55.4	+51.4	+44.4	+0.0	

SOURCE # 2, CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.3 DB SOUND LEVEL = +62.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+83.3	+76.3	+68.3	+62.3	+58.3	+55.3	+55.3	+51.3	+44.3	+0.0	

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.2 DB SOUND LEVEL = +62.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+83.2 +76.2 +68.2 +62.2 +58.2 +55.2 +55.2 +51.2 +44.2 +0.0

AT RECEIVER # 6 SITE #6

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +64.5 DB SOUND LEVEL = +43.9 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +64.5 DB SOUND LEVEL = +42.8 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+63.5 +56.5 +48.5 +42.5 +38.5 +35.5 +35.5 +31.5 +24.5 +0.0

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.8 +51.8 +43.8 +37.8 +33.8 +30.8 +30.8 +26.8 +19.8 +0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.7 +51.7 +43.7 +37.7 +33.7 +30.7 +30.7 +26.7 +19.7 +0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.0 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.7 +51.7 +43.7 +37.7 +33.7 +30.7 +30.7 +26.7 +19.7 +0.0

RESULTS SUMMARY

WITH BACKGROUND NOISE (IF ANY)

RECEIVER	S.PRESSURE LEV. (DB)	SOUND LEVEL (DBA)
# 1 SITE #1	+71.0	+49.5
# 2 SITE #2	+75.1	+53.5
# 3 SITE #3	+70.0	+48.5
# 4 SITE #4	+89.1	+67.5
# 5 SITE #5	+89.1	+67.4
# 6 SITE #6	+64.5	+43.9

* RESULTS *

SEMINOLE NOISE STUDY
PROPOSED FACILITY & BACKGROUND Leq

AT RECEIVER # 1 SITE #1

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +71.0 DB SOUND LEVEL = +52.4 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +71.0 DB SOUND LEVEL = +49.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+70.1	+63.1	+55.1	+49.1	+45.1	+42.1	+42.1	+38.1	+31.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB

OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.3 DB SOUND LEVEL = +44.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.3	+58.3	+50.3	+44.3	+40.3	+37.3	+37.3	+33.3	+26.3	+0.0	

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.3 DB SOUND LEVEL = +44.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.3	+58.3	+50.3	+44.3	+40.3	+37.3	+37.3	+33.3	+26.3	+0.0	

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +66.2 DB SOUND LEVEL = +44.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+65.2	+58.2	+50.2	+44.2	+40.2	+37.2	+37.2	+33.2	+26.2	+0.0	

AT RECEIVER # 2 SITE #2

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +75.1 DB SOUND LEVEL = +53.9 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +75.1 DB SOUND LEVEL = +53.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K	HERTZ
+74.1	+67.1	+59.1	+53.1	+49.1	+46.1	+46.1	+42.1	+35.1	+0.0	

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.4 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.3 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +70.3 DB SOUND LEVEL = +48.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+69.4	+62.4	+54.4	+48.4	+44.4	+41.4	+41.4	+37.4	+30.4	+0.0

AT RECEIVER # 3 SITE #3

WITH THE BACKGROUND NOISE (IF ANY).

SOUND PRESSURE LEVEL = +70.0 DB SOUND LEVEL = +49.2 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +70.0 DB SOUND LEVEL = +48.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+69.0	+62.0	+54.0	+48.0	+44.0	+41.0	+41.0	+37.0	+30.0	+0.0

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB
OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.3 DB SOUND LEVEL = +43.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+64.3	+57.3	+49.3	+43.3	+39.3	+36.3	+36.3	+32.3	+25.3	+0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.2 DB SOUND LEVEL = +43.6 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+64.3	+57.3	+49.3	+43.3	+39.3	+36.3	+36.3	+32.3	+25.3	+0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +65.2 DB SOUND LEVEL = +43.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+64.2	+57.2	+49.2	+43.2	+39.2	+36.2	+36.2	+32.2	+25.2	+0.0

AT RECEIVER # 4 SITE #4

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.9 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+88.1	+81.1	+73.1	+67.1	+63.1	+60.1	+60.1	+56.1	+49.1	+0.0

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB

OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.7 DB SOUND LEVEL = +63.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+83.8	+76.8	+68.8	+62.8	+58.8	+55.8	+55.8	+51.8	+44.8	+0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.3 DB SOUND LEVEL = +62.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+83.3	+76.3	+68.3	+62.3	+58.3	+55.3	+55.3	+51.3	+44.3	+0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +83.9 DB SOUND LEVEL = +62.2 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+82.9	+75.9	+67.9	+61.9	+57.9	+54.9	+54.9	+50.9	+43.9	+0.0

AT RECEIVER # 5 SITE #5

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +89.1 DB SOUND LEVEL = +67.4 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+88.1	+81.1	+73.1	+67.1	+63.1	+60.1	+60.1	+56.1	+49.1	+0.0

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB

OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.4 DB SOUND LEVEL = +62.8 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5	63	125	250	500	1K	2K	4K	8K	16K HERTZ
+83.4	+76.4	+68.4	+62.4	+58.4	+55.4	+55.4	+51.4	+44.4	+0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.3 DB SOUND LEVEL = +62.7 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+83.3 +76.3 +68.3 +62.3 +58.3 +55.3 +55.3 +51.3 +44.3 +0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +84.2 DB SOUND LEVEL = +62.5 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+83.2 +76.2 +68.2 +62.2 +58.2 +55.2 +55.2 +51.2 +44.2 +0.0

AT RECEIVER # 6 SITE #6

WITH THE BACKGROUND NOISE (IF ANY)

SOUND PRESSURE LEVEL = +64.5 DB SOUND LEVEL = +49.9 DBA

WITHOUT THE BACKGROUND NOISE

SOUND PRESSURE LEVEL = +64.5 DB SOUND LEVEL = +42.8 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+63.5 +56.5 +48.5 +42.5 +38.5 +35.5 +35.5 +31.5 +24.5 +0.0

THE SOURCES WHOSE A-WT CONTRIBUTIONS ARE WITHIN 10 DB

OF THE TOTAL SOURCE SOUND LEVEL AT THE RECEIVER LOCATION, ARE:

SOURCE # 1 , CT #1, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.8 +51.8 +43.8 +37.8 +33.8 +30.8 +30.8 +26.8 +19.8 +0.0

SOURCE # 2 , CT #2, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.1 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.7 +51.7 +43.7 +37.7 +33.7 +30.7 +30.7 +26.7 +19.7 +0.0

SOURCE # 3 , CT #3, CONTRIBUTES:

SOUND PRESSURE LEVEL = +59.7 DB SOUND LEVEL = +38.0 DBA

THE OCTAVE BAND SOUND PRESSURE LEVELS ARE:

31.5 63 125 250 500 1K 2K 4K 8K 16K HERTZ
+58.7 +51.7 +43.7 +37.7 +33.7 +30.7 +30.7 +26.7 +19.7 +0.0

RESULTS SUMMARY

WITH BACKGROUND NOISE (IF ANY)

RECEIVER S.PRESSURE LEV.(DB) SOUND LEVEL (DBA)

# 1 SITE #1	+71.0	+52.4
# 2 SITE #2	+75.1	+53.9
# 3 SITE #3	+70.0	+49.2
# 4 SITE #4	+89.1	+67.9
# 5 SITE #5	+89.1	+67.4
# 6 SITE #6	+64.5	+49.9

11.8 LIST OF PREPARERS

11.8 LIST OF PREPARERS

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11.9 INITIAL ORDER ON NEED DETERMINATION

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition of Seminole Electric	)	DOCKET NO. 880309-EC
Cooperative, Inc. to determine need	)	ORDER NO. 20930
for electrical power plant.	)	ISSUED: 3-23-89

The following Commissioners participated in the disposition of this matter:

MICHAEL MCK. WILSON, Chairman
THOMAS M. BEARD
GERALD L. GUNTER
JOHN T. HERNDON

INITIAL ORDER ON NEED DETERMINATION

BY THE COMMISSION:

On February 23, 1988, Seminole Electric Cooperative, Inc. (SEC) filed a petition to determine its need for two 220 MW class combined cycle generating units with an in-service date of January 1, 1993. Along with its petition, SEC submitted a Need Determination Study and Need Determination Study Appendices (Exhibits 1 and 2, respectively). These studies were intended to meet the requirements of Rule 25-22.081, Florida Administrative Code, our rule outlining the information required for this Commission to make a determination of need pursuant to the Florida Electrical Power Plant Siting Act (Siting Act), Sections 403.501-.517, Florida Statutes.

After reviewing these documents, Staff concluded that the petition filed by SEC did not meet the requirements of Rules 25-22.081(2), (4), and (6). SEC was given an opportunity to respond to Staff's written objections to its need determination petition. Based on a review of these documents, we found that SEC's petition did not comply with those sections of the rule and that it was unable to meet the statutory requirements of Sections 403.519 and 366.80-.85, Florida Statutes, until several events occurred. Using the earliest date on which all of these events could be completed and evaluated, we set a hearing date of December 7-9, 1988. Order No. 19468, issued on June 8, 1988, at 7-9.

SEC originally filed direct testimony in support of its petition on April 6, 1988 and rebuttal testimony on May 11, 1988. This was replaced by revised direct testimony filed on October 26, 1988. This October testimony completely superseded SEC's earlier testimony and formed the basis of SEC's testimony at trial. Staff filed the direct testimony of Wayne Makin and Theresa Walsh on April 6 as well. This testimony was no longer relevant after our ruling in June and was withdrawn. SEC filed its post-hearing brief on January 10, 1989, addressing all issues raised in the Prehearing Order in this docket, Order No. 20305, issued on November 15, 1988.

As part of its evaluation of the most cost-effective means of supplying its capacity needs in 1993, SEC issued a request for proposals (RFP) for capacity from qualifying facilities and independent power producers. At the December hearing, SEC indicated that it had compiled a "short list" of three bidders,

two of whom, with further negotiation of terms, might provide a more economical means of supplying SEC with its needed capacity than construction of its proposed units. Based on that representation, we requested that our Staff develop a procedure for resolution of this docket which would allow SEC to go forward with the certification of its proposed plants while not impeding SEC's negotiations with the short list of bidders.

The record before us today is fully developed on both SEC's need for 450 MW of capacity in 1993 and the parameters which are attached to its own construction of two 220 MW class combined cycle generating units at its Polk/Hardee county location. That being the case, our Staff has suggested that this docket be bifurcated and two sets of findings made: an initial order which deals with the need of SEC for 450 MW of capacity in 1993 and a second order, the final order in the docket, which deals with the most economical means of satisfying that need if one exists. These two orders taken together would satisfy the reporting requirements of Section 403.507(b), Florida Statutes. We adopt our Staff's approach with the following modification: because we will hear no additional testimony on SEC's own construction alternative, we can find that certain requirements of the Siting Act have been met, absent the RFP process.

SEC is a generation and transmission cooperative serving its member systems from 1214 MW of its own capacity: two 600 MW coal units and a 14 MW share of Florida Power Corporation's (FPC) Crystal River 3. All load above that level is served by partial requirements purchases from Florida Power and Light Company (FPL) and FPC. With the exception of a 50 MW purchase from the City of Gainesville, SEC has been unable to secure reserve capacity contracts for its 1214 MW from other generating utilities beyond 1992.

Thus, unlike other need determination cases which have come before this Commission, SEC is not proposing to build capacity to serve its anticipated load growth. SEC's projected load growth can, for at least the next seven years, continue to be satisfactorily served by FPL and FPC through partial requirements contracts. SEC is instead seeking to build capacity which will provide the necessary reserve margins on its system to "back up" its own generation. For that reason, although we find that SEC's load forecasts are adequate for planning purposes, they do not support the need for the capacity addition requested in this docket.

In order to identify the type and amount of capacity which will allow it to maintain its own system reliability and integrity, SEC has used an Expected Unserved Energy (EUE) standard of 1%. EUE is particularly appropriate in this application because it provides a direct expression of the amount of member load which will not be served by SEC's own generation as a result of capacity shortfalls. Without the addition of 450 MW of capacity in 1993, SEC will fall below the 1% EUE target. At a level below 1% EUE SEC would be unable to meet its own system requirements should one or both of its coal units fail. Maintenance of this amount of capacity is also necessary for SEC to meet the level of reserves required by the terms of its emergency interchange agreements with the other

Florida utilities with whom it is interconnected. Based on this testimony, we find that SEC has proven a need for 450 MW of reserve capacity in 1993.

Having determined that it needed 450 MW of reserve capacity in 1993, SEC then used the PROMOD and PROSCREEN models to evaluate the least-cost construction alternative to satisfy that need. The SEC screened 75 technologies and performed detailed cost analyses over a 30-year period on combinations of three generating technologies: combustion turbine, combined cycle and pulverized coal units. Essentially, the PROMOD and PROSCREEN models compare the present worth of revenue requirements (PWRR) of different options which meet the 1% EUE reliability standard. PWRR measures the capital costs, carrying costs, operation and maintenance costs and fuel costs associated with each unit or combination of units over the study period.

SEC developed its own fuel forecasts and capital carrying costs for input into the PROSCREEN and PROMOD models. The capital costs used as inputs into the models were either taken directly from the Electric Power Research Institute's (EPRI) Technical Assessment Guide (TAG) or were based on SEC's own historical experience or the cost projections of its consulting engineers. Operation characteristics of the various units were taken from the EPRI TAG document for all units.

Based on the PROMOD and PROSCREEN models using the above data, two 220 MW class combined cycle units fueled with natural gas and distillate oil on a 80%/20% basis were found to have the lowest PWRR over the 20 year study horizon as well as the 30-year life cycle of the plant. The total PWRR over the study horizon associated with each of the generating alternatives which meet the 1% EUE reliability criterion is as follows:

Two combined cycle 220 MW units*	\$ 3300 million
Three 75 MW combustion turbines, one combined cycle 220 MW unit	\$ 3326 million
Six 75 MW combustion turbines	\$ 3388 million
Southern Company UPS 450 MW	\$ 3363 million
500 MW steam coal	\$ 3542 million
Two 220 MW combined cycle with coal gasifier	\$ 3613 million

*These figures are based on the use of an 80/20% split of natural gas and distillate fuel for all combined cycle and combustion turbine unit combinations.

The figures developed above are the result from SEC's "base case" assumptions. The base case data is data which SEC considers to be the most likely scenario. SEC also did sensitivity studies which used high and low forecasts for fuel prices, the effect of broker sales, high and low load forecasts, high and low capital costs, and high and low interest rates in the computer models. In each instance, the proposed combined cycle units were found to be the most cost-effective on a PWRR basis. Additionally, SEC considered "strategic" factors: operating considerations (SEC's need for capacity which could be brought on line quickly), construction flexibility (combined cycle units are modular, can be constructed within a two-year period, and can be converted

via the addition of a gasifier to burn coal as well as oil and gas) and impact on SEC's ratepayers (addition of a coal unit would initially have a rate impact of 1.0 cents/KWH more than SEC's proposed units; initially adding coal gasification capability to the combined cycle units would have a rate impact of 1.3 cents/KWH more than SEC's proposed units). These strategic factors also support the selection of two 220 MW class combined cycle units as SEC's construction option.

The proposed combined cycle units will be fueled by both natural gas and distillate oil. SEC testified that natural gas would be available on an interruptible basis from the Phase II expansion of the Florida Gas Transmission Company (FGT) pipeline throughout the proposed plant's expected life at least 80 percent of the time. This gas would be transported to the Polk/Hardee site by a service lateral from the FGT pipeline of approximately 34 miles. The site is also capable of handling coal should the addition of a coal gasifier to the site become economically feasible in the future.

In addition to the supply side options discussed above, SEC has also evaluated the ability of conservation or other nongenerating alternatives to mitigate the need for its proposed plant. The forecasts used in the computer model which identified a need for 450 MW of capacity in 1993 included the expected effects of SEC's conservation and load management programs. Conservation decreases primarily weather-sensitive peak period loads. In SEC's case, peak loads are served by its partial requirements contracts. Because the proposed 450 MW is not needed to serve peak period load, but rather to provide reserve capacity should one or all of SEC's own units fail, one would expect that increases in conservation would not affect the need for the capacity. This assumption is borne out by the sensitivity studies conducted by SEC. These studies showed that even when conservation and load management affects were projected at roughly double that projected for Peninsular Florida in the 1986 Planning Hearing, 450 MW of capacity would still be needed in 1993 to maintain a 1% EUE.

Based on the above, we find that SEC has proven that of all of the supply side and demand side options considered, 440 MW of combined cycle capacity constructed at its proposed Polk/Hardee county site would provide SEC with adequate electricity at at reasonable cost. We also find that of the alternatives fully developed in this proceeding, SEC has proven that this option is the most cost-effective. We note again, however, that the final resolution of these issues cannot be made until the record is developed on the alternative or alternatives which are the result of SEC's negotiations with its RFP bidders. We expect that a detailed analysis of these RFP alternatives will be presented at the continuation of this hearing which is currently scheduled for June 14, 1989. Our intention is that this order will establish SEC's construction of two 220 MW combined cycle units as the benchmark against which all RFP bids are measured.

Therefore, it is

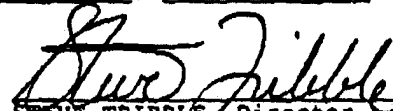
ORDERED By the Florida Public Service Commission that Seminole Electric Cooperative, Inc. has proven a need for 450 MW of capacity in 1993. It is further

ORDER NO. 20930
DOCKET NO. 880309-EC
PAGE 5

ORDERED that SEC has proven that of the demand side and supply side options fully developed in the record before us, this need is best and most economically provided by SEC's construction of two 220 MW combined cycle units located at its Polk/Hardee County site. It is further

ORDERED that the final resolution of the alternative which is most cost-effective is deferred until the alternative/s which are the result of negotiations with SEC's RFP bidders are known and presented to this Commission during a subsequent noticed public hearing.

BY ORDER of the Florida Public Service Commission,
this 23rd. day of MARCH, 1989.


STEVE TRIBBLE, Director
Division of Records and Reporting

(S E A L)

SB:r

**11.10 REQUEST FOR VARIANCE FROM CHAPTER 16C-16 AND
SUPPORTING INFORMATION**

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LIST OF ACRONYMS

Agrico	Agrico Chemical Company
Btu/hr	British thermal units per hour
°C	degrees Celsius
CaCO ₃	calcium carbonate
cfs	cubic feet per second
cm	centimeters
°F	degrees Fahrenheit
F.A.C.	Florida Administrative Code
FDER	Florida Department of Environmental Regulation
FDNR	Florida Department of Natural Resources
FEPPSA	Florida Electric Power Plant Siting Act
FS	Florida Statutes
ft	feet
gpm	gallons per minute
ha	hectare
in Hg	inches of mercury
km	kilometers
m	meters
m ³ /day	cubic meters per day
m ³ /sec	cubic meters per second
mgd	million gallons per day
mg/L	milligrams per liter
mm Hg	millimeters of mercury
MSL	mean sea level
MW	megawatts
NTU	nephelometric turbidity unit
pCi/L	picocuries per liter
SCA	Site Certification Application
SCA/EA	Site Certification Application/Environmental Assessment
µg/L	micrograms per liter
umho/cm	micromhos per centimeter

1.0 INTRODUCTION

TECO Power Services, Tampa Electric Company, and Seminole Electric Cooperative Incorporated (the Applicants) filed a site certification application/environmental assessment (SCA/EA) for the Hardee Power Station project under Chapter 17-17, Florida Administrative Code (F.A.C.), Electrical Power Plant Siting. The proposed project is a 660-megawatt (MW) combined cycle power plant that will utilize a cooling reservoir constructed as part of an overall reclamation project by Agrico Chemical Company (AGRICO). The project will require revisions to a reclamation plan filed by Agrico with the Florida Department of Natural Resources (FDNR) for the area being mined. To meet the design requirements of the cooling system, a variance from three of the reclamation criteria of Section 16C-16.0051, F.A.C., will be required. The ultimate decision for project approval and the variance request lies with the Governor and Cabinet under the Florida Electrical Power Plant Siting Act (FEPPSA). This document, as a supplement to the SCA/EA, addresses the variance request and provides additional information to FDNR for its review and decision making. It has been developed with the collaboration and input of Agrico.

Appendix A of this document provides information requested in Parts I and II of the FDNR variance application form, DNR 53-024(16), Draft Revised 9-14-87, Page 2 of 3. The following sections address the supporting information requested in Part III of the variance application, Page 3 of 3.

2.0 PROVIDE THE LANGUAGE OF THE STATUTE OR RULE
FROM WHICH A VARIANCE IS SOUGHT

A variance is sought from the underlined provisions of Section 16C-16.0051(1):

1. Safety

- (b) Structures. All temporary buildings, pipelines, and other man-made structures shall be removed with the exception of those that are of sound construction with potential use compatible with the reclamation goals.

A variance is sought from the underlined provisions of Section 16C-16.0051(5):

Wetlands and Water Bodies: The design of artificially created wetlands and water bodies shall be consistent with health and safety practices, maximize beneficial contributions within local drainage patterns, provide aquatic and wetland wildlife habitat values, and maintain downstream water quality by preventing erosion and providing nutrient uptake. Water bodies should incorporate a variety of emergent habitats, a balance of deep and shallow water, fluctuating water levels, high ratios of shoreline length to surface area and a variety of shoreline slopes.

- (a) At least 25% of the highwater surface area of each water body shall consist of an annual zone of water fluctuation to encourage emergent and transition zone vegetation. This area will also qualify as wetlands under the requirements of subsection (4) above if requirements in paragraph 16C-16.0051(9)(d) are met. In the event that sufficient shoreline configurations, slopes, or water level fluctuations cannot be designed to accommodate this requirement, this deficiency shall be met by constructing additional wetlands adjacent to and hydrologically connected to the water body.
- (b) At least 20% of the low water surface shall consist of a zone between the annual low water line and six feet below the annual low water line to provide fish bedding areas and submerged vegetation zones.

3.0 PROVIDE THE FACTS THAT WOULD SHOW THAT A VARIANCE SHOULD BE GRANTED
FOR THE REASON(S) CHECKED IN PART II, ITEM 2

3.1 BACKGROUND

3.1.1 INTRODUCTION

As will be discussed in the following sections, none of the alternatives to the proposed cooling system is practicable because of associated increased costs, land availability constraints, increased environmental impacts, and limited environmental benefits. See Section 378.212(1)(a) and (c) Florida Statutes (FS). The cooling reservoir will be required by state and federal discharge requirements to be equipped with a concrete swale and a fixed weir discharge, therefore, a variance from Section 16C-16.005.0051(1)(b), F.A.C. is also requested. The cooling reservoir will be connected to the power plant located to the southeast of the reservoir by buried intake and discharge condenser cooling water pipelines.

3.1.2 HEAT DISSIPATION REQUIREMENTS

One of the more significant design alternative decisions relating to the Hardee Power Station or any other power-generation facility is the selection of the preferred heat rejection or cooling system. This system serves to transfer and/or reject waste heat to the atmosphere from turbine exhaust steam condensate and directly affects the efficiency of the unit. The following is an economic and environmental evaluation of the alternative cooling systems considered for the Hardee Power Station project.

The cooling system must meet the following engineering, design, and operation criteria.

1. It shall have a continuous heat rejection capability of 1.95×10^9 British thermal units per hour (Btu/hr).
2. It shall be capable of supplying to the condenser, at all times, 281,000 gallons per minute (gpm) of water with a maximum temperature of 35 degrees Celsius ($^{\circ}\text{C}$) [95 degrees Fahrenheit ($^{\circ}\text{F}$)] or less under all meteorological conditions and at

100 percent load. Additionally, the condenser back pressure shall not exceed 730 millimeters of mercury (mm Hg) [4.5 inches of mercury (in Hg)].

3. It shall physically fit within the total available land at the Hardee Power Station site.
4. It shall be able to maintain satisfactory quality and quantity of cooling water to allow continuous, uninterrupted condenser cooling operation.
5. The cooling system must be able to be constructed and operated without unacceptable adverse environmental impacts.
6. The preferred cooling system shall be the most economical system to construct and operate that satisfies the preceding criteria.

3.1.3 ALTERNATIVE HEAT REJECTION SYSTEMS

The proposed project site is an inland location. A once-through, non-reuse cooling system was not considered to be a feasible alternative because it would require 281,000 gpm [404 million gallons per day (mgd)] of water flow to the condenser from an existing river, lake, stream, or aquifer which would then be discharged. There are no existing water bodies in the area capable of continuously supplying or receiving this amount of water. Therefore, a non-reuse cooling system was eliminated from further consideration.

Two conceptual cooling water heat rejection systems involving reuse were evaluated: a cooling reservoir and mechanical draft cooling tower. The following site-specific alternative designs were identified and evaluated for the Hardee Power Station:

1. A recirculating cooling water reservoir that receives makeup water from Lower Floridan aquifer wells, natural runoff, and the reuse of plant process water;
2. Mechanical draft cooling towers that receive makeup from Lower Floridan aquifer and discharge blowdown to either:
 - a. The Peace River,
 - b. A percolation pond,

- c. A deep injection well, or
- d. Payne Creek.

Cooling Water Reservoir

In a recirculating cooling water reservoir system, water from the reservoir is continuously pumped through the condenser, where it is heated 11°C (20°F) and then is returned to the reservoir. The reservoir dissipates this waste heat primarily through evaporative and radiant cooling, and returns water for reuse at a maximum temperature of 35°C (95°F). The cooling reservoir must provide two primary functions:

1. It must collect, store, and supply water for use in condenser cooling; and
2. It must have sufficient surface and depth to dissipate the waste heat generated by the Hardee Power Station through evaporative, radiant, and other cooling processes.

Such a cooling reservoir must be sized to optimize evaporative and radiant cooling--controlled by unimpeded surface area--and minimize solar heating--controlled by water depth. Computer modeling using the Shallow Cooling Pond Performance Code developed by the Department of Civil Engineering, Massachusetts Institute of Technology has shown if the reservoir water depth is 3.1 meters (m) [10 feet (ft)] deep or deeper, the heat load of the Hardee Power Station requires a surface area of 231 hectares (ha) (570 acres); this depth/area combination defines the effective cooling area of this reservoir. To the extent the reservoir is made shallower, the aerial dimensions of the reservoir need to be increased. This surface area of the reservoir is necessary to evaporate and radiate all waste heat generated by the plant. This depth is necessary to avoid excessive solar heating that occurs with shallower systems.

In Florida, the threat of infestation with aquatic macrophytes in ponds, lakes, and reservoirs is a serious problem. In reservoirs, the growth of plants can limit the hydraulic effectiveness by significantly reducing flow and water exchange. If such growth occurred, the overall thermal

effectiveness of a reservoir would be reduced. The major aquatic weed problems in Florida are caused by exotic plants that grow uncontrolled and rapidly invade new areas. The effect of this vegetative growth on the thermal and hydraulic performance of the reservoir is directly dependent on the area involved.

As shown in Figure 3-1, the projected average requirement for annual cooling water reservoir makeup is estimated to be approximately 6,740 cubic meters per day (m^3/day) (1.78 mgd). Water makeup of the reservoir will include direct rainfall, runoff, seepage from the upland watershed, and treated plant wastewater and, as necessary, pumped Lower Floridan aquifer well water. To facilitate the infrequent discharges which may be necessitated by extreme (wet) meteorological conditions, a concrete structure will be provided to allow overflow to Payne Creek. The storage capacity of the cooling reservoir alternative promotes maximum water reuse and minimum Lower Floridan aquifer water withdrawals.

Cooling Tower

This alternative would use a counterflow, wood frame, rectangular mechanical draft cooling tower for waste heat rejection. In this mechanical draft cooling tower system, cooling water is pumped from the cooling tower basin through the condenser where it is heated 11°C (20°F). This heated water is returned to the cooling tower where it is pumped to the top of the tower and allowed to cascade down through the tower. Large electrical fans pull air through the tower, and heat exchange occurs by evaporation and convection.

As water is evaporated in the tower, the dissolved chemical materials contained in the natural makeup water are concentrated in the remaining tower waters. To prevent facility and equipment damage, a significant portion of this highly mineralized water, called blowdown, is withdrawn from the system and discharged. This blowdown is replaced with fresh makeup water. Such cooling tower water losses to evaporation and blowdown

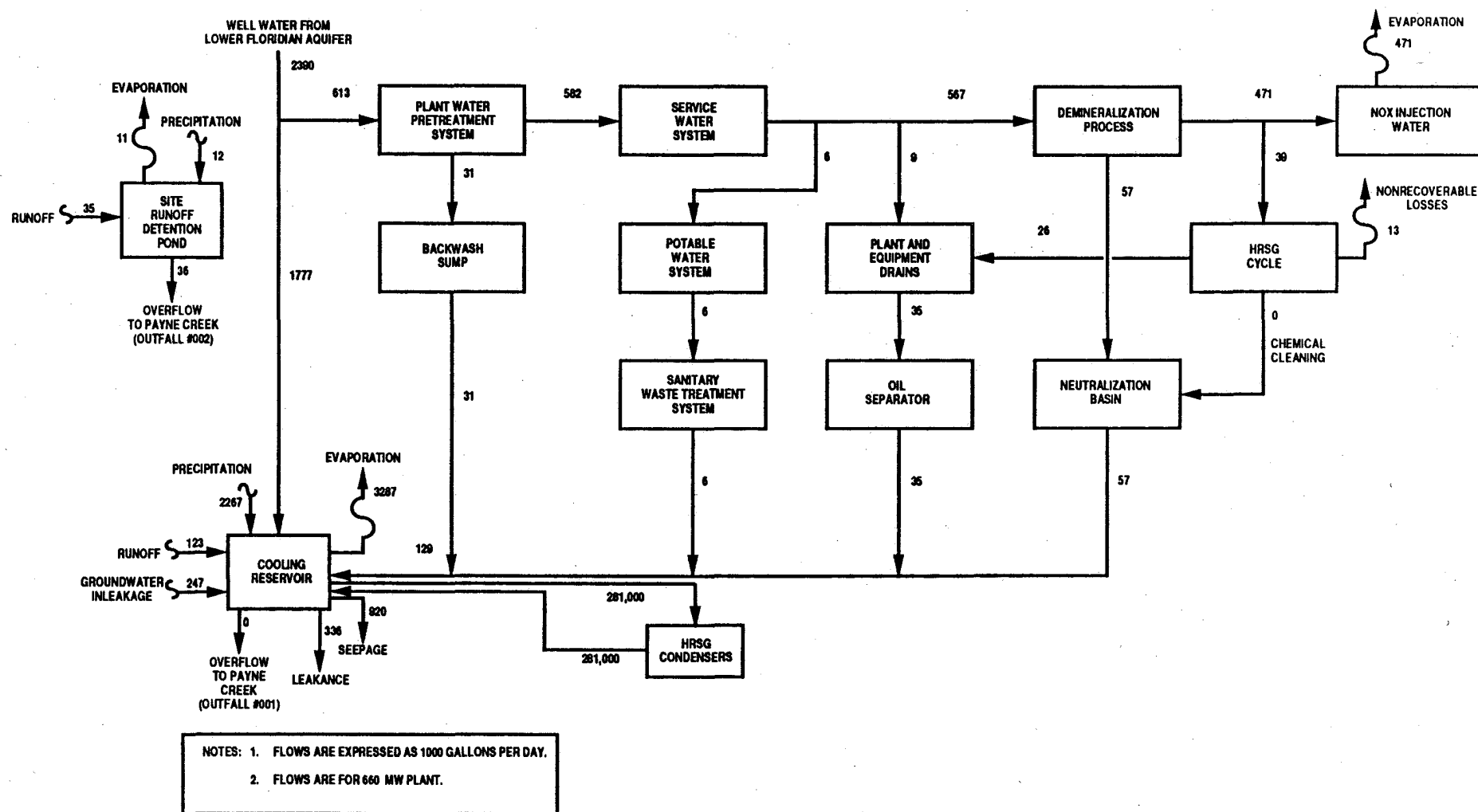


Figure 3-1 WATER MASS BALANCE:
ANNUAL AVERAGE MAKEUP

**Hardee
Power Station**

are estimated to be 9,085 m³/day (2.4 mgd); these losses would be replaced by softened Lower Floridan aquifer water.

Under projected average annual load conditions, cooling tower blowdown discharge is estimated to be 1,514 m³/day (0.4 mgd) or 0.02 cubic meters per second (m³/sec) [0.6 cubic feet per second (cfs)]; under maximum annual load conditions, cooling tower blowdown discharge is estimated to be 5,110 m³/day (1.35 mgd) or 0.059 m³/sec (2.09 cfs).

Four blowdown discharge options are available at the Hardee Power Station. These options are:

1. Blowdown Discharge to the Peace River--Blowdown from the towers (necessary to maintain operational water quality within the tower) would be routed to the Peace River. The site location would require construction of a pipe 30 centimeters (cm) (12 inches) in diameter approximately 16 kilometers (km) (10 miles) to the Peace River.
2. Blowdown Discharge to the Percolation Pond--This cooling tower alternative would route tower blowdown to a percolation pond located on-site but not on mined lands. To accommodate the anticipated maximum tower blowdown, plant discharge rate, and site-specific surficial aquifer conditions, a preliminary, conceptual design evaluation of the percolation pond indicates a 53-ha (131-acre) pond would be necessary to percolate the required volume of tower blowdown. This percolation pond would discharge tower blowdown through seepage to the surficial aquifer. During extremely wet periods, a surface discharge from the pond to Payne Creek would be necessary.
3. Blowdown Discharge to a Deep Injection Well--This cooling tower alternative would route tower blowdown to a deep injection well. This well would be at least 61 cm (24 inches) in diameter and at least 914 to 1,230 m (3,000 to 4,000 ft) deep.
4. Blowdown Discharge to Payne Creek--The cooling tower alternative would route tower blowdown continuously to Payne Creek.

3.1.4 ECONOMIC EVALUATION OF ALTERNATIVE SYSTEMS

An estimate of capital and operational costs was prepared for four alternative heat rejection systems. No cost analysis was prepared for discharge of tower blowdown to Payne Creek because of failure of this alternative to meet environmental criteria (see Section 3.1.5). The results of the economic evaluation are presented in Table 3-1.

The capital cost analysis shows that, from an economic perspective, the cooling water reservoir is more cost effective than any of the three cooling tower alternatives. This is due in part to the increased capital costs for the additional process water treatment and wastewater disposal system required for the cooling tower alternatives.

The analysis shows that the cooling water reservoir alternative has a lower operational cost compared to any of the cooling tower alternatives. This is a direct function of the increased cooling tower operational energy, water treatment, and maintenance requirements.

Considering both capital and operational costs, the cooling water reservoir alternative is less costly by more than a factor of 2 than any of the cooling tower alternatives. The total present worth of capital and operating costs for the cooling reservoir alternative is approximately \$20 million as compared to the approximately \$41 million for any of the tower alternatives.

3.1.5 ENVIRONMENTAL EVALUATION OF ALTERNATIVE SYSTEMS

The two major environmental differences between the cooling reservoir alternative and the cooling tower alternative are makeup water requirements and the water discharge requirements. The cooling reservoir will obtain makeup water from natural runoff, reuse of plant process water, and groundwater withdrawal from the Lower Floridan aquifer. The cooling tower can only obtain water from the Lower Floridan aquifer. The cooling reservoir will be discharged infrequently, in contrast to the cooling tower alternative, which will discharge blowdown continuously.

Table 3-1. Summary of Total Present Worth Analysis for Capital and Operating Costs for Alternative Heat Rejection Systems Initially Evaluated for the Hardee Power Station

Cost Category	<u>Heat Rejection System Alternatives Total Present Worth</u>			
	Cooling Reservoir	Cooling Towers with Percolation Pond	Cooling Towers with Injection Wells	Cooling Towers with Peace River Discharge
Capital Costs	\$13,599,000	\$18,870,000	\$18,398,000	\$19,245,000
Operating Costs	\$6,577,000	\$22,327,000	\$23,512,000	\$22,527,000
TOTAL	\$20,176,000	\$41,197,000	\$41,910,000	\$41,772,000

Source: Black and Veatch, 1989.

As shown in Figure 3-1, the projected average requirement for annual cooling water reservoir makeup is estimated to be approximately 6,740 m³/day (1.78 mgd). The reservoir serves as an effective water management facility to minimize the total withdrawal demand placed on the Lower Floridan aquifer groundwater system when compared to the other alternatives. The cooling reservoir alternative will have off-site surface discharges only during extreme meteorological conditions such as those associated with major frontal systems and hurricanes. The cooling water reservoir can be constructed and operated with minimum adverse environmental impacts.

In contrast, the required cooling tower makeup is estimated to be 9,085 m³/day (2.40 mgd). This is 35 percent more groundwater compared with the reservoir alternative. The cooling tower alternative conserves less water than the reservoir alternative.

Unlike the infrequent discharges from the cooling reservoir, daily cooling tower blowdown discharge will be required. Under projected average annual load conditions, cooling tower blowdown discharge is estimated to be 1,514 m³/day (0.4 mgd) or 0.02 m³/sec (0.6 cfs); under maximum annual load conditions, cooling tower blowdown discharge is estimated to be 5,110 m³/day (1.35 mgd) or 0.059 m³/sec (2.09 cfs).

The direct discharge of the cooling tower blowdown to the Peace River would require construction of a 16-km (10-mile) pipeline from the plant site to the Peace River. It would also necessitate a mixing zone in order to comply with state water quality standards. The Peace River will be subject to periodic low flow conditions; for example, the 7-day, 10-year low flow for the Peace River near Zolfo Springs is estimated to be 1.53 m³/sec (54 cfs). Given a maximum cooling tower blowdown discharge rate of 0.059 m³/sec (2.09 cfs), tower blowdown discharge would be approximately 3.9 percent of the 7-day, 10-year low flow. Therefore, the Peace River should have sufficient flow to allow adequate mixing and dilution of the

tower blowdown discharge to meet Class III water quality criteria at the edge of a mixing zone.

Discharge of the blowdown to a percolation pond would be expected to have greater impacts on surficial aquifer water quality as compared with the cooling reservoir due to differences in dilution volumes. Discharge of the blowdown to deep injection well may be very difficult or infeasible at the project site due to low transmissivity rock formations at depths greater than 914 m (3,000 ft).

3.1.6 PREFERRED HEAT REJECTION SYSTEM ALTERNATIVE

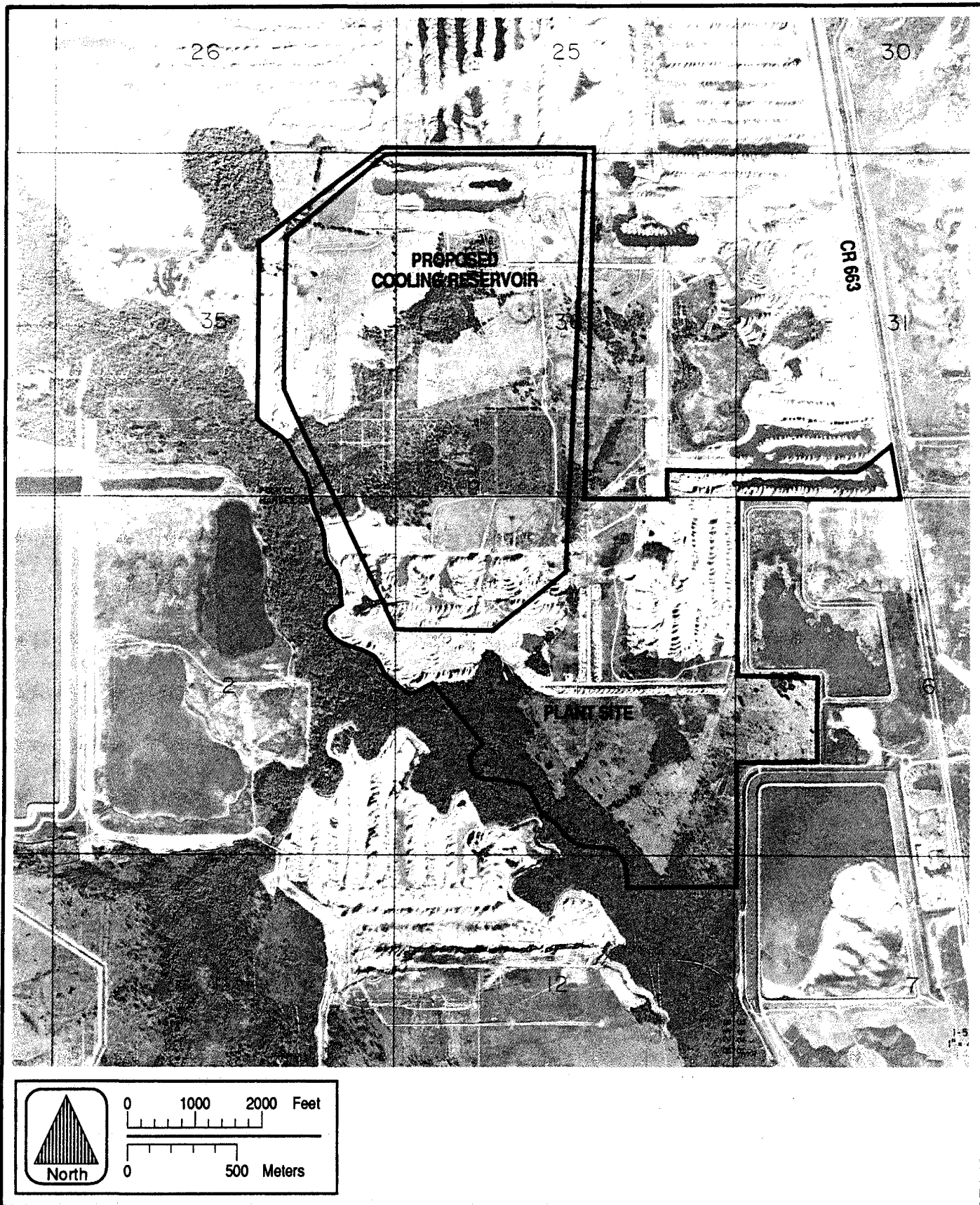
Based on both environmental and economic considerations described previously, the preferred heat rejection alternative is a closed cycle cooling system that utilizes a cooling water reservoir of 231 ha (570 acres) at 3-m (10-ft) depth. This is the preferred alternative because of the following reasons:

1. Meets all engineering criteria,
2. The cooling reservoir is more than a factor of 2 less costly than any other cooling tower alternative,
3. The cooling reservoir uses 35 percent less water as compared to the cooling tower alternatives, and
4. The cooling reservoir has the lowest potential for adverse water quality and quantity impacts.

3.2 ALTERNATIVE COOLING RESERVOIR DESIGNS

Based on the determination that the preferred heat rejection system alternative is a cooling reservoir (see Section 3.1.6), the Applicants designed a cooling reservoir to meet all engineering criteria described in Section 3.1.2. This design is presented in Section 6.0 and is described in the SCA/EA.

A major constraint in the preparation of this design was the availability and location of mined lands for reservoir construction. The area depicted in Figure 3-2 is the maximum amount of land available for reservoir



**Figure 3-2 HARDEE POWER STATION SITE BOUNDARY
AND PROPOSED COOLING RESERVOIR**

**Hardee
Power Station**

construction. Lands outside the property boundary depicted in Figure 3-2 could not practicably be obtained due to the following factors:

1. Sand tailing disposal and topographic requirements which must be met by Agrico to the north,
2. Other wetland mitigation areas to be created or preserved by Agrico to the east,
3. The Payne Creek floodplain to the west and southwest, and
4. The plant site location to the southeast.

Within the property boundary depicted in Figure 3-2, 325 ha (803 acres) is the maximum available area for reservoir construction, including open water, buffers, berms and access. The 325 ha (803-acre) area consists of the following:

1. 6.5 ha (16 acres) of divider dike,
2. 4.9 ha (12 acres) of perimeter access roads,
3. 83 ha (205 acres) of sloped upland and wetland buffers, and
4. 231 ha (570 acres) of cooling reservoir underlain by water 3-m (10-ft) deep.

To meet the FDNR 25 and 20 percent criteria, an additional 92.3 ha (228 acres) [i.e., 57.7 ha (142.5 acres) and 34.6 ha (85.5 acres)] would have to be provided between mean high water and 1.8 m (6 ft) below mean low water. A detailed discussion of these area requirements is provided in subsequent sections. No additional land area is available to satisfy these requirements. Therefore, these requirements could only be met by allocating land within the available 325 ha (803 acres). Such an allocation would reduce the total land available for the cooling reservoir, result in a reduced-capacity cooling reservoir, and would create a substantial cost penalty.

The steam turbine exhausts to a condenser cooled by the water from the reservoir. The present design is based on a maximum inlet temperature of 35°C (95°F). If the effective surface area of the pond is reduced from 231 ha (570 acres) to 138 ha (340 acres) to provide the additional area to meet

the 25 percent and 20 percent criteria, the maximum inlet water temperature could rise to 38°C (101°F). This rise in temperature will result in a reduction in plant output by about 1,500 kW, which would have to be made up by purchasing more expensive power. It would also decrease the efficiency of the plant by about 180 Btu/kWh. The replacement power, plus the decreased plant efficiency, would result in a total present worth cost of approximately \$31 million (1993 dollars).

The plant also uses the reservoir water to cool plant equipment. The current design uses coolers that require water at 35°C (95°F) or cooler. The effect of a higher water temperature on equipment cooling has not been evaluated, due to its complex effect on plant design.

Such a reduced-capacity cooling reservoir would not meet the engineering criteria described in Section 3.1.2. Therefore, supplemental cooling would be required to assure that all engineering criteria are met.

Two additional cooling reservoir designs were evaluated. These alternatives involved designing a shallower, reduced-capacity cooling reservoir on the available 231 ha (570 acres) of land to meet FDNR reclamation standards. This would require supplemental cooling to meet the required thermal capacity of the reservoir for the proposed 660 MW. These alternatives include a smaller, reduced-capacity cooling reservoir with a helper tower and a serpentine reservoir (of reduced capacity) with a helper tower. The helper tower is a small mechanical draft cooling tower that precools heated condenser cooling water before discharge into the cooling reservoir. The heated condenser cooling water is pumped to the top of the tower, where it is allowed to cascade down through the tower. Large electrical fans pull air through the tower and heat exchange occurs. This water is discharged to the cooling reservoir, where the water is cooled further. The helper tower would be needed to augment the insufficient cooling reservoir capacity of these two alternatives.

3.2.1 COOLING RESERVOIR WITH A HELPER COOLING TOWER

This reduced capacity water cooling reservoir with a helper cooling tower alternative is presented in Appendix C and could be used to meet the applicable FDNR reclamation standards, including the 25 percent and 20 percent standards. Since the available land area is limited, meeting the 25 percent and 20 percent criteria would substantially decrease the effective thermal area of the reservoir and reduce the heat dissipation capacity. Therefore, a helper cooling tower would have to be added to meet the engineering requirements outlined in Section 3.1.2.

This reduced capacity cooling reservoir alternative would be constructed in the same plan area available for the proposed 231-ha (570-acre) reservoir. Under this alternative, the 25 percent and 20 percent standards would be met by the construction of shallow transition zones around the entire perimeter of the reservoir and along the center divider dike, as shown in Appendix B.

To meet the 25 percent standard, a sloped and transition zone approximately 64 m (210 ft) in width would be constructed between the mean high water and mean low water elevations. With a reservoir perimeter of 8,992 m (29,500 ft), this transition zone provides approximately 57.7 ha (142.5 acres), or 25 percent of the total mean high water reservoir area.

To meet the 20 percent standard, a sloped and transition zone approximately 39.6 m (130 ft) in width would be constructed between the mean low water elevation and 1.8 m (6 ft) below the mean low water elevation. With the reservoir perimeter, this transition zone provides approximately 34.6 ha (85.5 acres), or 20 percent of the total mean low water reservoir area.

By meeting the 25 percent and 20 percent standards, at least 92.3 ha (228 acres) of the total reservoir area will be less than 1.8 m (6 ft) in depth at mean low water. The increased influence of solar insolation in these shallow areas and the reduced flow and water exchange due to

significant vegetation growth will cause the overall thermal effectiveness to be significantly reduced to approximately 137.6 ha (340 acres).

To meet the engineering requirements outlined in Section 3.1.2, only 390 MW of the plant capacity could be cooled using this reduced capacity reservoir without helper towers. Therefore, helper towers would have to be provided for 270 MW or 41 percent of the total site capacity of 660 MW. It should be noted that without helper towers, this reduced capacity reservoir does not meet the first phase of anticipated plant construction (440 MW) and requiring the tower to be constructed by 1993.

Construction and operation of these helper cooling towers are estimated to cost approximately \$9.4 million.

Use of a shallower reservoir with the helper cooling towers would result in increased water quantity and water quality impacts. Implementation of this alternative would require the increased use of approximately 1,438 m³/day (380,000 gpd) of groundwater under average annual plant operation conditions due to the increased evaporative losses associated the helper towers. This additional demand would have to be satisfied by a 16 percent increase in total groundwater withdrawal from the Floridan aquifer wells.

Discharge of the helper tower blowdown into the shallower, lower volume reservoir would result in the increased mineralization of the reservoir water. Using the analysis methodology presented in the SCA/EA, anticipated water quality was estimated within this reservoir alternative (including the helper towers) and is summarized in Table 3-2.

Depending on the parameter, the water quality concentrations within this alternative reservoir are as much as 15 percent higher than the larger open reservoir proposed in the SCA (Table 3-2). Two additional water quality parameters, iron and lead, are predicted to exceed applicable Florida Department of Environmental Regulation (FDER) water quality criteria. Mixing zones will be required for these additional parameters. Given the

Table 3-2. Summary of Estimated Cooling Reservoir Quality for the Proposed Open Reservoir, a Smaller Reservoir With Helper Towers, and a Serpentine Reservoir With Helper Towers for the Hardee Power Station

Parameter	Concentration			FDER Class III Water Quality Criteria
	SCA/EA Cooling Reservoir	Smaller Cooling Reservoir with Helper Tower	Serpentine Cooling Reservoir with Helper Tower	
Calcium, mg/L as CaCO_3	240	270	280	
Magnesium, mg/L as CaCO_3	100	120	120	
Sodium, mg/L as CaCO_3	200	210	210	
Potassium, mg/L as CaCO_3	16	18	18	
Total Hardness, mg/L as CaCO_3	340	390	400	
Alkalinity, mg/L as CaCO_3	260	310	310	20
Sulfate, mg/L as CaCO_3	250	260	260	
Chloride, mg/L as CaCO_3	50	60	60	
Silica, mg/L	60	60	60	
Fluoride, mg/L	4.1	4.7	4.7	10
Cyanide, mg/L	0.01	0.01	0.01	0.005
MBAS, mg/L	0.358	0.413	0.419	0.5
Oil and Grease, mg/L	<5	<5	<5	5
Turbidity, NTU	31	35	36	29 above background
pH, units	7.5	7.5	7.5	6.0-8.5
Total Dissolved Solids, mg/L	860	970	980	
Specific Conductivity, umho/cm	1,080	1,180	1,190	1,275
Total Kjeldahl Nitrogen, mg/L	0.9	1.0	1.0	
Ammonia Nitrogen, mg/L	0.4	0.5	0.5	
Un-ionized Ammonia, mg/L	0.014	0.017	0.017	0.02
Organic Nitrogen, mg/L	0.4	0.5	0.5	
Nitrate+Nitrite-Nitrogen, mg/L	0.1	0.1	0.1	
Total Nitrogen, mg/L	1.0	1.1	1.1	
Orthophosphorus, mg/L	0.5	0.6	0.6	
Total Phosphorus, mg/L	0.8	0.9	0.9	
Arsenic, $\mu\text{g/L}$	20	20	20	50
Barium, $\mu\text{g/L}$	150	170	170	
Beryllium, $\mu\text{g/L}$	4.0	4.3	4.3	1,100
Cadmium, $\mu\text{g/L}$	2.6	2.8	2.8	1.2
Chromium, $\mu\text{g/L}$	28	32	32	50
Copper, $\mu\text{g/L}$	27	29	29	30
Iron, $\mu\text{g/L}$	980	1,110	1,120	1,000
Lead, $\mu\text{g/L}$	29	33	34	30
Manganese, $\mu\text{g/L}$	47	56	57	
Mercury, $\mu\text{g/L}$	0.5	0.5	0.5	0.2
Nickel, $\mu\text{g/L}$	49	56	57	100
Selenium, $\mu\text{g/L}$	32	37	38	25
Silver, $\mu\text{g/L}$	0.8	0.9	0.9	0.07
Strontium, $\mu\text{g/L}$	610	700	710	
Zinc, $\mu\text{g/L}$	280	330	330	1,000
Alpha, Gross (pCi/L)	22.2	24.8	25.1	15
Radium 226 (pCi/L)	6.2	7.1	7.2	5

Note: Reservoir quality estimates are based on mass balances and do not take into account any chemical reaction, precipitation, sedimentation, deposition or biological activity which may occur in the reservoir and act to remove material from the water column and thus reduce reservoir concentrations.

Un-ionized ammonia concentrations are based on a worst case reservoir water temperature of 35°C (95°F).

higher concentrations for the other parameters, slightly longer mixing zones will be required to meet applicable FDER water quality criteria downstream from the point of discharge.

The environmental benefit associated with this alternative is the creation on-site of additional artificial wetlands to meet the 25 percent and 20 percent criteria. However, this alternative will result in additional off-site environmental impacts including increased groundwater withdrawal and additional water quality impacts to Payne Creek. Because of the economic considerations associated with the helper cooling tower, the potential water quantity and quality impacts associated with tower operation, and the lack of commensurate environmental benefit, construction and operation of a reduced capacity cooling reservoir with a helper cooling tower is not a practicable alternative.

3.2.2 SERPENTINE WATER COOLING RESERVOIR WITH A HELPER COOLING TOWER

This reduced-capacity serpentine cooling reservoir with a helper tower alternative is presented in Appendix D and is a second alternative that could be used to meet the applicable FDNR reclamation standards, including the 25 percent and 20 percent standards. This alternative attempts to make use of the mine rows (to the extent possible) as internal baffles to potentially minimize the total earthwork that would have to be done during construction. Since much of this area has been mined and may not be compatible with the required design, substantial recontouring will be required at an additional cost. Since the available land area is limited, including the additional area needed for baffle dikes, meeting the 25 percent and 20 percent criteria would substantially decrease the effective thermal area of the reservoir. A helper cooling tower would have to be added to meet the engineering requirements outlined in Section 3.1.2. This reduced-capacity serpentine cooling reservoir would be constructed in the same plan area available for the proposed 231-ha (570-acre) reservoir. Under this alternative, the 25 percent and 20 percent standards would be met by the construction of transition zones around the entire perimeter of the reservoir and along the internal baffle dikes.

To meet the 25 percent standard, a sloped and transition zone approximately 25 m (82 ft) in width would be constructed between the mean high water and mean low water elevations. With a reservoir perimeter of 21,640 m (71,000 ft), this transition zone provides approximately 53.8 ha (133 acres), or 25 percent of the total mean high water reservoir area.

To meet the 20 percent standard, a sloped and transition zone approximately 15.2 m (50 ft) in width would be constructed between the mean low water elevation and 1.8 m (6 ft) below the mean low water elevation. Given an effective reservoir edge of 21,640 m (71,000 ft), this transition zone provides approximately 33.2 ha (82 acres) or 20 percent of the total mean low water reservoir area.

By meeting the 25 percent and 20 percent standards, at least 87 ha (215 acres) of the total reservoir area will be less than 1.8 m (6 ft) in depth at mean low water. The increased influence of solar insolation in these shallow areas and the reduced flow and water exchange in these areas due to significant vegetation growth will cause the overall thermal effectiveness to be reduced to approximately 127.5 ha (315 acres).

To meet the engineering requirements outlined in Section 3.1.2, only 360 MW of plant capacity could be cooled using this reduced capacity serpentine reservoir without helper towers. Therefore, helper towers would have to be provided for 300 MW or 45 percent of the total site capacity of 660 MW. It should be noted that without helper towers, this reduced capacity, serpentine reservoir does not meet the first phase of the anticipated plant construction (440 MW).

Construction and operation of these helper cooling towers are estimated to cost approximately \$9.4 million.

Use of a smaller, serpentine reservoir with the helper cooling towers would result in increased water quantity and water quality impacts.

Implementation of this alternative would require the increased use of

groundwater to approximately 1,594 m³/day (421,000 gpd) under average annual plant operation conditions due to the increased evaporative losses associated with the helper towers. This additional demand would have to be satisfied by an 18 percent increase in total groundwater withdrawal from the Floridan aquifer wells.

Discharge of the helper tower blowdown into the smaller, lower volume reservoir would result in the increased mineralization of the reservoir water. Using the analysis methodology presented in the SCA/EA, anticipated water quality within this reservoir alternative (including the helper towers) was estimated and is summarized in Table 3-2. Depending on the parameter, water quality concentrations within this alternative reservoir are as much as 18 percent higher than the larger reservoir proposed in the SCA. As a result, the two additional water quality parameters, iron and lead, are predicted to exceed applicable FDER water quality criteria. Mixing zones will be required for these additional parameters. Given the higher concentrations for the other parameters, slightly longer mixing zones will be required to meet applicable FDER water quality criteria downstream from the point of discharge.

The environmental benefit associated with this alternative is the creation on-site of additional artificial wetlands to meet the 25 percent and 20 percent criteria. However, this alternative will result in additional off-site environmental impacts including increased groundwater withdrawal and additional water quality impacts to Payne Creek. Because of the economic considerations associated with the helper cooling tower, the potential water quantity and quality impacts associated with tower operation, and the lack of commensurate environmental benefit, construction and operation of a reduced-capacity, serpentine water cooling reservoir with a helper cooling tower is not a practicable alternative.

3.2.3 ECONOMIC EVALUATION OF ALTERNATIVE COOLING RESERVOIR DESIGNS

An estimate was prepared of the capital and operational costs for the alternative cooling reservoir designs. The results of the economic evaluation are presented in Table 3-3.

The capital cost analysis shows that, from an economic perspective, the proposed cooling water reservoir is more cost effective than the smaller cooling reservoir with a helper tower or the serpentine reservoir with a helper tower. The proposed cooling water reservoir has both a lower capital and operational cost compared to the other cooling reservoir alternatives. The proposed cooling water reservoir is less costly by more than a factor of 1.5 than the other cooling reservoir alternatives. The total present worth of capital and operating costs for the proposed cooling reservoir alternative is approximately \$20 million as compared to the approximately \$30 million for the other reservoir alternatives.

3.2.4 PHASED COOLING RESERVOIR CONSTRUCTION

This construction alternative would be based on the construction of that portion of the reservoir which would be necessary for the early phases of plant construction (e.g., 380 acres for the initial 440 MW) and leave the remaining area (e.g., 190 acres) in an essentially unreclaimed form, allowing for the formation of transition areas along the unreclaimed mine rows.

The major engineering consideration related to this phased alternative is the increased construction cost compared to completing reservoir construction at one time. These additional considerations include costs for additional remobilization, additional dewatering requirements for this area to effectively reclaim these areas, and re-reclamation to an open water body to meet the ultimate capacity of the reservoir.

Any potential environmental benefits (i.e., wetland creation and wildlife usage) associated with this alternative are short term (5 years) and must be balanced against any risk of future impacts (i.e., loss of wetlands and

Table 3-3. Summary of Total Present Worth Analysis for Capital and Operating Costs for Alternative Cooling Reservoir Designs Evaluated for the Hardee Power Station

Cost Category	<u>Alternative Cooling Reservoir Design Total Present Worth</u>		
	Cooling Reservoir (Proposed)	Cooling Reservoir with Helper Tower	Serpentine Reservoir with Helper Tower ^a
Capital Costs	\$13,599,000	\$19,076,000	\$20,254,000
Operating Costs	\$6,577,000	\$11,743,000	\$12,468,000
TOTAL	\$20,176,000	\$30,819,000	\$32,722,000

^a The capital costs and operating costs of the serpentine reservoir are assumed to be similar to the cooling reservoir with the helper tower. The costs associated with the helper tower for this case are taken from the cooling reservoir with helper tower case, adjusted slightly to reflect the larger tower required for the serpentine reservoir.

Source: Black & Veatch, 1990.

wildlife usage at the time when the reservoir is expanded to full capacity). For example, if a rookery were to develop in these temporary wetlands during this interim period, this rookery would be destroyed during full capacity expansion construction. Given the realistic potential for this or a similar scenario, the wetland area would have to be managed (e.g., maintenance of herbaceous versus shrub or woody vegetation) to maintain lower wildlife usage to avoid major future environmental impacts as a consequence. Full wetland values would never be realized.

This alternative would only meet or approach the applicable criteria (e.g., 25 percent of high water area and 20 percent of low water area) for the short-term period prior to expansion to full capacity; after expansion, the reservoir would be identical to the proposed alternative with respect to the applicable criteria.

In conclusion, the only benefit of this alternative would be that it meets or approaches the applicable FDNR reclamation criteria in the short term. Given the relatively low and short-term environmental benefits, the potential for significant future impact when the reservoir is expanded to full capacity, and the significant additional construction costs, phased cooling reservoir construction is not a practicable or realistic alternative.

3.3 REQUESTED VARIANCE

3.3.1 SECTION 16C-16.0051(1)(b)

A variance is requested from Section 16C-16.0051(1)(b) because there is no practicable alternative. Water balance and hydrologic modeling have demonstrated that a discharge will be required for rainfall events greater than the 10-year, 24-hour storm. For the operation of the cooling reservoir and associated facilities, this discharge must be released through a properly designed discharge structure to allow accurate measurement of discharge quantities. The proposed fixed weir and swale is the only practicable discharge structure.

3.3.2 SECTION 16C-16.0051(5)(a) and (b)

There is no practicable means known or available to comply with Section 16C-16.0005(5)(a) and (b), F.A.C. in designing the cooling reservoir. The cooling reservoir location is dictated by the power plant location, the Payne Creek floodplain boundaries, the location of preserved wetlands, and the sand tailing disposal area requirements. The size of the cooling reservoir is dictated by the thermal efficiency requirements for the 660-MW power plant. If the 25/20 percent criteria were met, only 137.6 ha (340 acres) of effective cooling area would be available, compared to the 231 ha (570 acres) of effective thermal cooling area required for the 660-MW plant.

4.0 PROVIDE THE FACTS IN SUPPORT OF THE PERIOD OF
TIME FOR WHICH THE VARIANCE IS SOUGHT

A perpetual variance from Section 16C-16.0051(1)(b) and Section 16C-16.0051(5)(a) and (b) is sought.

5.0 PROVIDE THE REQUIREMENTS WHICH CAN BE MET BY THE OPERATOR,
INCLUDING THE DATE OR TIME WHEN THE REQUIREMENTS CAN BE MET

The following reclamation and restoration standards can be met on the operational date of the Hardee Power Station (1993).

Section 16C-16.0051--Reclamation and Restoration Standards

Section 16C-16.0051(2) Backfilling and containing

Section 16C-16.0051(3) Soil zone

Section 16C-16.0051(4) Wetland restoration

Section 16C-16.0051(5) Water quality

Section 16C-16.0051(6) Flooding and drainage

Section 16C-16.0051(7) Waste disposal

Section 16C-16.0051(8) Revegetation

Section 16C-16.0051(9) Wildlife

Section 16C-16.0051(10) Time schedule

Section 16C-16.0051(5)(a) and (b) can be partially met. Section 16C-16.0051(5)(a), F.A.C. requires that at least 25 percent of the high water surface area of each water body consists of an annual zone of water fluctuation to encourage emergent and transition zone vegetation. The proposed cooling reservoir design will have an annual zone of water fluctuation of 12 ha (29.7 acres); this is 5.2 percent of the total area.

Section 16C-16.0051(5)(b), F.A.C. requires that at least 20 percent of the low surface water shall consist of a zone between the annual low water line and 1.8 m (6 ft) below the annual low water line to provide fish bedding areas and submerged vegetation zones. The proposed cooling reservoir design will consist of 6.9 ha (17.1 acres) of low surface water area which can be used for fish bedding areas and submerged vegetation zones. This is 3.2 percent of the total low surface water area.

These percentages will be met on completion of the reservoir and are described in detail in Section 6.0.

6.0 PROVIDE THE MEASURES OR STEPS THE OPERATOR IS TAKING OR
HAS TAKEN TO MEET THE REQUIREMENTS OF THE STATUTE OR
RULE FROM WHICH THE VARIANCE IS SOUGHT

The design of the proposed cooling reservoir alternative is presented and evaluated in the SCA/EA. The location and design of the proposed cooling reservoir is also depicted in Figure 3-2 and Appendix B. The proposed reservoir will be constructed on land that has been mined for phosphate by Agrico and is a part of their reclamation program.

The cooling reservoir design will meet all the FDNR reclamation requirements with the exception of three requirements. Two of these reclamation requirements will be partially met by changes in the cooling reservoir design. As discussed in the following paragraphs the proposed open-water cooling reservoir design takes into account the intent of the FDNR phosphate mine reclamation requirement (Section 16C-16, F.A.C.) especially Section 16C-16.0051, F.A.C., and will generally meet the engineering requirements in the following manner:

1. The size and shape of the reservoir was arranged to utilize the entire mined land area available to the applicant and still maintain the surface area necessary for heat dissipation. This modification allowed for:
 - a. Minimum interior slopes of at least 4:1, thereby creating zones for vegetation growth,
 - b. A reservoir perimeter of more than 9,445 m (31,000 ft) versus 6,065 m (19,900 ft) from an ideal rectangular configuration thereby creating 18.9 ha (46.8 acres) of additional littoral zone, and
 - c. Creating an additional transitional shelf 31 m (100 ft) wide transitional shelves along 33 percent of the reservoir perimeter.
2. The exterior slopes are either at grade or have a minimum slope of 20:1 to avoid the construction of discernable dams or berms.

3. A minimum access center divider dike with a 38.4 m (126 ft) width was designed to create a shoreline of approximately 3,337 m (11,000 ft), upland habitat acres, littoral zones, and additional transition shelves.

The area and shape of the reservoir were arranged to utilize the maximum amount of mined land area available to the applicant, to meet engineering requirements outlined in Section 3.1.2, and to comply to the maximum extent practicable with the FDNR reclamation requirements. The reservoir will be approximately 231 ha (570 acres) in area and it will be located north and adjacent to the power plant and out of the Payne Creek floodplain. The average cooling reservoir water depth will be greater than 3.1 m (10 ft).

A transitional vegetation zone shelf, varying in width from 31 to 40 m (100 to 130 ft), was added to provide additional littoral zone areas along the northern and eastern portions of the reservoir. This shelf will be constructed at the reservoir mean low water elevation of 37.2 m (122 ft) above mean sea level (MSL) and will provide 8.6 ha (21.1 acres) of transition zone.

The width of the center divider dike was expanded to a total of 38.4 m (126 ft) to create additional shoreline of approximately 3,337 m (11,000 ft). The dike will provide slopes of at least 4:1, thereby creating additional zones for vegetation growth. In addition, a transitional zone shelf 3.1 m (10 ft) wide will facilitate additional littoral zone growth on both sides of the divider dikes. The shelf will be constructed at the reservoir mean low water elevation of 37.2 m (122 ft) MSL and will provide 1.8 ha (4.4 acres) of transitional zone. Therefore, this center divider dike system will support upland habitat acreage, littoral zones, and additional transitional shelves.

Vegetation zones will consist of uplands, a littoral zone, and a submerged zone. The uplands along the divider dike and around the perimeter of the cooling reservoir will be reclaimed to grasslands, with an emphasis placed

on those species which are important for wildlife food and cover. Two wetland zones will be created. The littoral zone, which encompasses the annual zone of water fluctuation, will provide a variety of habitat types by including both transitional and emergent plant species. The second wetland zone will consist of the submerged vegetation zone and encompasses a region between the annual low water line and 1.8 m (6 ft) below the annual low water line. The 4:1 slope along both the reservoir perimeter and center dike will allow the establishment of littoral and submerged vegetation zones along both sections of the cooling reservoir. The uplands vegetation zone, consisting of mixed native grasses, will be established along the upper perimeter of the reservoir and along the top of the center dike.

Given these design features, the proposed open water cooling reservoir design provides an area of approximately 12 ha (29.7 acres) between the mean high water and mean low water elevations. This is 5.2 percent of the total mean high water area. These areas will provide for emergent/wetlands vegetation, habitat areas, and wetlands related water quality functions.

Establishing emergent and transitional vegetation along the edge of the water cooling reservoir between the mean high water and mean low water elevations accomplishes several beneficial goals. First, the wetland and upland vegetation provides habitat for various birds, fish, reptiles, mammals, and amphibians; plants such as salt-bush and woolgrass (Scirpus cyperinus) provide protective cover, whereas plants such as sedges, pennywort, and rushes produce seeds which are an important animal food source. Second, vegetation establishment along the shoreline binds and stabilizes substrates and thus minimizes erosion potential. Third, shoreline vegetation can improve the water quality by removing nutrients, sediments, etc. from the water.

The proposed open water cooling reservoir design provides an area of approximately 6.9 ha (17.1 acres) between the mean low water elevation and 1.8 m (6 ft) below the mean low water elevation. This represents

3.2 percent of the total mean low water surface area. These areas will provide fish bedding areas and submerged vegetation zones.

7.0 DISCUSS THE SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS ON
THE OPERATOR AND RESIDENTS OF THE AREA AND THE STATE, IF THE VARIANCE
IS GRANTED AND IF THE VARIANCE IS DENIED

7.1 IMPACTS IF VARIANCE GRANTED

Granting the variances will allow for the construction of a cooling system that is the most economical and efficient and causes the least amount of environmental impact to the area and the state. No negative social, economic, or environmental impacts to the residents of the area and state will occur if the variance is granted; in fact, granting the variance will benefit the residents of the area and state.

Overall, the primary benefit to be derived from the Hardee Power Station project is the provision of a new, clean, reliable source of low-cost energy to the public served by the Applicants. In addition to the provision of energy, the proposed project will provide jobs, tax revenues, and a productive use for the site after mining. As discussed in Section 3.2.3, granting the variance could save the public more than \$10 million.

The environmental consequences of not completely meeting Section 16C-16.0051(5), F.A.C. are minimal. There will be no significant adverse environmental effects associated with the proposed cooling reservoir (see SCA/EA, Sections 5.1 and 5.8) and there will be no net loss to the environmental resources of the area (Section 16C-16.0053, F.A.C.), including endangered and threatened species and their habitats, surface water drainage patterns and water quality, and uplands. In fact, in addition to the 83 ha (206 acres) of wetland restored by Agrico in its reclamation plan, an additional 19 ha (47 acres) of wetlands will be created as part of the cooling reservoir design.

The volume of water that enters Payne Creek by subsurface seepage from the cooling reservoir will be equivalent to the volume of water that the creek received from tributaries and stormwater runoff before the site was mined.

However, instead of receiving water in pulses during rainfall events, there will be a steady stabilized flow to the floodplain.

Currently, the flatwoods vegetation of the floodplain is being overgrown by a maturing hardwood canopy due to lack of fire. Steady seepage with no long intervening drought periods will enhance the invasion of hardwood wetland forest into what is now a flatwoods community.

A large off-site wetland adjacent to the northwest corner of the site will be slightly wetter than it is currently due to seepage from the cooling reservoir. Historically, this wetland probably received more water before the surrounding uplands were mined than it does now. The seepage from the cooling reservoir is seen as a positive benefit to this wetland.

The currently proposed reclamation plan for the site without the cooling reservoir shows the proposed reclaimed land uses to be lake, grassland and pastureland, coniferous and upland mixed forest, wetland forested mixed, and vegetated nonforested wetland. The cooling reservoir will result in the replacement of cropland and pastureland, upland coniferous forest, and upland mixed forest with open water. Table 7-1 compares the different existing approved reclamation plan land uses with the proposed revised reclamation plan land uses. If granted, the proposed cooling reservoir with the revised reclamation plan will result in a 180-ha (445-acre) increase in open water, 22-ha (55-acre) increase in wetlands, 168-ha (415-acre) decrease in pasture, and 30-ha (73-acre) decrease in upland forest.

7.2 IMPACTS IF VARIANCE DENIED

If the variance is denied, the Applicants would be forced to use one of the cooling tower alternatives (described in this report) at a significantly higher construction and operational cost penalty, as compared with the proposed cooling reservoir. This significantly higher cost penalty would be reflected in the cost of the electricity generated by this facility.

Table 7-1. Area Differences in Land Use Classification Between the Proposed Revised Reclamation Plan With Cooling Reservoir and the Existing Approved Reclamation Plan Without the Cooling Reservoir

<u>Land Use and Cover</u>	<u>Reclamation Plan Area [ha (acre)]</u>		
	<u>Proposed Revised^a</u>	<u>Existing Approved^b</u>	<u>Change in Area</u>
210 - Cropland/pastureland	190 (470)	358 (885)	-168 (-415)
310 - Grassland	42 (104)	24 (60)	+18 (+44)
320 - Shrubs/brushland	3.6 (9)	3.6 (9)	0 (0)
410 - Upland coniferous forest	58 (143)	42 (104)	+16 (+39)
430 - Upland mixed forest	28 (68)	73 (180)	-45 (-112)
520 - Lakes	231 (570)	51 (125)	+180 (+445)
630 - Wetland forested mixed	30 (73)	24 (60)	+6 (+13)
640 - Vegetated nonforested wetlands	19 (47)	2 (5)	+17 (+42)

^aWith the approximately 231-ha (570-acre) cooling reservoir.

^bWithout a cooling reservoir.

Compared to the proposed cooling reservoir, the smaller reservoir with helper towers would have the following social, economic, and environmental impacts:

1. Increase the cost of the cooling system more than 50 percent (\$10 million to 12 million).
2. Require a 16-percent increase in total groundwater withdrawal, for additional cooling system makeup,
3. May require more frequent discharge to Payne Creek and greater water quality impacts, and
4. Require additional mixing zones for iron and lead and up to 20 percent longer mixing zones for other parameters.

7.3 CONCLUSION

Section 378.212(2), FS, provides that variances to FDNR reclamation rules shall be considered based on the particular facts and circumstances surrounding each individual request. In this case, the variance would be issued by the Governor and Cabinet either sitting as the head of FDNR, or sitting as the Siting Board. The fundamental legislative criteria for siting decisions are that there be a reasonable balance between the need for the facility and the environmental impact of the facility on resources of the state, and that abundant, low-cost electrical energy be provided. In addition, Section 378.212(1)(c), FS, envisions that a variance in FDNR reclamation rules may be granted, in appropriate cases, in order to avoid economic penalties.

One of the primary advantages of the Hardee Power Station is its beneficial reuse of mined lands for a cooling reservoir that will minimize water consumption demands and avoid the major expense associated with a mechanical cooling tower. Although site constraints, engineering needs, and costs preclude the construction of a cooling system that will comply with all of the normal FDNR reclamation criteria, the cooling reservoir proposed will provide a net increase in lake and wetlands areas over current reclamation plans of Agrico. It is the best and only practicable

cooling alternative that reasonably balances the need for power with the broad interests of the public.

APPENDIX A

**FLORIDA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RESOURCE MANAGEMENT
BUREAU OF MINE RECLAMATION
VARIANCE APPLICATION**

FLORIDA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RESOURCE MANAGEMENT
BUREAU OF MINE RECLAMATION
2051 EAST DIRAC DRIVE
TALLAHASSEE, FLORIDA 32304-7795

VARIANCE APPLICATION

DNR Use Only	
File No.	_____
Approved	_____
BMR Code	_____

PART I. GENERAL INFORMATION

1. Operator
 - a. Name: Agrico Chemical Company
 - b. Mine: Payne Creek Mine
2. Applicant (Authorized Agent)
 - a. Name: Mike Opalinski
 - b. Title/Position: Manager of Environmental Affairs
 - c. Business Address: 16313 N. Dale Mabry Highway
 - d. Mailing Address: P.O. Box 27200
 - e. City, State & Zip: Tampa, FL 33688-2000
 - f. Telephone Number: 813/963-0994
3. Person to Contact Regarding Contents of Application
 - a. Name: Mike Opalinski
 - b. Title/Position: Manager of Environmental Affairs
 - c. Telephone Number: 813/963-0994

PART II. DESCRIPTION OF VARIANCE

1. Statute or Rule from Which a Variance is Requested
Section 16C-16.0051(1)(b) and (5)(a) and (b) (chapter, section, etc.)
2. Reason(s) for Variance (check one or more)
 - ☒ There is no practicable means known or available to comply.
 - ☐ Compliance will necessitate the taking of measures which must be spread over a considerable period of time.
 - ☒ It will relieve or prevent hardship, including economic hardship, of a kind other than the two reasons above.
 - ☐ It will accommodate specific phosphate mining, processing, or chemical plant uses that otherwise would be inconsistent with the requirements of Chapter 378, Part III, F.S.
 - ☐ A variance will provide for an experimental technique that would advance the knowledge of reclamation and restoration methods.
3. Duration of Variance: From Date of certification to Life of the site

PART III. See additional attached pages.

Date Submitted

Signature of Applicant

Signature of Coapplicant*

APPENDIX B
COOLING RESERVOIR (PROPOSED)

OVERSIZE
DOCUMENT WAS
REMOVED AND
INSERTED INTO
OCULUS
SEPARATELY.

APPENDIX C
COOLING RESERVOIR (REDUCED)

OVERSIZE
DOCUMENT WAS
REMOVED AND
INSERTED INTO
OCULUS
SEPARATELY.

APPENDIX D
COOLING RESERVOIR (SERPENTINE)

OVERSIZE
DOCUMENT WAS
REMOVED AND
INSERTED INTO
OCULUS
SEPARATELY.

**11.11 AGRICO CHEMICAL COMPANY RECLAMATION PROGRAM
APPLICATION**

FLORIDA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF RESOURCE MANAGEMENT
BUREAU OF MINE RECLAMATION
2051 EAST DIRAC DRIVE
TALLAHASSEE, FLORIDA 32304-7795

RECLAMATION PROGRAM APPLICATION

DNR Use Only	
File No.	_____
Approved	_____
BMR Code	_____

PART I. GENERAL INFORMATION

1. Operator

a. Name: Agrico Chemical Company
b. Mine: Payne Creek
c. Business Address: P. O. Box 1110
d. Mailing Address: Same
e. City, State & ZIP: Mulberry, FL 33860
f. Telephone Number: 813 / 428 - 1431

2. Applicant (Authorized Agent)

a. Name: Mr. Selwyn L. Presnell
b. Title/Position: Environmental Manager
c. Business Address: P. O. Box 1110
d. Mailing Address: Same
e. City, State & ZIP: Mulberry, FL 33860
f. Telephone Number: 813 / 428 - 1431

3. Person to Contact Regarding Contents of Application

a. Name: Mr. George A. Weinman
b. Title/Position: Superintendent of Reclamation
c. Business Address: P. O. Box 1110
d. Mailing Address: Same
e. City, State & ZIP: Mulberry, FL 33860
f. Telephone Number: 813 / 428 - 1431

PART II. APPLICATION SUMMARY

(Provide the following information for the program application area.)

1. Location:

County	Township	Range	Sections
a. <u>Polk</u>	<u>32 N S</u>	<u>23 E W</u>	<u>25, 26, 35 & 36</u>
b. _____	<u>N S</u>	<u>24 E W</u>	<u>30 & 31</u>
c. <u>Hardee</u>	<u>33 N S</u>	<u>23 E W</u>	<u>1 & 2</u>
d. _____	<u>N S</u>	<u>E W</u>	_____

2. Mining Operations Acreages:

a. Mined before 7/1/75	---
b. Mined from 6/30/75 to present	<u>820</u>
c. To be mined	<u>149</u>
d. Disturbed before 7/1/75	---
e. Disturbed from 6/30/75 to present	<u>40</u>
f. To be disturbed	<u>20</u>
g. To remain undisturbed	<u>157</u>

3. Estimated Quantities Considered in Planning Program
Reclamation:

- a. Dry tons of clay to dispose of -----
- b. Dry tons of sand tailings to dispose of -----
- c. Dry tons of other waste to dispose of -----

4. If the program application contains a waste disposal site,
provide the following:

Waste Disposal Designation (site code) -----

Disposal area acres	Dam Height Above Grade		Cap type	Cap thickness
	Minimum	Maximum		
-----	-----	-----	-----	-----
Infill rate	% Solids infill	Immediate % solids	Average Storage Depth	Storage Acre-feet
-----	-----	-----	-----	-----

5. Postreclamation Program Acreage:

a. Uplands	547		
b. Nonforested		508	
c. Forested		39	
d. Coniferous			-----
e. Hardwood			-----
f. Mixed			39
g. Water bodies	613		
h. Fluctuating zone		26	
i. Forested			-----
j. Herbaceous			26
k. Low water area		587	
l. Shallow zone			-----
m. Deep zone			-----
n. Streams			
o. Wetlands	26		
p. Forested		23	
q. Herbaceous		3	
k. Total	1,186		

QUESTION:

PART III. OWNERSHIP, LEASES, AND PERMITS.

1. List the names and addresses of all persons having fee simple or lessee estate in the application area.

RESPONSE:

Agrico Chemical Company
P. O. Box 1110
Mulberry, FL 33860

QUESTION:

2. Has the State of Florida, if not included in item 1 above, claimed ownership of any area within the application area? If yes, discuss.

RESPONSE:

No.

QUESTION:

3. If any part of the application area is subject to DRI-ADA approval under section 380.06, Florida Statutes, provide the status of the approval process, including approval dates and the approving agencies when known.

RESPONSE:

This application area is not subject to DRI-ADA approval relative to mining. A power plant siting certification application has been submitted to the Florida Department of Environmental Regulation, Power Plant Siting Department, for Seminole Electric Cooperative/TECO Power Services, Hardee Power Project.

QUESTION:

4. Identify those areas where a jurisdictional determination has been completed and is subject to Department of Environmental Regulation jurisdiction. Provide a copy of each permit obtained.

RESPONSE:

An application to mine 34.6 acres of wetlands over which DER claims jurisdiction (file No. 251224079) was approved June 27, 1986, application file No. 531120329 to mine 63.1 additional acres of wetlands over which DER also claims jurisdiction is pending.

QUESTION:

5. List all other permits related to reclamation activities that have been obtained or are known to be needed for the application area. Provide the identification number (if applicable), type, agency filed with or to be filed with, and status of each permit.

RESPONSE:

<u>Permit</u>	<u>Agency</u>	<u>Status</u>
Polk County Operating Permit	Polk County	Issued.
Dredge and Fill Permit	U.S. Army C.O.E.	Issued Permit No. 87IPB-20211

QUESTION:

PART IV. DESCRIPTION OF APPLICATION AREA.

Describe the application area in a list format. Headings for the list shall be township, range, section, quarter section, and quarter-quarter section. Include the acreage for each partial quarter-quarter section.

RESPONSE:

<u>Township</u>	<u>Range</u>	<u>Section</u>	<u>Quarter Section</u>	<u>Quarter-Quarter Section</u>	<u>Acres</u>
32S	23E	25	SW	SW-1/4	2
32S	23E	25	SW	SE-1/4	2
32S	23E	35	NE	NW-1/4	4
32S	23E	35	NE	NE-1/4	30
32S	23E	35	NE	SW-1/4	23
32S	23E	35	NE	SE-1/4	40
32S	23E	35	SE	NW-1/4	24
32S	23E	35	SE	NE-1/4	40
32S	23E	35	SE	SW-1/4	11
32S	23E	35	SE	SE-1/4	40
32S	23E	36	NE	NW-1/4	7
32S	23E	36	NE	SW-1/4	6
32S	23E	36	NW	NW-1/4	40
32S	23E	36	NW	NE-1/4	40
32S	23E	36	NW	SW-1/4	40
32S	23E	36	NW	SE-1/4	40

<u>Township</u>	<u>Range</u>	<u>Section</u>	<u>Quarter Section</u>	<u>Quarter-Quarter Section</u>	<u>Acres</u>
32S	23E	36	SW	NW-1/4	40
32S	23E	36	SW	SW-1/4	40
32S	23E	36	SW	SE-1/4	40
32S	23E	36	SW	NE-1/4	40
32S	23E	36	SE	NW-1/4	6
32S	23E	36	SE	SW-1/4	5
32S	23E	36	SE	SE-1/4	11
32S	24E	31	SW	SW-1/4	12
32S	24E	31	SW	SE-1/4	15
33S	23E	1	NW	NW-1/4	42
33S	23E	1	NW	SW-1/4	42
33S	23E	1	NW	NE-1/4	40
33S	23E	1	NW	SE-1/4	42
33S	23E	1	NE	NW-1/4	42
33S	23E	1	NE	SW-1/4	42
33S	23E	1	NE	SE-1/4	42
33S	23E	1	NE	NE-1/4	42
33S	23E	1	SE	NW-1/4	42
33S	23E	1	SE	SW-1/4	29
33S	23E	1	SE	SE-1/4	42
33S	23E	1	SE	NE-1/4	42
33S	23E	1	SW	NE-1/4	25
33S	23E	1	SW	SE-1/4	6
33S	23E	1	SW	NW-1/4	7
33S	23E	2	NE	NE-1/4	36
33S	23E	2	NE	SE-1/4	25

QUESTION:

PART V. RECLAMATION PROGRAM

Respond to the items below by providing enough detailed information to evaluate compliance with the standards in section 16C-16.0051 and 16C-16.0053, F.A.C., and the approved conceptual plan.

1. Discuss site cleanup and remaining structure.

RESPONSE:

All items associated with the mining operation will be removed. No structures will be constructed under this program application. A NPDES permitted discharge point will be constructed by the future property owner under separate permit.

QUESTION:

2. Discuss the nature of all backfill material, the proposed landforms, and the proposed land uses.

RESPONSE:

All backfill material will consist of on-site overburden. One lake will be constructed as indicated on the attached pages and drawings. The lake will overflow through a grassland area to the floodplain of the Alafia River. The land-use proportions in the program area compared to pre-mining conditions and approved conceptual plan are listed below.

<u>FLUCCS</u> <u>dated 4/76</u>	<u>Pre-Mining</u> <u>Land Use Acres</u>	<u>Post-Reclamation</u> <u>Land Use Acres</u>
210	644	333
230	41	
310	3	112
320	37	
340	50	
410	89	
430	226	39
520		587
620		
630	44	23
640	45	29
	<u>1,179</u>	<u>1,186</u>

QUESTION:

3. Discuss the topsoils existing prior to mining and the topsoils that will exist after reclamation.

RESPONSE:

Myakka - Pomello - Basinger Soil Association

Nearly level to gently sloping, poorly and moderately well-drained sandy soils with weakly cemented sandy subsoil and poorly drained soils sandy throughout, not subject to flooding.

Myakka fine sand - Poorly drained sandy soils on coastal flatwoods. Surface layer of black sand about six inches thick, subsurface layer of white sand about 14 inches thick. Subsoil reddish brown and dark brown to dark grayish brown sand, 56 to 80 or more inches thick. Slopes range from 0 to 2 percent.

Pomello - Moderately well drained sandy soils occurring in low ridges. Surface layer of gray fine sand about four inches thick with a white subsurface layer about 38 inches thick. Subsoils of dark reddish brown nearly cemented fine sand approximately 12 inches thick. Below a 54-inch depth is a brown to light gray fine sand. Slopes are 0 to 5 percent.

Basinger - A series of poorly drained deep sandy soils that occur in brown sloughs, poorly defined drainage ways and depressions. Surface layer thin and very dark gray with a light gray fine sand subsurface layer. Brown and light brownish gray subsoil between 18 and 36 inches with a light colored fine sand extending to a depth of 60 inches. Slopes are less than 2 percent.

Also present is the Basinger - Pompano - Swamp Association. Nearly level poorly drained soils sandy throughout and very poorly drained soils subject to prolonged flooding.

Pompano - Poorly drained nearly level soils in south and central Florida. In a representative profile, the surface layer is dark gray fine sand in the upper five inches and grayish brown fine sand in the next nine inches. Between depths of 16 to 30 inches is very pale brown fine sand. Below this to depths of 75 inches or more is fine sand. Slopes range from 0 to 2 percent.

The source of soils information for the area to be mined during the application period was the General Soil Map for Polk County, Florida published by the U.S.D.A. Soil Conservation Service. Detailed soils mapping within the application areas is not available at this time. Soil types were not field checked.

QUESTION:

4. Discuss the acreage and type of each wetland to be established and how this information compares with the approved conceptual plan.

RESPONSE:

Reclamation plans for this program provide for 26 acres of herbaceous wetlands in the lake fluctuation zone and 19 acres of forested wetlands near the southeasterly portion of the lake. Total wetland acreage after reclamation will be 52 acres. This will include 23 forested acres (of which four existing acres will remain unmined), and 29 acres of herbaceous wetlands (of which three existing acres will remain unmined). This varies from the Payne Creek conceptual plan for which a modification application is being submitted in conjunction with this program application.

QUESTION:

5. Discuss the design and location of all proposed wetlands and water bodies.

RESPONSE:

The pre-mining drainage in the program area is from north to south. The reclamation plan for the area will maintain the direction of drainage. The proposed lake and wetlands will be constructed by redistributing overburden to achieve design elevations as shown on attached drawings. Marsh soil from other locations on Agrico's property will be utilized to inoculate the wetland sites with seeds and roots of wetland plants.

The forested wetlands will be planted with at least three indigenous species after the site is inoculated with marsh soil. Tree planting will be spaced approximately 10'x10'. At the end of one growing season, at least 200 trees per acre will be established on all areas planted with wetland trees.

The herbaceous wetland area will be inoculated with marsh soil from various locations on Agrico's property. Also, wetland plants common to the area will be planted to augment the natural seeding which will occur on the site.

QUESTION:

6. Discuss what methods will be used to determine that all applicable water quality standards will be met.

RESPONSE:

All process water (water utilized in the processing of the phosphate resource) must pass through a permitted discharge point before leaving Agrico's property. Non-process water (area runoff) is not regulated by Chapter 17-3, F.A.C. The permitted discharge point for this mine is located in SE-1/4, Section 27, Township 32 South, Range 24 East. The NPDES permit number is FL0000353.

All water monitoring data from this discharge point is provided to DER and EPA (Region IV) and must meet permit requirements.

QUESTION:

7. Discuss how the original drainage patterns will be restored and what reasonable steps will be taken to eliminate the risk of flooding on lands not controlled by the operator when reclamation activities are complete.

RESPONSE:

Ditches around the perimeter of the operations intercept runoff which might cause siltation on lands not controlled by Agrico. The ditches are connected to the water recirculation system. Proper spoiling procedures and observing proper setback from property lines when mining also help eliminate the risk of offsite flooding.

Original drainage patterns from north to south will slightly differ from post-reclamation north to south drainage due to DER jurisdictional wetland mitigation and proposed lake construction.

Agrico submitted a surface water model to SWFWMD for the entire Payne Creek Mine site. This model is being reviewed in compliance with Chapter 40D-4. The model will be updated as appropriate.

QUESTION:

8. Discuss the disposal of waste clays, sand tailings, and other material within the application area.

RESPONSE:

Waste clay disposal is not planned within the program area. Sand tailings however will be pumped to backfill part of the area with sufficient material to provide post-reclamation elevations. All sand tailings will be capped with at least 12 inches of overburden and revegetation. Please see attached drawings.

QUESTION:

9. Discuss the plan for revegetating the application area.

RESPONSE:

A probable seed mixture for the upland areas to be grassed is as follows:

Bahia Grass	20 lbs./acre
Bermuda Grass	8 lbs./acre
Millet (if seeded in warm season)	20 lbs./acre
Rye (if seeded in cool season)	60 lbs./acre

The species have proven effective in controlling erosion and offering multiple land use possibilities. The seeding procedures will be as follows:

1. Apply fertilizer to the site.
2. Disc heavily.
3. Apply seed.
4. Disc light or harrow.

Sixty three (63) acres around the lake perimeter will be planted with vegetation consisting of tree and shrub species indigenous to the area in addition to ground cover. This will be a greenbelt area.

Thirty-nine (39) acres will be planted as mixed upland forest. At least three indigenous species will be used. Nineteen (19) acres will be planted with wetland tree species. All tree plantings will be spaced no closer than 10'x10'. At the end of one growing season, at least 200 trees per acre will be established on all areas where trees are planted.

Marsh soil from various locations on Agrico's property will be utilized to inoculate wetland sites discussed in Part V-4 with seeds and plant parts of wetland plants. Marsh soil will not be applied as a layer but scattered lightly as inoculum.

Maintenance of vegetation will include fire protection for trees. The upland areas will be fertilized as necessary. Vegetation maintenance will be carried out as warranted by Agrico's land-use objectives, but will definitely continue until vegetation is well established.

Erosion control measures which may become necessary in the application area include earth structures and grass waterways.

QUESTION:

10. Discuss pre-mining wildlife values and what wildlife considerations have been included in the reclamation program.

RESPONSE:

The capacity for fish and wildlife values is expected to be improved after reclamation due to a diversified habitat. Habitat diversity will be enhanced by utilizing a variety of tree species on area to be reforested. Prompt revegetation of the land area after earth-moving operations will hasten wildlife utilization of the area. Special programs of reclamation for wildlife will not be necessary to provide excellent wildlife values after mining.

Wildlife Habitats (Acres)

	<u>Pre-Mining</u>	<u>Post-Reclamation</u>
Cropland and Pastureland	644	333
Citrus Grove	41	
Grassland	3	112
Shrubland and Brushland	37	
Mixed Rangeland	50	
Greenbelt		63
Coniferous Forest	89	
Mixed Forest	226	39
Lake		587
Wetland-Mixed Forest	44	23
Wetland-Vegetated Non-Forested	45	29

Endangered species of wildlife known or suspected to occur on Agrico property are: Red-cockaded woodpecker and wood stork.

Threatened species which are known or possible inhabitants of property belonging to Agrico are: Sherman's fox squirrel, Audubon's caracara, southeastern kestrel, Florida sandhill crane, southern bald eagle, osprey, American alligator, eastern indigo snake, gopher tortoise, and Florida gopher frog.

Suspected habitation of the area covered by this application by endangered or threatened species is based on the existence of suitable habitat within the application area.

The wood stork is the only endangered species known to be present in the area. Past experience has indicated that the population of this species greatly increase after mining due to the increase of suitable habitat.

Threatened species known to be present within the area are the Florida sandhill crane and the gopher tortoise.

Suitable habitat for the Florida sandhill crane will be increased after reclamation due to the proposed increase of shallow wetland habitat within the application area.

Revegetated, reclaimed lands with sandy soils should provide suitable habitat for the gopher tortoise.

QUESTION:

11. Discuss how the natural resources that will not be disturbed by mining operations will be protected.

RESPONSE:

Ditches around the perimeter of the operations intercept runoff which might cause siltation on lands not controlled by Agrico. The ditches are connected to the water recirculation system. Proper spoiling procedures and observing proper setback from property lines when mining also help eliminate the risk of offsite effects.

VI. VARIANCES

For each variance requested provide a completed variance application, Reclamation Form No. 7. If no variance is requested, state: No Variance Requested.

A completed variance application, Reclamation Form No. 7, is attached requesting a variance to 16C-16.0051(5)(a) and 16C-16.0051(5)(b).

VII. MAPS

Provide the following maps. Do not combine maps. Identify each map by number, title, operator's name, and mine name.

1. Location
2. Mined, Disturbed and Permit Areas
3. Post-Reclamation Topography and Drainage
4. Post-Reclamation Vegetation and Postreclamation Land Use
5. Waste Disposal
6. Cross Section Locations and Temporary Land Use Areas
7. Aerial Photograph

Please see attached drawings.

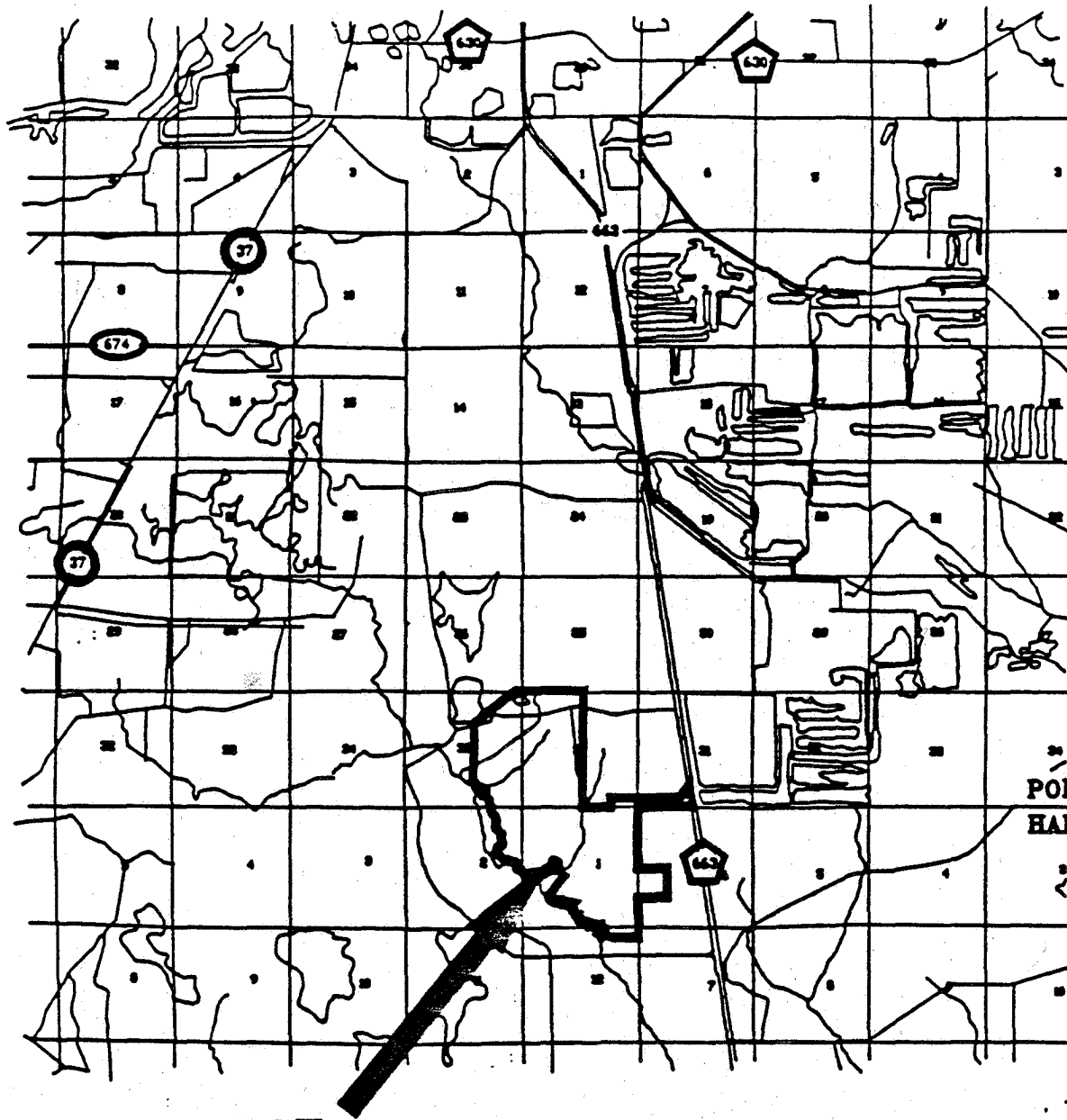
VIII. CROSS SECTIONS

Provide the following cross sections. Identify each cross section by number, title, operator's name, and mine name.

All cross sections shall be identified as A-A', B-B', C-C', etc., and shall be based on actual data or design.

Use the cross section endpoints in the title of each cross section, e.g., GEOLOGIC CROSS SECTIONS A-A', B-B', and C-C'.

1. GEOLOGIC CROSS SECTIONS
2. POSTRECLAMATION CROSS SECTIONS
 - A. Upland
 - B. Water Body
 - C. Wetland
3. DRAINAGE CROSS SECTIONS



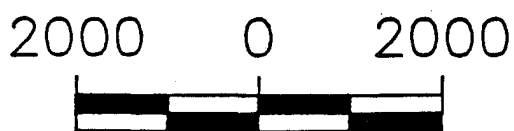
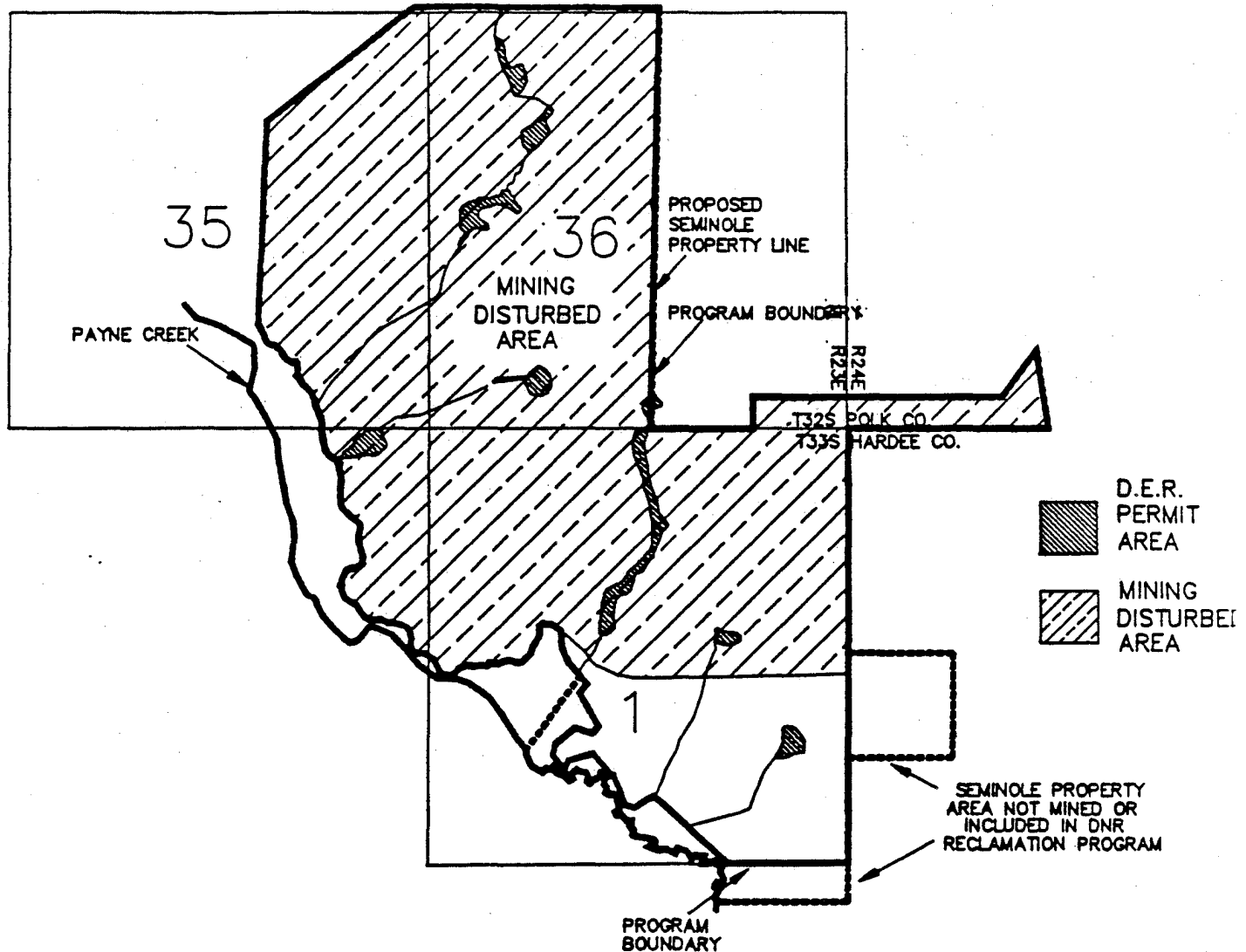
PROJECT LOCATION

- ⊙ STATE PRIMARY HIGHWAY
- STATE SECONDARY HIGHWAY
- ⬠ COUNTY HIGHWAY

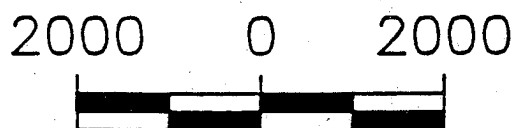
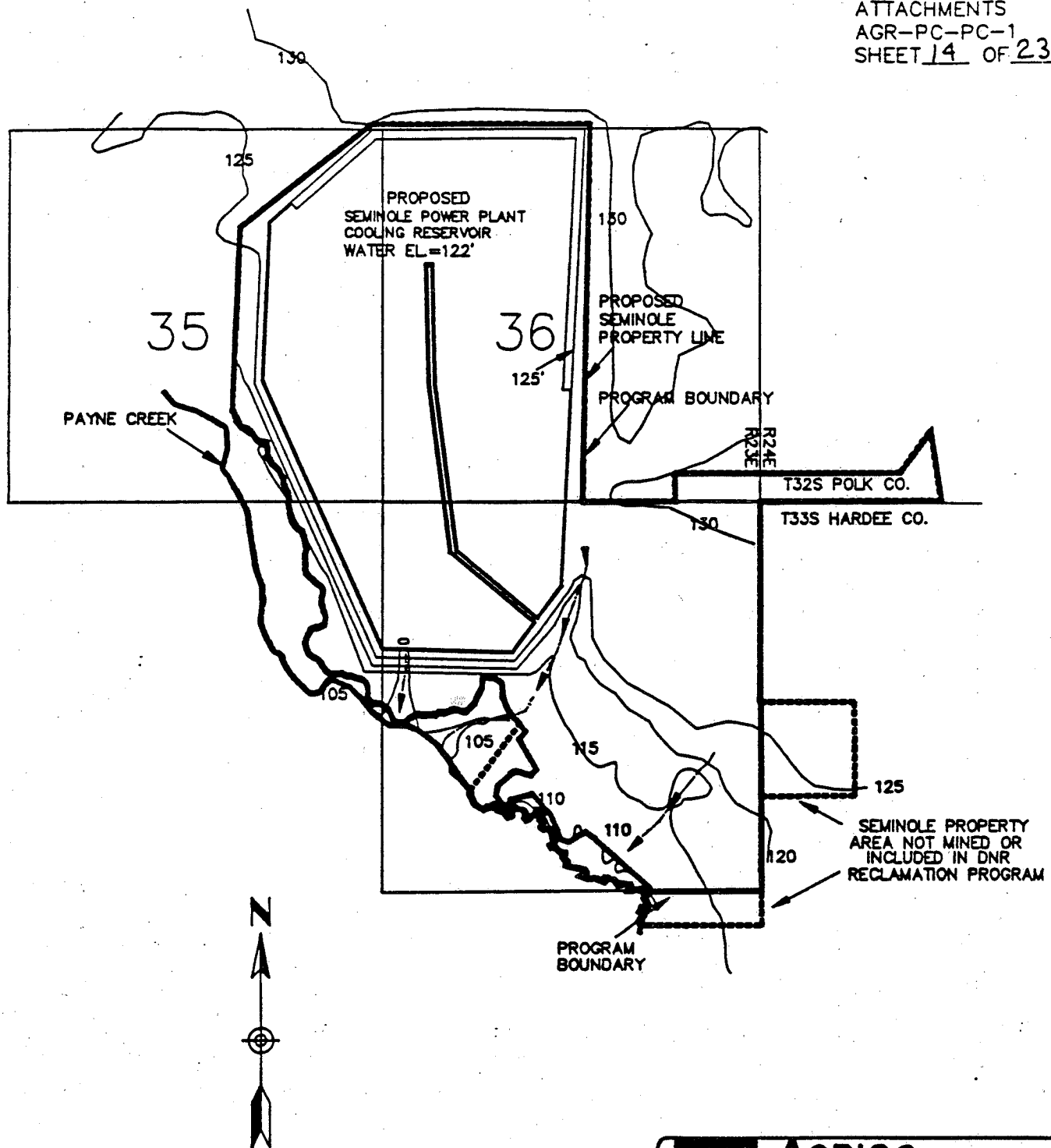
7500' 0' 7500'



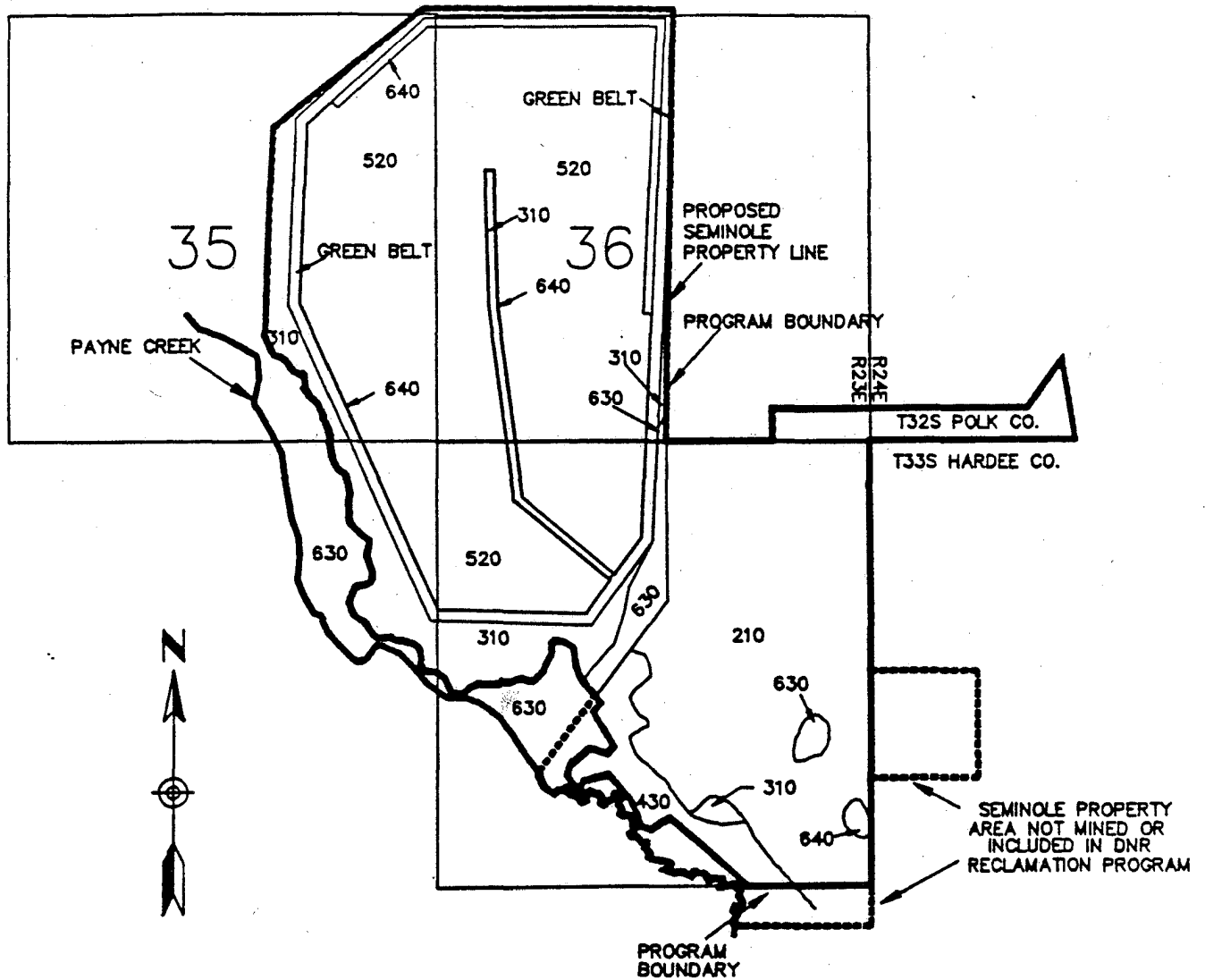
 AGRIC Division of Forest-McMullan Resource Partners	
PROPOSED AGR PC-PC-1 GENERAL LOCATION MAP SEC.36 T32S,R23E SEC.1 T33S,R23E	
DATE	1/4/90
REV.	



 AGRIC Division of Freeport-McMullan Resource Partners	
PROPOSED AGR PC-PC-1 MINED, DISTURBED AND PERMIT AREA SEC.36 T32S,R23E SEC.1 T33S,R23E	
DATE	12/4/89
REV.	

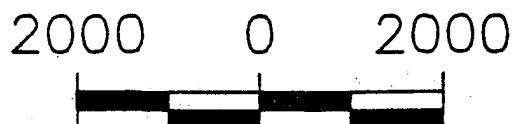


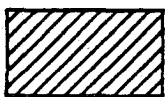
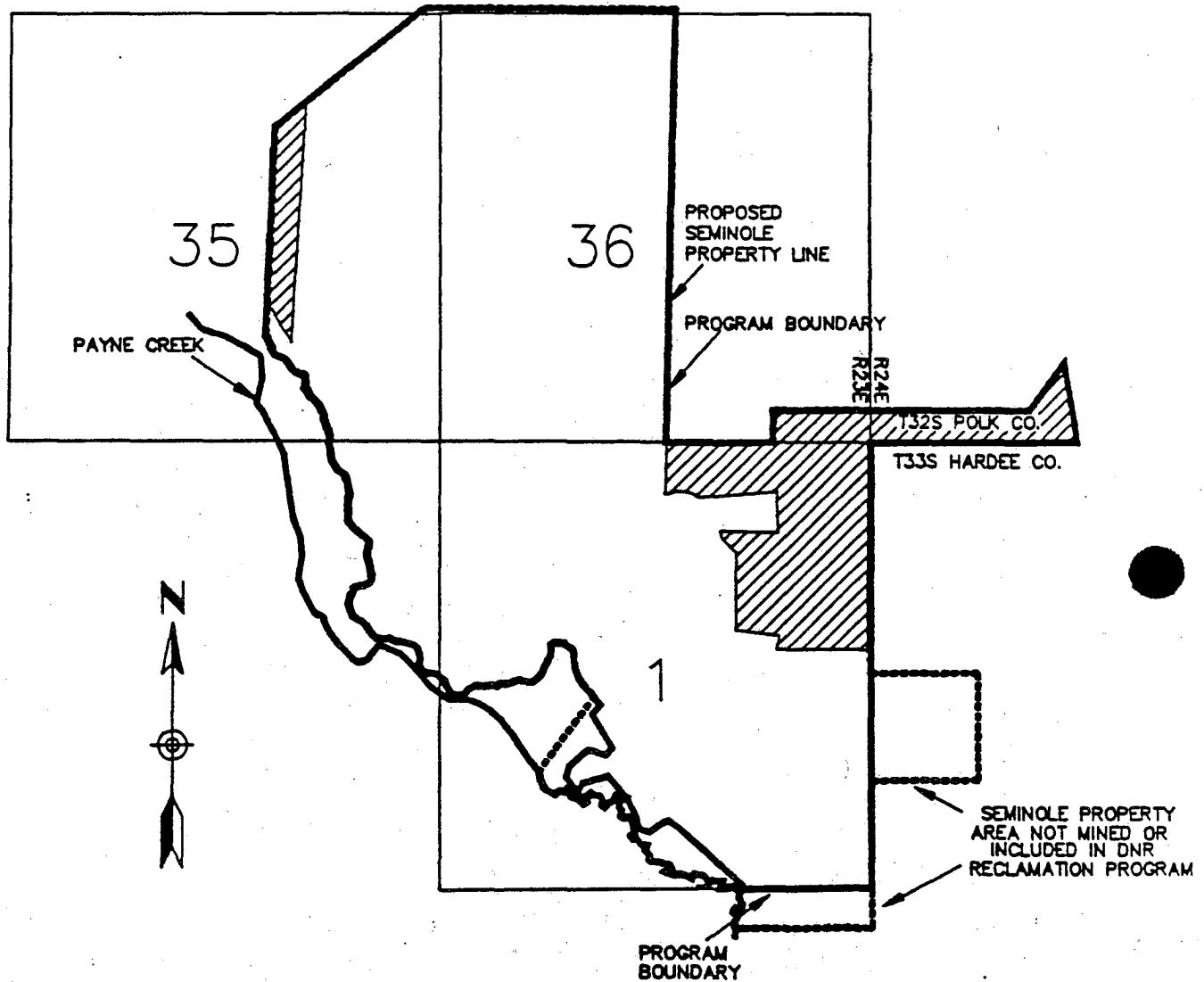
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PROPOSED AGR PC-PC-1 POST RECLAMATION TOPOGRAPHY & DRAINAGE SEC.36 T32S,R23E SEC.1 T33S,R23E	
DATE	12/4/89
REV.	



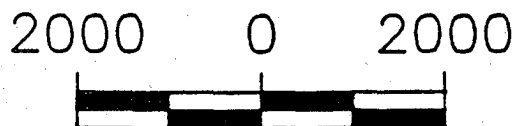
LEGEND	
LAND USE & COVER TYPE	
210	CROP & PASTURE
310	GRASS
320	SHRUB & BRUSH
330	MIXED RANGE
410	CONIFEROUS FOREST
430	MIXED FOREST
520	LAKES
620	HARDWD FOREST WETLAND
630	MIXED FOREST WETLAND
640	NOFORESTED WETLAND

 AGRIC Division of Forest-McMoran Resource Partners	PROPOSED AGR PC-PC-1 POST RECLAMATION VEGETATION & LAND USE SEC.36 T32S,R23E SEC.1 T33S,R23E
	DATE <u>12/5/89</u> REV. _____ DWG.NO. _____

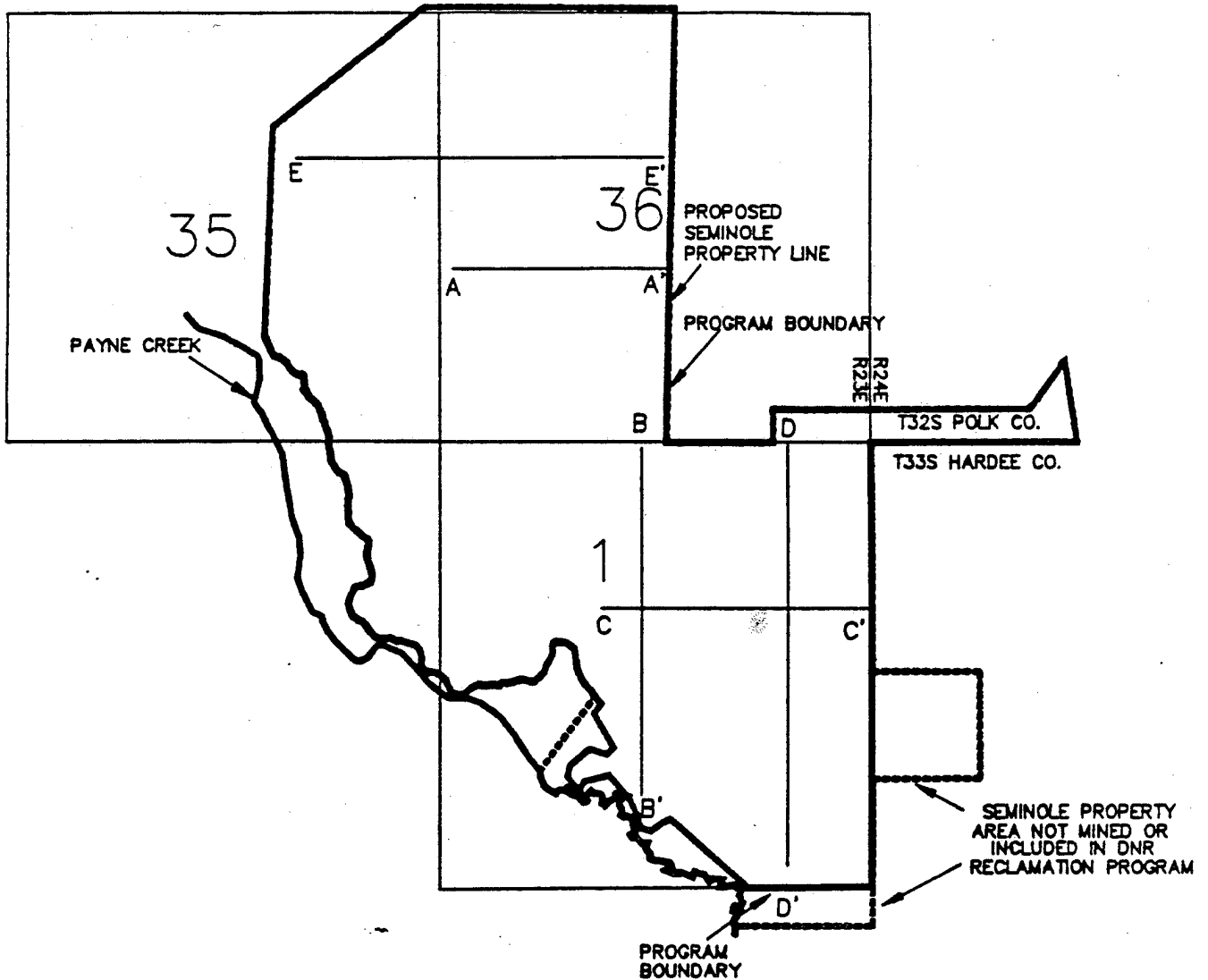




SAND TAILING AREAS



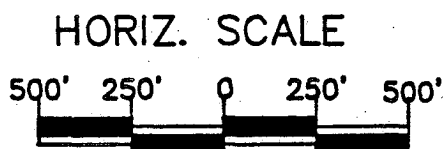
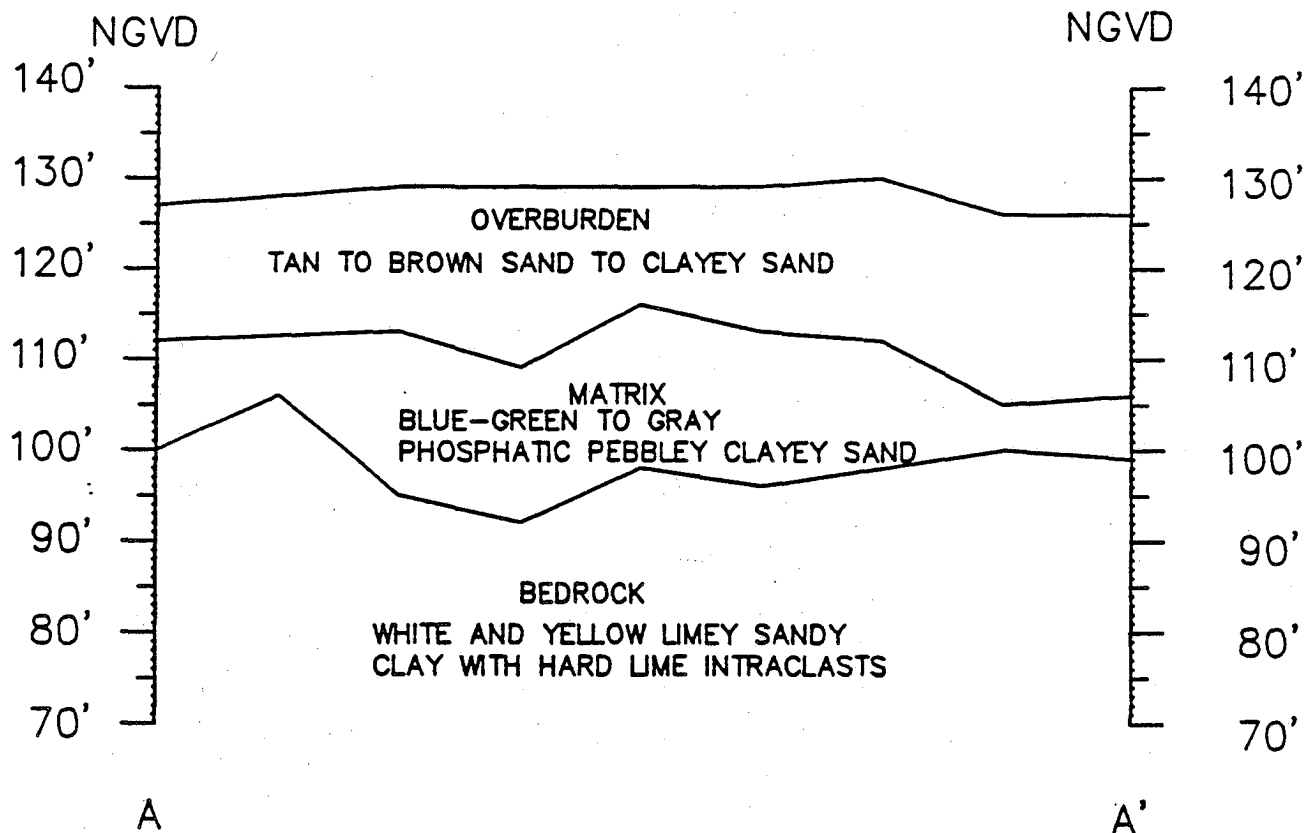
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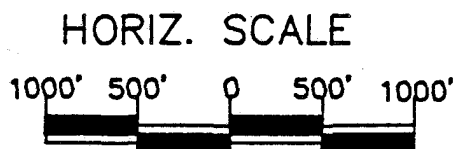
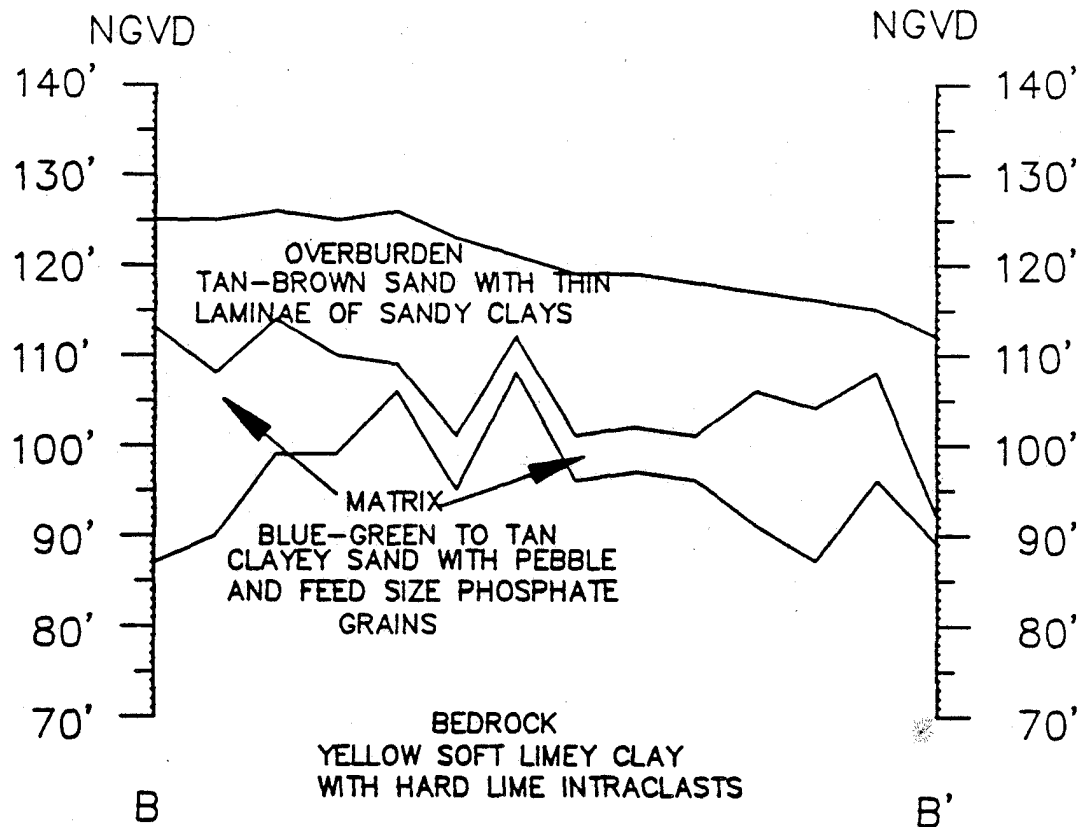
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	AGR PC-PC-1 CROSS SECTIONS LOCATIONS SEC.36 T32S,R23E SEC.1 T33S,R23E
DATE <u>12/4/89</u> REV. _____	



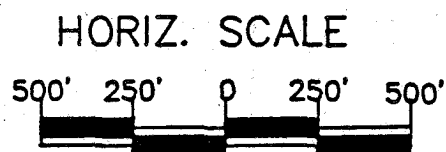
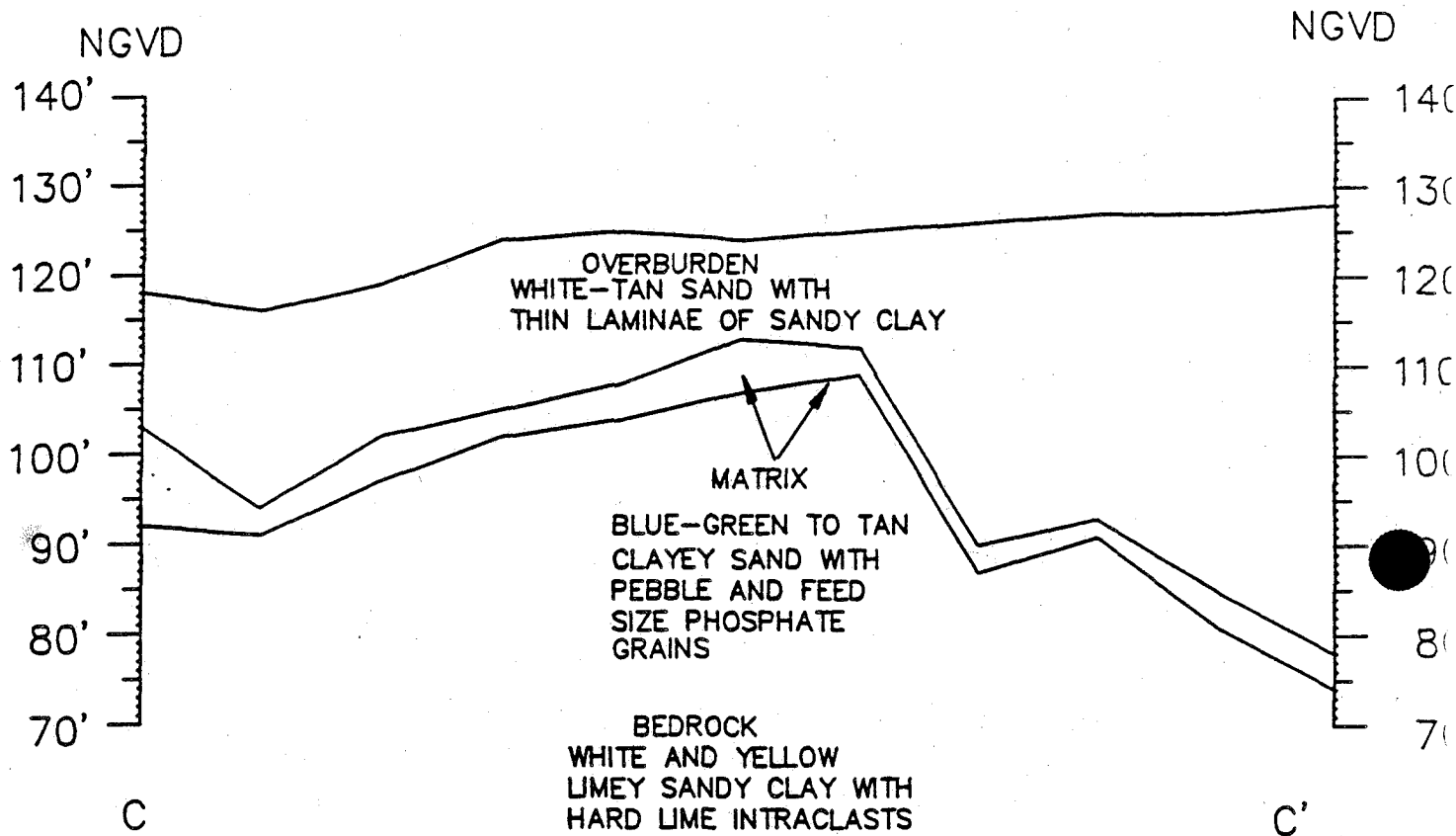
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GEOLOGICAL CROSS SECTION (A-A')	
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SEC.1 T33S,R23E	
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Image Quality

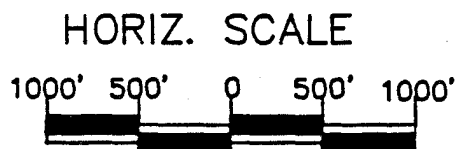
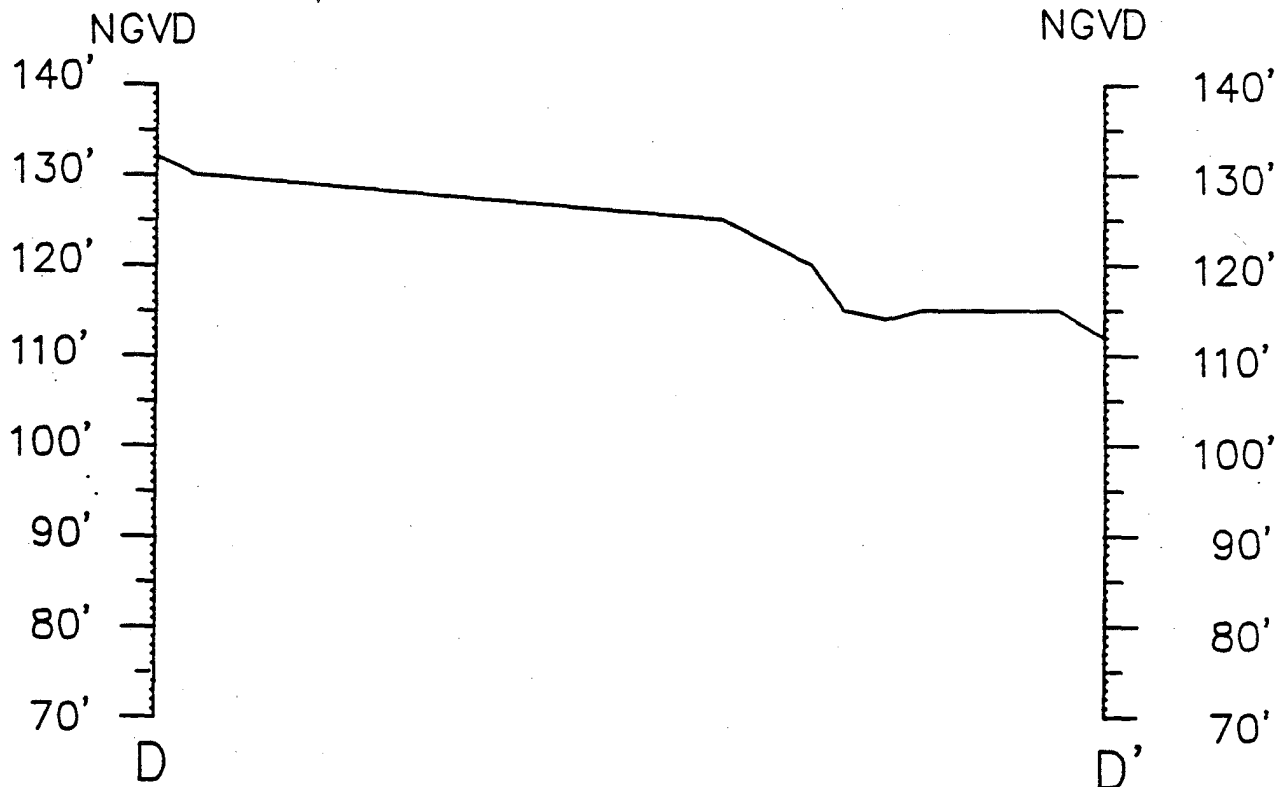
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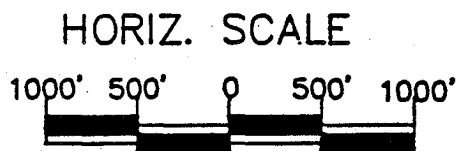
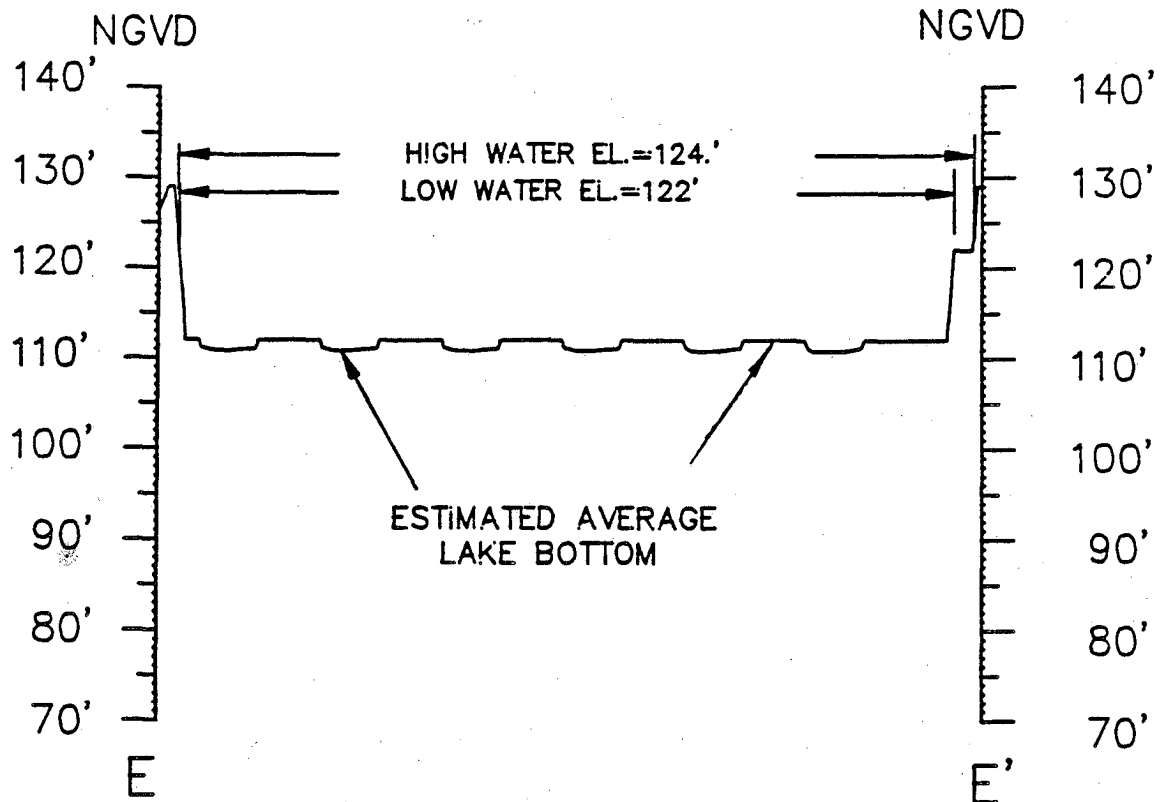
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SEC.36 T32S,R23E	
SEC.1 T33S,R23E	
DATE	12/4/89
REV.	



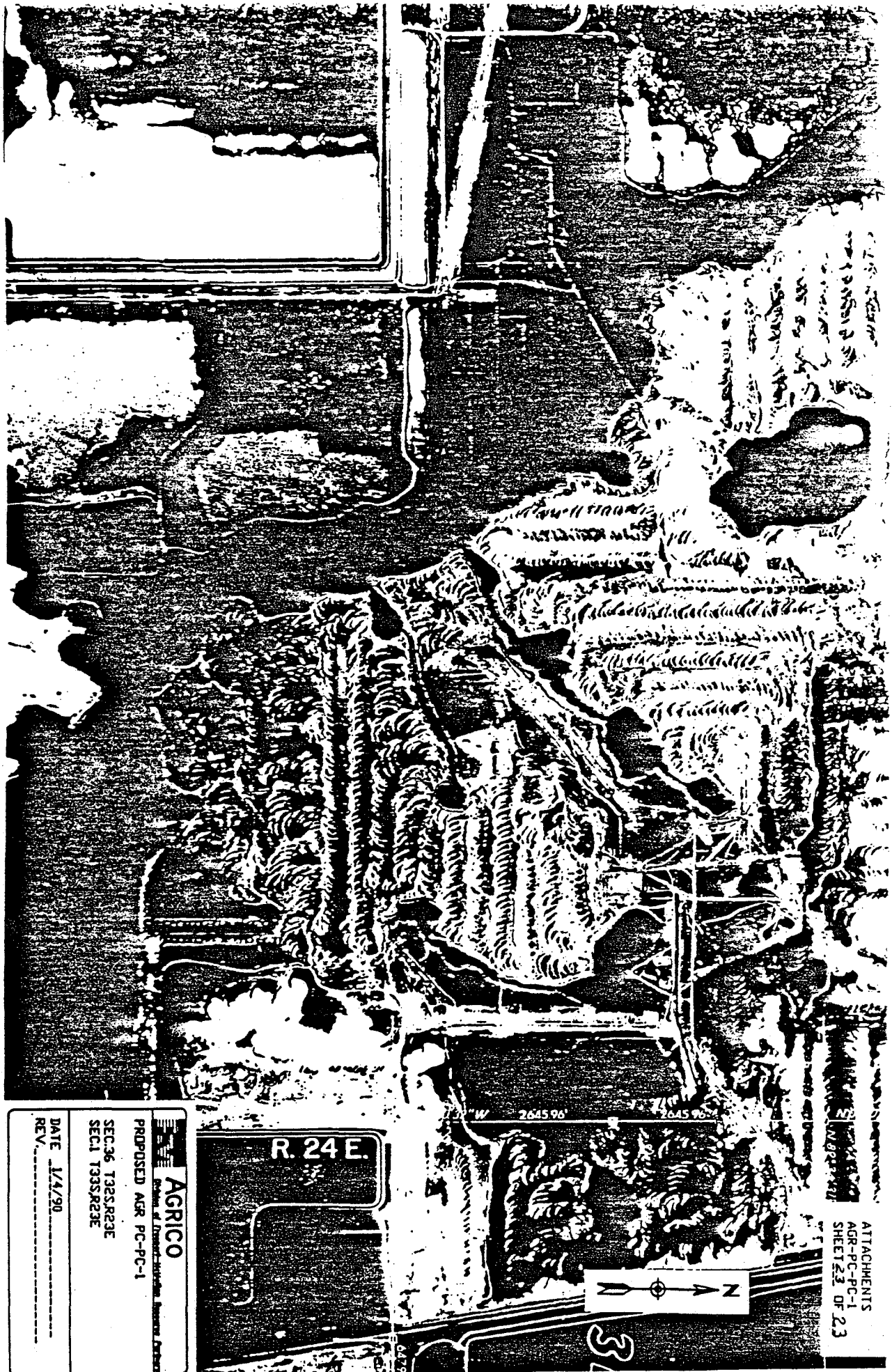
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	DATE <u>12/4/89</u> REV. _____



	AGRIC Division of Freeport-McMoan Resource Partners
AGR PC-PC-1 POST RECLAMATION CROSS SECTION (D-D') LOOKING EAST SEC.36 T32S,R23E SEC.1 T33S,R23E	
DATE <u>12/4/89</u>	
REV. _____	



 AGRICO Division of Freeport-McMoRan Resource Partners	
AGR PC-PC-1 POST RECLAMATION CROSS SECTION (E-E') LOOKING NORTH SEC.36 T32S,R23E SEC.1 T33S,R23E	
DATE	12/4/89
REV.	



ATTACHMENTS
AGR-PC-PC-1
SHEET 2.3 OF 2.3



R. 24 E.

AGRICOLA

PROPOSED AGR PC-PC-1

SEC. 26 T32S R23E
SECT 133S R23E

DATE 1/4/90
REV.

**11.12 CHARACTERIZATION OF HABITAT WITHIN THE
TRANSMISSION LINE CORRIDOR THROUGH CECIL M. WEBB
WILDLIFE MANAGEMENT AREA SOUTH TO THE LEE
SUBSTATION.**

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APPENDIX A -- TRANSMISSION LINE CORRIDOR LOCATIONS

1.0 INTRODUCTION

In support of licensing efforts for the 230-kilovolt (kV) transmission line from the Hardee Power Station in Hardee County south to the Lee substation in Lee County, KBN Engineering and Applied Sciences, Inc. (KBN) conducted a field survey of a proposed 100-foot (ft) right-of-way through the Cecil M. Webb Wildlife Management Area (WMA) (see Figure 1-1 in Appendix A). In addition, a detailed habitat survey of the proposed half-mile corridor running south of Webb WMA to the Lee Substation was completed (see Figure 1-2 in Appendix A). The surveys were conducted between January 15 and 22, 1990. Major habitats were described and the presence of any threatened or endangered species were noted. Species given special attention were the sandhill crane, the gopher tortoise, the Big Cypress fox squirrel, and the red-cockaded woodpecker.

The results of the surveys are presented in the following sections in the form of a narrative, starting at the entrance of the proposed right-of-way (ROW) onto the Webb WMA and continuing to the Lee substation.

2.0 RESULTS OF SURVEY

2.1 CECIL M. WEBB WMA RIGHT-OF-WAY

2.1.1 OVERVIEW OF HABITATS

A proposed ROW has been sited primarily along the boundary of Webb WMA and takes advantage of existing access roads and firebreaks (see Figure 1-1 in Appendix A). The ROW crosses a variety of pine flatwoods habitat and pasture. The location of the ROW has been chosen so that no cavity trees (active, inactive, or abandoned) of the red-cockaded woodpecker occur in the ROW. Additionally, the ROW will be constructed outside the known foraging areas of current red-cockaded woodpecker clans. Locations of abandoned and active cavity trees have been identified through field surveys and communications with Webb WMA personnel. The 30-meter (m) (100-ft) ROW will result in the loss of some pine flatwoods habitat outside the currently known red-cockaded woodpecker foraging areas. The ROW has been chosen so that contiguous areas of mature pines which could serve as habitat for the red-cockaded woodpecker and the Big Cypress fox squirrel are avoided. No gopher tortoise burrows were observed within the ROW. The ROW has been selected to avoid crossing any wetlands larger than 0.4 kilometer (km) (0.25 mile) in length. The ROW does pass next to several smaller wet prairies, which can be spanned by the transmission line. Sandhill cranes and various wading birds forage in low-lying open pastures and wet prairies on Webb WMA. The ROW has been selected to minimize the risk of bird collisions by avoiding major wetlands in Webb WMA, by not directly crossing isolated wetlands, and, where possible, by crossing at the narrowest sections of other surface water drainages. In other wetland areas, the ROW has been sited away from these wetlands to take advantage of pineland buffers. The ROW crosses approximately 42 ha (103 acres) of pine flatwoods, 18 ha (44 acres) of pasture/palmetto, and 4 ha (11 acres) of wetlands. The following is a narrative description of the habitats observed within the 30 m (100 ft) ROW starting from where the transmission line corridor enters the northern part of Webb WMA.

2.1.2 RIGHT-OF-WAY NARRATIVE

Section 1--Beginning at the junction of Section 35, 36, 2, and 1 and proceeding due west adjacent to the highway through Section 2 (see Appendix A, Figure 1-1, Page 1 of 4).

0 to 0.4 mile	Scattered young south Florida slash pine (<u>Pinus elliotti</u> var. <u>densa</u>) with a few older trees up to approximately 10 inches diameter at breast height (dbh). Very few older trees. Heavy, vigorous (evidence of flowering) wiregrass (<u>Aristida stricta</u>) groundcover. Patches of palmetto (<u>Serenoa repens</u>). Some wax myrtle (<u>Myrica cerifera</u>). Some chalky bluestem (<u>Andropogon capillipes</u>) mixed with wiregrass. Some runner oak (<u>Quercus</u> spp.).
0.6 to 0.7 mile	Wiregrass and other grasses with few trees (see Appendix A, Figure 1-1, Page 2 of 4).
0.7 to 1.0 mile	Mostly young pines, but with about 25 percent older trees. Some trees up to 10- to 12-inch dbh with flat tops indicating old age. Palmetto-wiregrass understory.
1.0 to 1.3 mile	Young, relatively dense pines. Generally 3- to 8-inch dbh. A few older trees. Heavy palmetto understory.
1.3 to 1.6 mile	Scattered young pines. A few older trees, but most less than about 8-inch dbh. Mixed grasses with some wiregrass in understory.
1.6 to 1.9 mile	Same as above, but with more vigorous wiregrass.
1.9 to 2.0 miles	Low area. Grassy with more wax myrtle.
2.0 miles	Raised road leading to field trial area. Australian pines (<u>Casuarina equisetifolia</u>) planted on berm are spreading into young pine/palmetto/wiregrass to west.
2.0 to 2.1 miles	Young pines with heavy saw palmetto/wax myrtle understory. Occasional melaleuca (<u>Melalueca quinquenervia</u>).
2.1 to 2.2 miles	Dense, young pines with a few old ones (not very large). Palmetto/wiregrass.

2.2 to 2.4 miles	Scattered, somewhat stressed pines. Trees have sparse needles which often indicates a wet site and marginal pine habitat. Some older trees. Mostly grassy understory with much wiregrass.
2.4 to 3.4 miles	Many older pines, some 10- to 12-inch dbh, but most smaller. Extensive wax myrtle in understory. Needs burning to maintain habitat. Two pine plantations to the south.
3.4 to 4.6 miles	Pasture. Scattered pine, beginning where ROW angles southwest from northern boundary around experimental eucalyptus (<u>Eucalyptus</u> spp.) grove to western boundaries.

Section 2--Beginning where ROW turns toward the south along western boundary of Webb WMA (see Appendix A, Figure 1-1, Page 3 of 4).

0.0 to 0.5 mile	Pasture.
0.0 to 0.4 mile	Pasture.

Section 3--Beginning on western boundary of Webb going due south where FPL line turns to the north (SW quadrant of Section 6) (see Appendix A, Figure 1-1, Page 3 of 4).

0 to 0.1 mile	Wetland. Depression with maidencane (<u>Panicum hemitomon</u>) and pickerel weed (<u>Pontederia cordata</u>). Grasses, including hairgrass (<u>Muhlenbergia capillaris</u>) around edges.
0.1 to 0.7 mile	Grasses, with low, sparse palmettos. Grassy understory is variable. Difficult to ascertain extent of wiregrass, since hairgrass and other similar-looking species are abundant.
0.7 to 0.9 mile	Patchy young pines and palmettos. A few older pines. There are young pines (1- to 6-inch dbh) along fenceline to the west, bordering Charlotte Ranchettes. Some of these are longleaf pine (<u>Pinus palustris</u>).
0.9 to 1.4 mile	Grasses with low, sparse palmettos.
1.4 to 1.5 miles	Patchy young pines and palmettos.
1.5 to 1.6 miles	Wetland surrounded by palmetto rim.

Maidencane and pickerel weed with spatterdock (Nuphar lutea) in deepest part along the west edge. Grass and sedge band just inside palmettos includes hairgrass, sand cordgrass (Spartina bakeri), and sawgrass (Cladium jamaicense).

1.6 to 2.3 miles

Patchy young pines and palmettos. Mixed grasses, including much wiregrass.

Section 4--Beginning at the Alligator Slough water control structure heading south (see Appendix A, Figure 1-1, Page 3 of 4).

0

Area highly disturbed by construction of weir. Many pines killed to the east by flooding and fire. Banks stabilized with bahiagrass (Paspalum notatum).

0 to 0.1 mile

Some dead pines. Many old (both dead and alive), but few over 8-inch dbh. Disturbed wiregrass understory.

0.1 to 0.2 mile

Few trees. Wiregrass understory, but not especially vigorous. May be relatively heavily grazed. Patchier, shorter, more variable grass. A few melaleuca.

0.2 to 0.3 mile

Wetland. Wet prairie grasses and sedges.

0.3 to 0.5 mile

Scattered young pines. Palmetto/wiregrass understory.

Corridor turns to the southwest:

0.6 to 0.9 mile

Prairie. Wiregrass and other grasses. Palmetto patches. Variable seasonal flooding.

0.9 to 1.0 mile

Scattered pines.

1.0 to 1.2 miles

Prairie. Wiregrass and other grasses. Palmetto patches. Variable seasonal flooding.

This point is at jeep road that goes southeast from Jones Loop into Webb.

1.2 to 1.3 miles

Mostly young pines. Palmetto understory. Patchy recent burn.

1.3 to 1.8 miles	Wet prairie. Mixed grasses and sedges with much maidencane. Distinct border of low palmettos.
1.8 to 1.9 miles	Young pines. Recently burned. No wiregrass.
1.9 to 2.2 miles	Wiregrass. Recently burned.
2.2 to 2.3 miles	Old pasture. Bahia. Recently burned with patchy fire.
2.3 to 2.9 miles	Wiregrass, low palmettos, and wax myrtles. Eastern half recently burned.
This point is at the east end of rock pit.	
2.9 to 3.2 miles	Mostly bare ground with some bahiagrass and weeds. Sod has been removed.
3.2 to 3.4 miles	Bahia pasture with a few scattered young pines.
3.4 to 3.6 miles	Dense stand of more mature pines. Palmetto and wiregrass.
3.6 to 3.9 miles	Old bahia pasture heavily invaded by Brazilian pepper (<u>Schinus terebinthifolius</u>) and wax myrtle. Some young pines and palms.
Corridor turns due south (see Appendix A, Figure 1-1, Page 4 of 4).	
3.9 to 4.1 miles	Habitat same as previous.
4.1 to 4.3 miles	Dense stand of relatively large pines, but few look old. Some cabbage palms (<u>Sabal palmetto</u>). A few live oaks.
4.3 to 4.9 miles	Scattered large pines, some old. Heavy palmetto understory.
4.9 to 5.0 miles	Floodplain palm/oak hammock. Some bromeliads, serpent fern (<u>Polypodium aureum</u>). Royal fern (<u>Osmunda regalis</u> var. <u>spectabilis</u>) and palmetto along creek.
5.0 to 6.3 miles	Mostly young pines 6- to 8-inch dbh, but some old ones. Heavy palmetto understory. Occasional live oaks (<u>Quercus virginiana</u>). Some eucalyptus, especially to the south. Some wiregrass and wax myrtle.

Section 5--Beginning at Interstate, heading due south (see Appendix A, Figure 1-1, Page 4 of 4).

0 to 1.5 mile	Canal berm dropping off into overgrown pineland to the east. Pines are almost all young. 6- to 8-inch dbh. Melaleuca is abundant. Mostly small, but some 20 ft tall. Palmettos, mixed grasses. A little downy myrtle (<u>Rhodomirtus tomentosus</u>), laurelleaf greanbrier (<u>Smilax laurifolia</u>), wax myrtle, Brazilian pepper. Weeds on berm. Occasional cattails (<u>Typha</u> spp.) and white waterlilies (<u>Nymphaea odoratus</u>) in ditch, torpedograss (<u>Panicum repens</u>) along edges.
1.5 to 1.7 miles	Tuckers Grade.
Grassy, weedy berm continues along the west edge of:	
1.7 to 2.0 miles	Cleared field. Mostly bare. Some weedy grasses and forbs. A few melaleuca.
2.0 to 2.4 miles	Young pines. Palmetto understory. Some Brazilian pepper.
2.4 to 2.8 miles	Wet prairie. Deer hider (<u>Stillingia aquatica</u>) and St. Johns wort (<u>Hypericum</u> spp.) around edge. Large patches of maidencane. Hairgrass around edges. Center looks like rush (<u>Juncus</u> spp.).
2.8 to 3.1 miles	Pines. Some moderately old, most young. Palmetto.
3.1 to 3.5 miles	Wet prairie (same as previous). Some older pines around edges.
3.5 to 3.6 miles	Tiny hammock remnant with palms, dahoon (<u>Ilex cassine</u>), wax myrtle, swamp fern (<u>Blechnum serrulatum</u>), palmetto.
3.6 to 3.7 miles	Wet prairie (same as previous).
3.7 to 4.0 miles	Pineland with trees of mixed ages, most young. Wax myrtle/palmetto understory. Hairgrass.

Corridor crosses railroad at Marker 945.

- | | |
|------------------|--|
| 4.0 to 4.7 miles | Young pines with dense understory of saw palmetto and wax myrtle. Some eucalyptus and melaleuca, dense in places. |
| 4.7 to 4.8 miles | Medium-size (6- to 8-inch dbh) pines over better palmetto, myrtle, and wiregrass understory. |
| 4.8 to 5.2 miles | Pines up to 6- to 10-inch dbh, but not very old looking. Also, numerous young trees. Dense palmetto, some gallberry (<u>Ilex glabra</u>). |
| 5.2 to 5.5 miles | Wet prairie with deer hider and St. Johns wort around edges. Hairgrass. Some melaleuca. Bog buttons (<u>Lachnacaulon</u> spp.). Yellow-eyed grass (<u>Xyris</u> spp.). Maidencane in center. |
| 5.5 to 5.7 miles | Weedy thicket with Brazilian pepper, dog fennel (<u>Eupatorium</u> spp.), melaleuca, saltbush (<u>Baccharis</u> spp.), some young pines. |

Fire tower at end of Webb corridor.

- | | |
|-----------------|---|
| 0.4 to 0.6 mile | Same as above, but with numerous cabbage palms, somewhat more wax myrtle, and some gallberry. |
|-----------------|---|

2.2 CORRIDOR SOUTH OF WEBB WMA TO LEE SUBSTATION

2.2.1 OVERVIEW OF HABITATS

Habitats in this section of the corridor are dominated by pine flatwoods interspersed with wet and dry prairies. There are a few cypress domes/strands, one small scrub, and some scattered residential development. The section of corridor from the Webb WMA south to the Lee substation was selected to minimize impacts to the heavily developed areas to the east along Highway 41. Based on the survey, the corridor was adjusted to avoid red-cockaded woodpecker nesting sites.

2.2.2 CORRIDOR NARRATIVE

The following narrative describes the habitats and wildlife observed within the corridor south of the Webb WMA. This survey covered a corridor a

quarter-mile to a half-mile wide. Most of the habitat changes occurred as gradual transitions. Therefore, it was not practical to convey this information in the same segment-by-segment style used for the 100-ft ROW through Webb WMA. The following narrative describes the habitats observed. The survey results are described in a north-to-south direction from Webb WMA. The following references locate the areas surveyed in relation to the point where the corridor enters relatively natural habitats south of the U-pick farm located on the west side of U.S. Highway 41 (see Appendix A, Figure 1-2).

- Mile 0--Intersections of Sections 11/12 and Sections 14/13
- Mile 1--Sections 14/13
- Mile 2--Sections 23/24
- Mile 3--Sections 26/25
- Mile 4--Sections 35/36
- Mile 5--Sections 2/1
- Mile 6--Sections 11/12
- ~Mile 7--Sections 14/13
- ~Mile 8--Section 24
- ~Mile 9--Section 30
- ~Mile 10--Section 29
- ~Mile 11--Section 28

The corridor leaves Webb along the boundary between Sections 11 and 12 (see Appendix A, Figure 1-2, Page 1 of 4). It crosses the Florida Division of Forestry fire tower property where continuation of the ROW would run the transmission lines across an open field between the buildings and U.S. Highway (U.S.) 41. The corridor continues south across the highway and a large produce farm with a U-pick operation and, to the north, a retail sales stand.

The northern two-thirds of the stretch through Sections 13 and 14 is generally young pine flatwoods interspersed with small patches of wet to dry prairie. From this area south through Section 23, active use and management of the land as rangeland is evident. At the extreme northern

end of this segment, the flatwoods are mesic and somewhat disturbed with bahiagrass between the palmetto clumps in the groundcover. There are some melaleuca stands. The pinelands grade southward into more xeric open flatwoods with saw palmetto, wiregrass, fetterbush (Lyonia ferruginea), shiny blueberry (Vaccinium myrsinites), gopher apple (Licania michauxii), chalky bluestem, liatris (Liatris spp.), and runner oak (Quercus spp.). Entering the southern third of this segment, a large ditch crosses the pineland diagonally. South of the ditch, the western part of the corridor is a treeless dry prairie dominated by dense saw palmettos about 3 feet tall. A grassy wet prairie is to the east.

From this area south through Section 23, the corridor is pine flatwoods with patches of wet prairie. Except for small stands north of Section 23, the pines are virtually all young. In most areas, there is an open understory of frequently burned wiregrass thickly scattered with palmetto clumps. Wax myrtle is abundant in lower spots and there are a few areas of melaleuca invasion.

The habitat is very similar south of the boundary between Sections 23 and 26, but it has not been as actively managed for grazing. There are fewer signs of cattle activity and a heavier understory that has not been burned so frequently. Going south through Sections 26, 35/36, 2/1, and 11/12, the same type of generally young pinelands continue to dominate the landscape, but melaleuca (and, to a lesser extent, Brazilian pepper) invasion and evidence of off-road vehicle (ORV) activity increase and evidence of cattle use decreases (see Appendix A, Figure 1-2, Page 2 of 4). There are a few small clumps of cypress trees in the wettest places.

From Sections 35/36 southward, there are occasional tiny hammocks in the wet prairies. Heavy ORV traffic is clearly playing a role in changing these areas from small patches of pines and palms into more genuinely hammock vegetation. Intense ORV activity has left bare swaths of unvegetated ground around these islands of vegetation. These swaths function as firebreaks and allowing the survival of fire-sensitive plants,

such as cabbage palm, slash pine, dahoon holly, swamp bay (Persea palustris), myrsine (Myrsine guianensis), live oak, wax myrtle, saw palmetto, and swamp fern.

There are areas of deeper wetlands in Sections 2/1. The central parts of many of the wet prairies are fire flag (Thalia geniculata) marshes that hold water most of the year. A Y-shaped slough crosses the corridor in the north part of this segment. The western trunk of this Y is a cypress strand with maidencane and fire flag in the center. The northeastern fork is an extremely wet flatwoods with small slash pines apparently stressed by the long hydroperiod and an understory of grasses and wax myrtle. The southeastern fork is wet prairie with fire flag in the deepest part. Heavy ORV traffic has eliminated almost all of the wet prairie vegetation.

A few older trees begin to appear in Sections 2/1, but no stands of significant extent were noted north of the southern part of Section 11. From the boundary of Sections 11/12 and 14/13 southward through Section 23, there are patches of generally very small and contorted old pines, many of which are so stressed and dwarfed that they are reminiscent of the dwarf cypress (Taxodium distichum) in the Big Cypress Swamp. In most places, these pines are mixed with younger trees and melaleuca to the extent that the habitat must be considered only marginal for red-cockaded woodpeckers.

No signs of red-cockaded woodpeckers were observed in the corridor, although evidence of a clan was noted in the southwest corner of Section 13, where more extensive stands of older trees extend to the west. One active cavity, one active start hole, and three abandoned cavities were observed in this area. Without active melaleuca control, this habitat cannot be expected to sustain red-cockaded woodpeckers for more than a few years. The corridor location has been revised to avoid this area.

North of the Gator Slough Canal in Section 24, melaleuca and Brazilian pepper invasion, heavy ORV traffic, dumping, fire suppression, and other human disturbances have dramatically altered the character of the

flatwoods. The wetland pockets are essentially highly disturbed mud holes with patches of fire flag and/or willow (Salix caroliniana) near the center.

South of the canal, homes are being constructed on large ranchette-type lots. Vegetation includes both improved and well-grazed unimproved pasture and overgrown pine flatwoods (see Appendix A, Figure 1-2, Page 3 of 4). The flatwoods have trees of various ages and a generally tall, dense understory of saw palmetto, Brazilian pepper, wax myrtle, and melaleuca. There is considerable live oak and myrtle oak (Quercus myrtifolia) in places, but no real scrub. These areas might be considered marginal scrub jay habitat, but no scrub jays were observed. In some places, the heavy understory fuel accumulation has burned and the heat of the fire has killed the pines and left a dense thicket of saw palmetto with some fetterbush. There are a few small ponds with willow, fire flag, and maidencane. Two-thirds of the way down this segment, a wet prairie occupies the western portion of the corridor. There is a fire flag pond in the center. Hairgrass, maidencane, deer hider, wax myrtle, and sawgrass grow around the pond and pines, whereas melaleuca, dog fennel, and broomsedge are invading the prairie edges. South of the prairie is a tiny hammock with cabbage palm, slash pine, live oak, redbay (Persea borbonia), myrsine, palmetto, and swamp fern.

The narrow north-south segment through Section 30 is mostly a mixture of young pines and melaleuca with patches of large saw palmettos, wax myrtle, and Brazilian pepper, but there is a small willow marsh in the northern end. This marsh has a tiny patch of fire flag in the center.

The western end of the east-west segment of the corridor across Section 30 is young pine flatwoods with a degraded understory of soft rush (Juncus effusus) and maidencane heavily invaded with melaleuca grading eastward into wiregrass/palmetto beneath middle-aged pines. The central portion is palmetto thicket. The eastern half is burned-out pineland with much palmetto and many snags. The grassy understory includes sawgrass and sand

cordgrass. Where pines survive, they are generally large, relatively young trees. The understory is wiregrass/palmetto heavily invaded by melaleuca, wax myrtle, Brazilian pepper. A pileated woodpecker was observed foraging here.

The edge of a wet prairie extends into the northern border of this segment in the east-central part of Section 30. This prairie, which is dominated by soft rush and has patches of sawgrass, cattail, and open water in deeper portions, appears to be well utilized as a wading bird feeding and roosting area. The survey team observed one wood stork, two immature white ibis, one killdeer, one little blue heron, one great egret, and about 12 common gallinules feeding in this pond. A great blue heron and six snowy egrets were resting in the cattails.

The trail from this prairie eastward to the pond on the boundary between Section 30 and Section 29 appears to be a heavily utilized wildlife corridor. Tracks of foxes, bobcats, armadillos, raccoons, and other animals were abundant along this route.

Pond is bordered by cattails, wax myrtle, and Brazilian pepper. There is bahiagrass on higher ground to the east.

The east-west segment from the pond on the boundary between Sections 30 and 29 eastward has a slash pine plantation at its western end. The trees are young, but large enough to harvest for pulpwood. There is a heavy carpet of pine needles covering the ground. Many palmettos have been left in the understory. The rest of this segment is young pine flatwoods with occasional cabbage palms, oaks, and hog plum (Ximenia americana) and extensive clumps of big saw palmettos. Old logging slash is still evident. A patchy wiregrass understory persists. There is some melaleuca invasion and a few Brazilian peppers and badly freeze-damaged Java plums (Syzygium cumini). The remains of several reptilian eggs presumably preyed upon by raccoons were observed midway through this segment. The species could not be determined.

The narrow north-south segment through Section 29 has a thicket of tall saw palmettos in its southern portion. There are some scrub species here, including shiny blueberry, pennyroyal (Pilobiephis rigida) fetterbush, and a few myrtle oaks and sand live oaks (Quercus geminata). One gopher tortoise burrow was observed in this habitat. The northern end is young pineland with a good wiregrass understory in some places and disturbed ground with bahiagrass and broomsedge in others.

The short, narrow, east-west segment on the eastern side of Section 29 is patchy young pine forest with a degraded wiregrass/palmetto understory heavily invaded by melaleuca.

The edge of a cypress dome protrudes into the northern half of the east end of this segment. The dome has a sawgrass understory and live oaks and wax myrtle around the edge. There are some cabbage palms with serpent fern. A ditch and berm separates the wetland from the pineland.

The northwest quadrant of Section 28 is mesic flatwoods with areas of wet to dry prairie (see Appendix A, Figure 1-2, Page 4 of 4). The overgrown understory of large saw palmetto, wax myrtle, Brazilian pepper, gallberry, and live oak indicates fire has been infrequent in recent years. Melaleuca invasion is extensive. There are scattered cabbage palms, some of which support serpent ferns. Sawgrass is notable in a few low grassy areas. In the eastern part of the corridor, the pines are generally large, but young. In the western part just east of the point where the narrow corridor coming from the west broadens eastward, is a stand of relatively large old trees. The wiregrass/palmetto understory has been so heavily invaded by melaleuca that it no longer has the open character of red-cockaded woodpecker habitat. Trails throughout this segment of the corridor indicate regular horseback riding use.

Along the north-central border of this segment is a large wet prairie dominated by soft rush. Musk-grass (Chara spp.) is the dominant submerged species in two ponds in the deepest part. These areas have patches of fire

flag, cattail, and giant reed (Phragmites australis) around the edges. There are several tiny hammocks of cabbage palm and wax myrtle scattered around the prairie.

The northeastern corner of this segment of the corridor is an expansive thicket of palmetto with small patches of wiregrass groundcover and a few other shrubs, such as fetterbush. There is a little runner oak and chalky bluestem.

An area of scrub on white sand is in the southwestern quadrant of Section 28. This area is dominated by dense saw palmetto with many large scrub oaks up to 15 to 20 ft. Myrtle oak is particularly prominent. Other species include fetterbush, shiny blueberry, goldenrod (Solidago spp.), greenbriar (Smilax spp.), and dwarf wax myrtle. There is very little reindeer moss (Cladonia spp.). The area is not very diverse, but shows little sign of exotic invasion or other disturbance other than light use for horseback riding. Many animal tracks cross the area. No evidence of fire for many decades is indicated. There has been extensive slash pine and cabbage palm invasion around the edges. There is only about an acre with no trees other than oaks. Serpentine fern grows on many of the palms, but shows much freeze damage. The area still appears to provide scrub jay habitat, but no jays were observed. The proposed corridor avoids this area.

To the west and north of the Lee Substation is bahiagrass pasture with scattered cabbage palms.

APPENDIX A
TRANSMISSION LINE CORRIDOR LOCATIONS

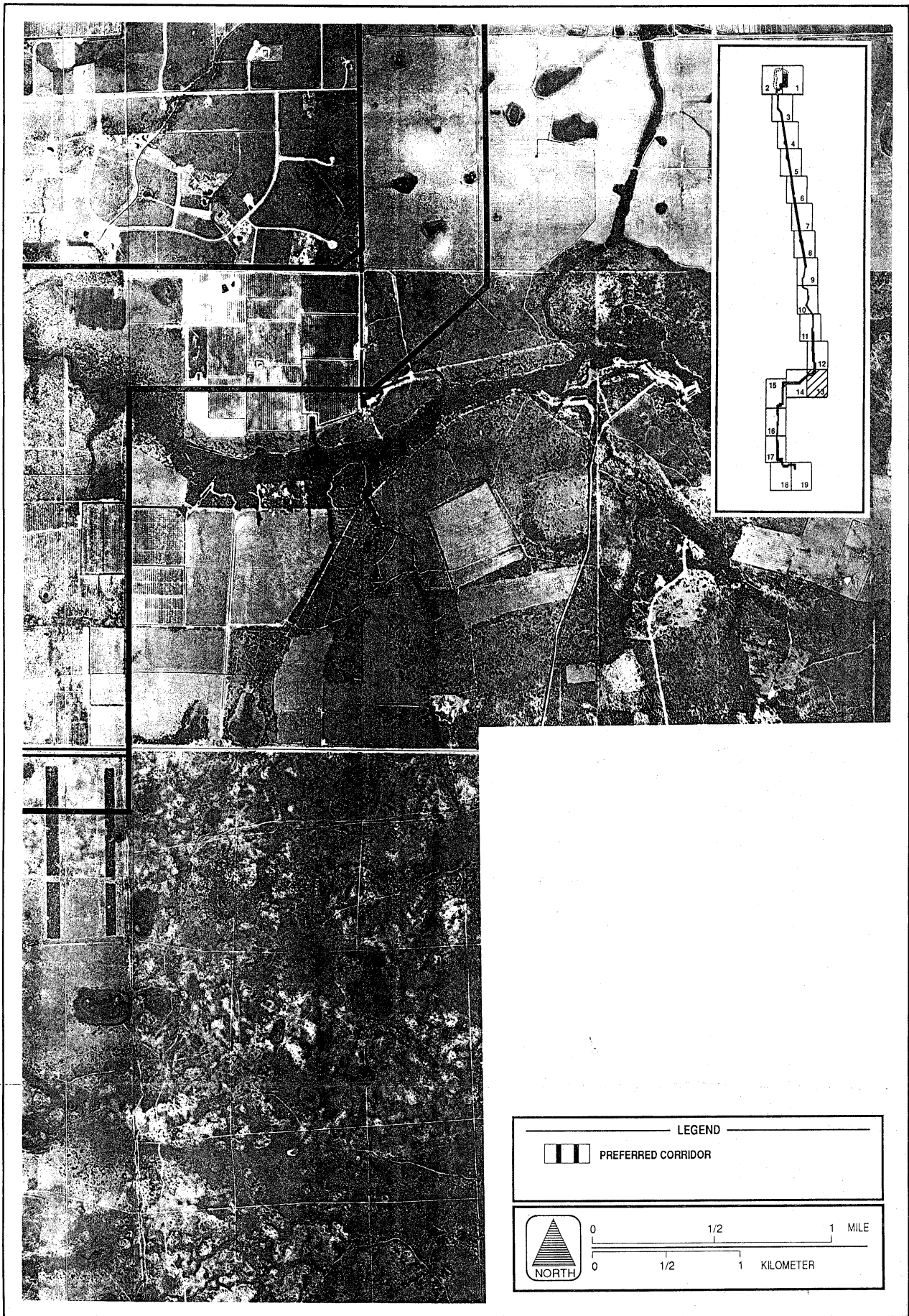


Figure 1-1 TRANSMISSION LINE CORRIDOR AND RIGHT-OF-WAY WITHIN
CECIL M. WEBB WILDLIFE MANAGEMENT AREA
(PAGE 1 OF 4)

**Hardee
Power Station**

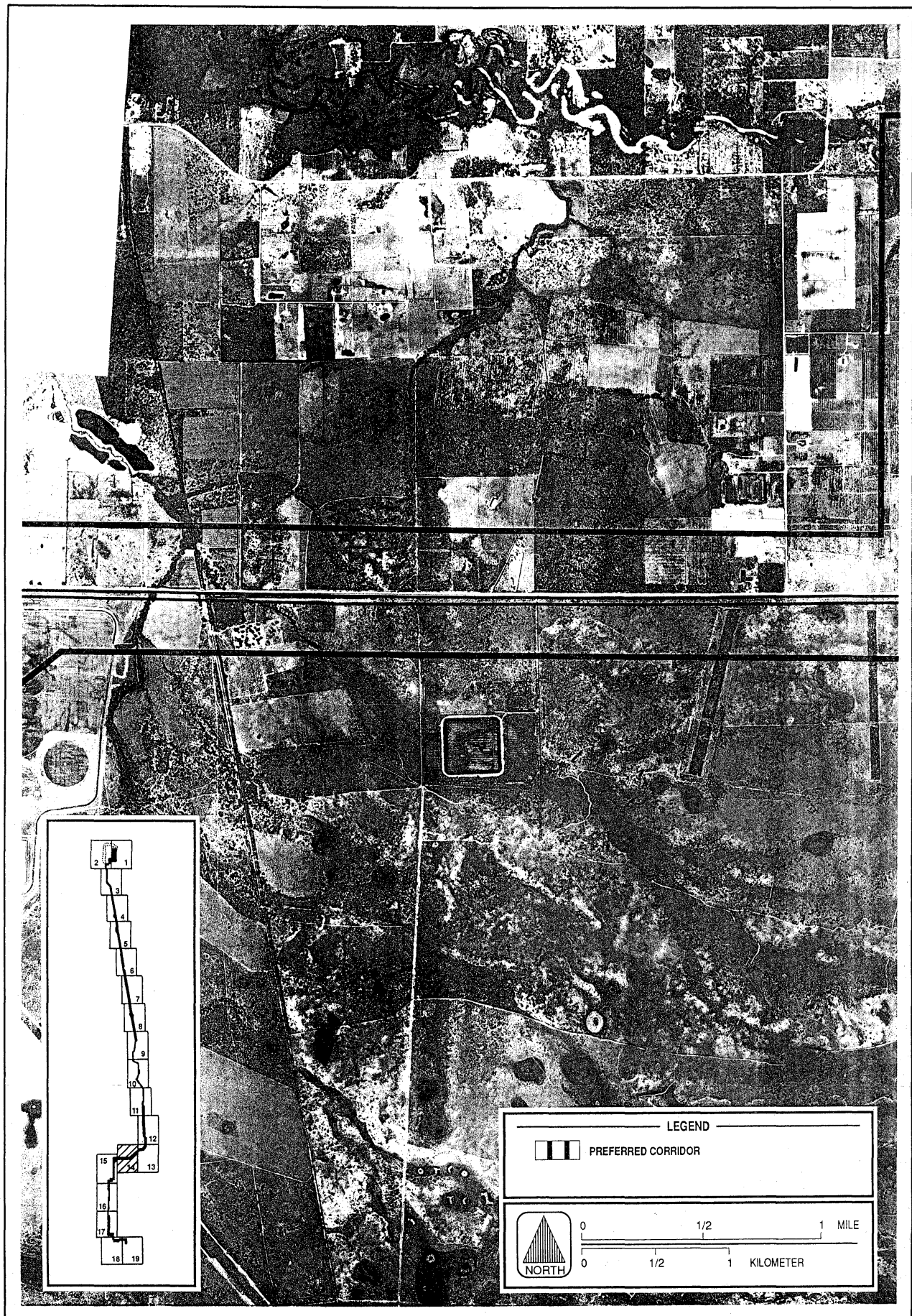


Figure 1-1 TRANSMISSION LINE CORRIDOR AND RIGHT-OF-WAY WITHIN
CECIL M. WEBB WILDLIFE MANAGEMENT AREA
(PAGE 2 OF 4)

**Hardee
Power Station**

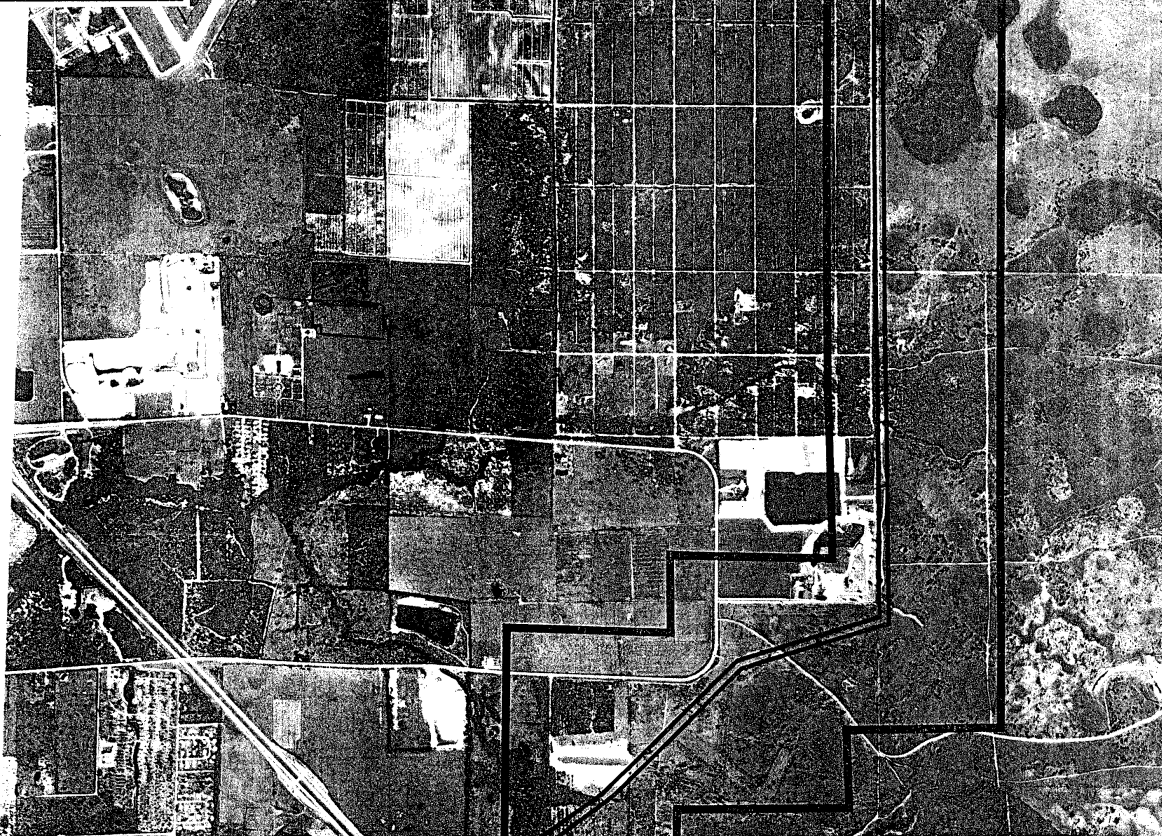
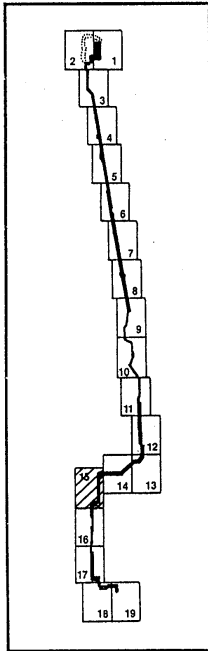
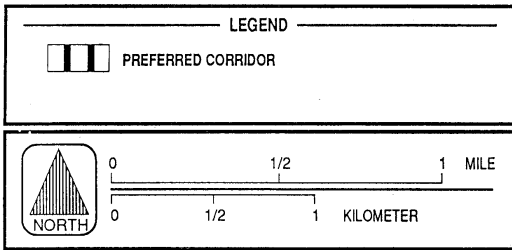


Figure 1-1 TRANSMISSION LINE CORRIDOR AND RIGHT-OF-WAY WITHIN
CECIL M. WEBB WILDLIFE MANAGEMENT AREA
(PAGE 3 OF 4)

**Hardee
Power Station**

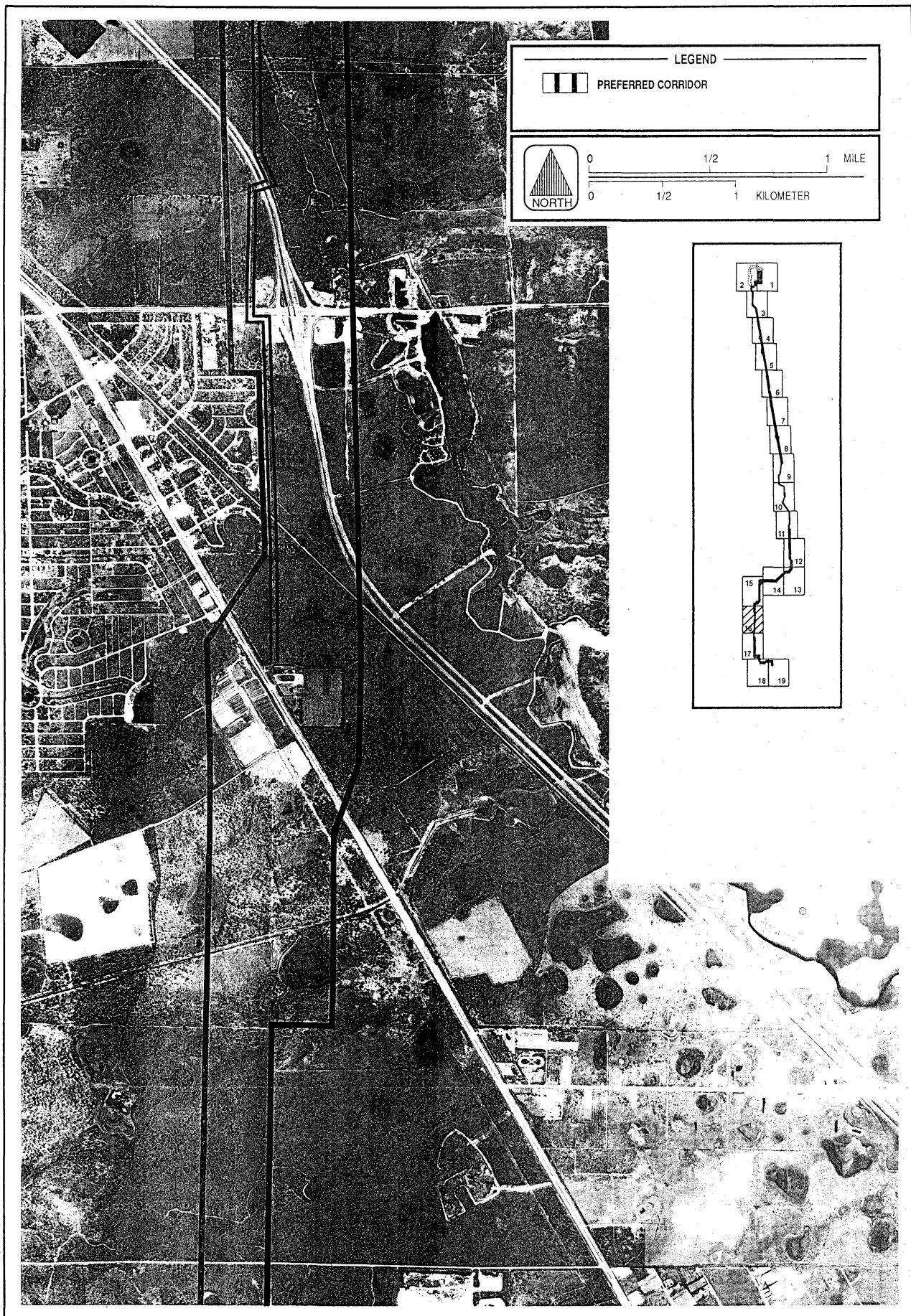


Figure 1-1 TRANSMISSION LINE CORRIDOR AND RIGHT-OF-WAY WITHIN
CECIL M. WEBB WILDLIFE MANAGEMENT AREA
(PAGE 4 OF 4)

**Hardee
Power Station**

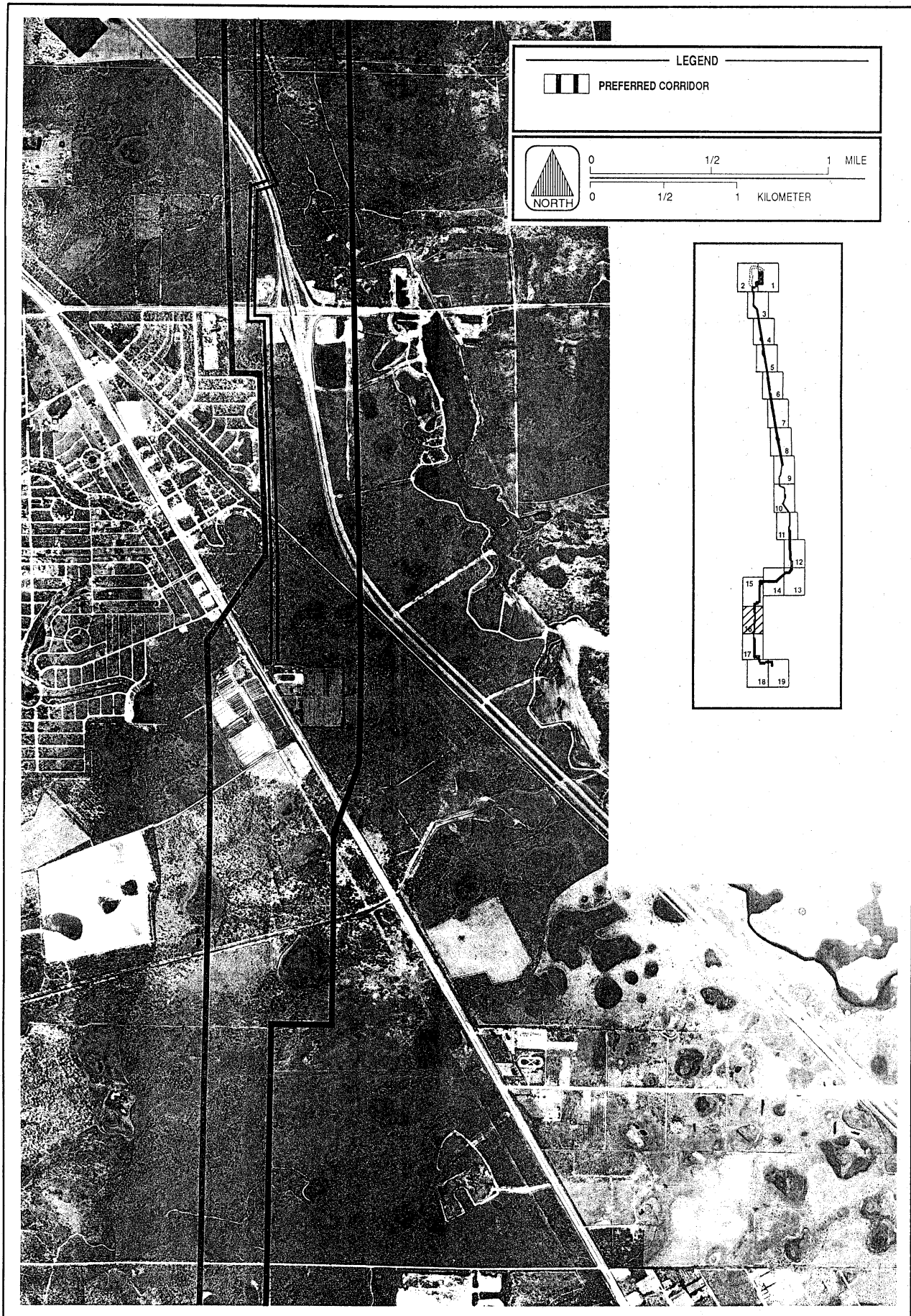


Figure 1-2 TRANSMISSION LINE CORRIDOR SOUTH OF CECIL M. WEBB
WILDLIFE MANAGEMENT AREA TO LEE SUBSTATION
(PAGE 1 OF 4)

**Hardee
Power Station**

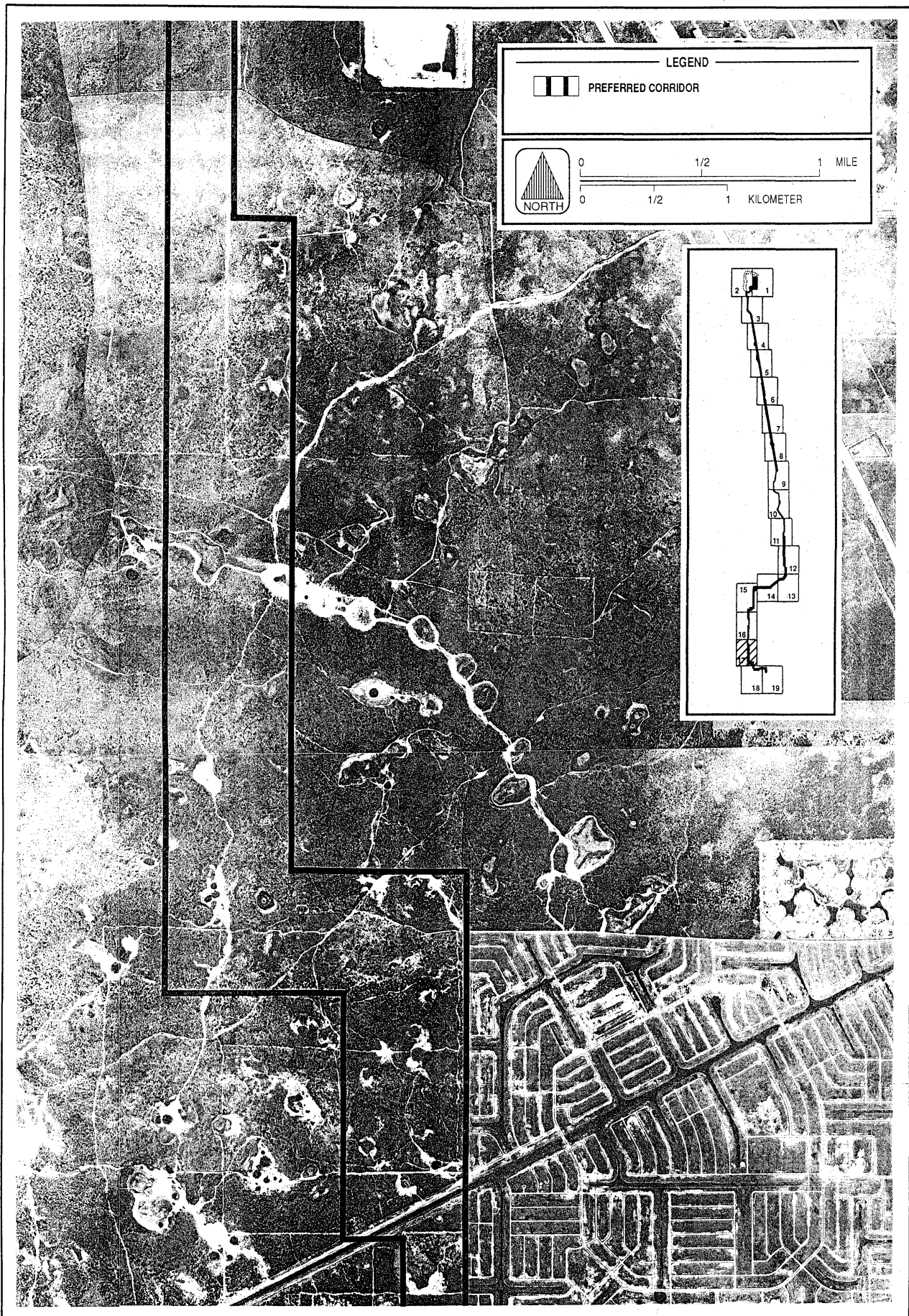


Figure 1-2 TRANSMISSION LINE CORRIDOR SOUTH OF CECIL M. WEBB
WILDLIFE MANAGEMENT AREA TO LEE SUBSTATION
(PAGE 2 OF 4)

**Hardee
Power Station**

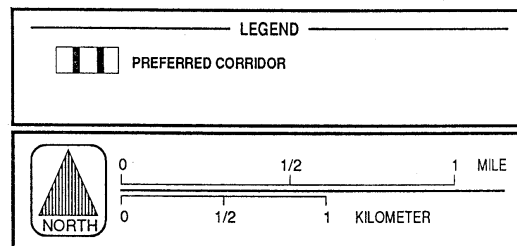
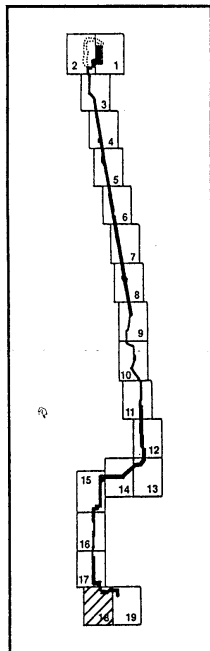
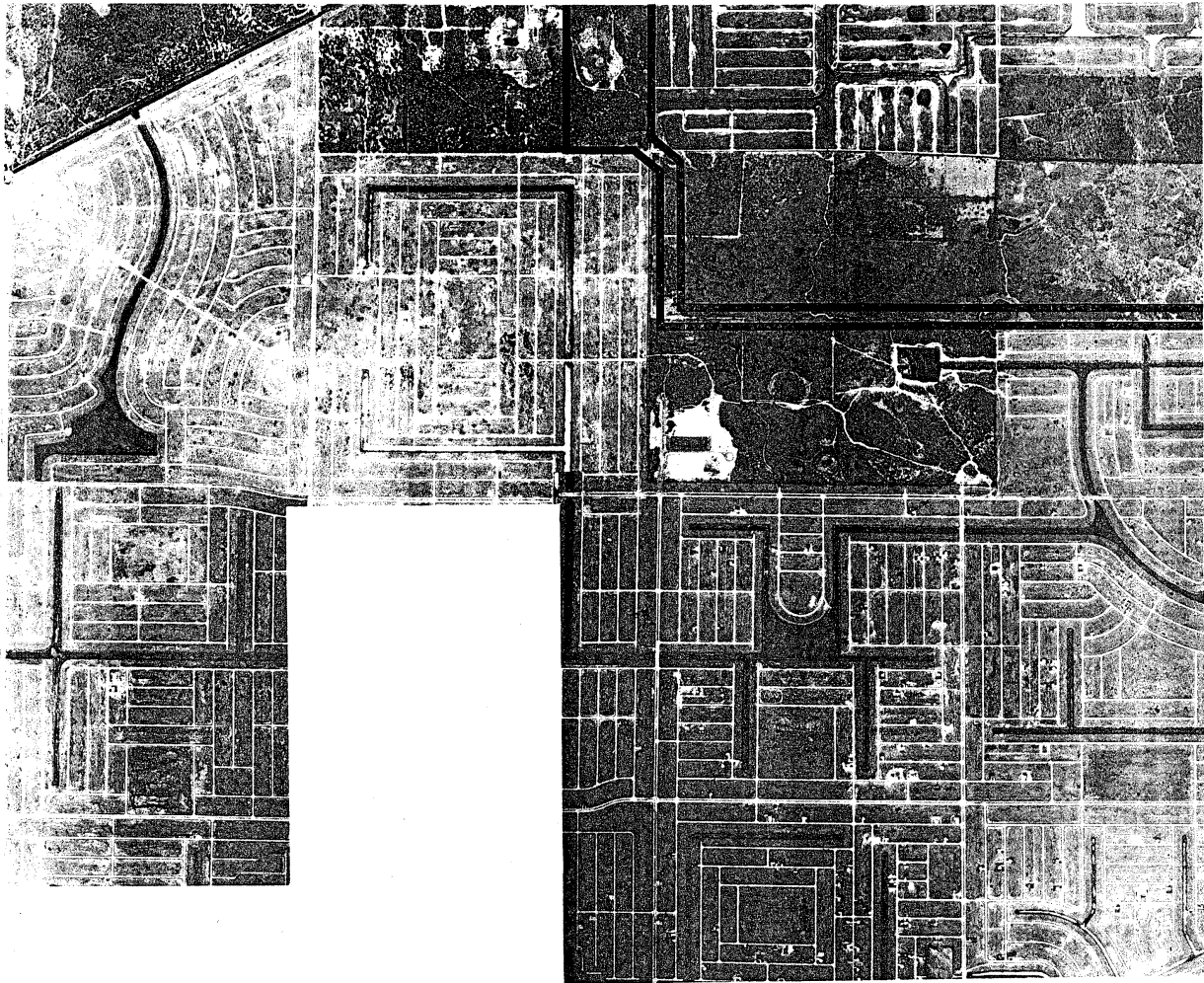


Figure 1-2 TRANSMISSION LINE CORRIDOR SOUTH OF CECIL M. WEBB
WILDLIFE MANAGEMENT AREA TO LEE SUBSTATION
(PAGE 3 OF 4)

**Hardee
Power Station**

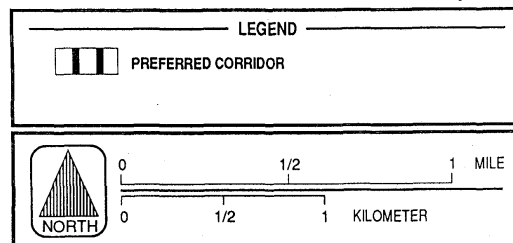
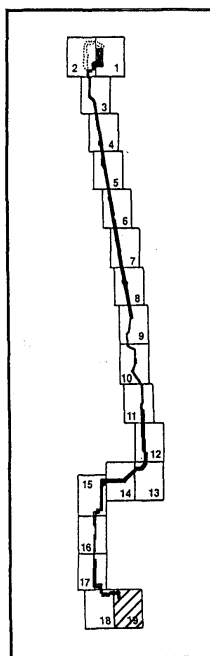
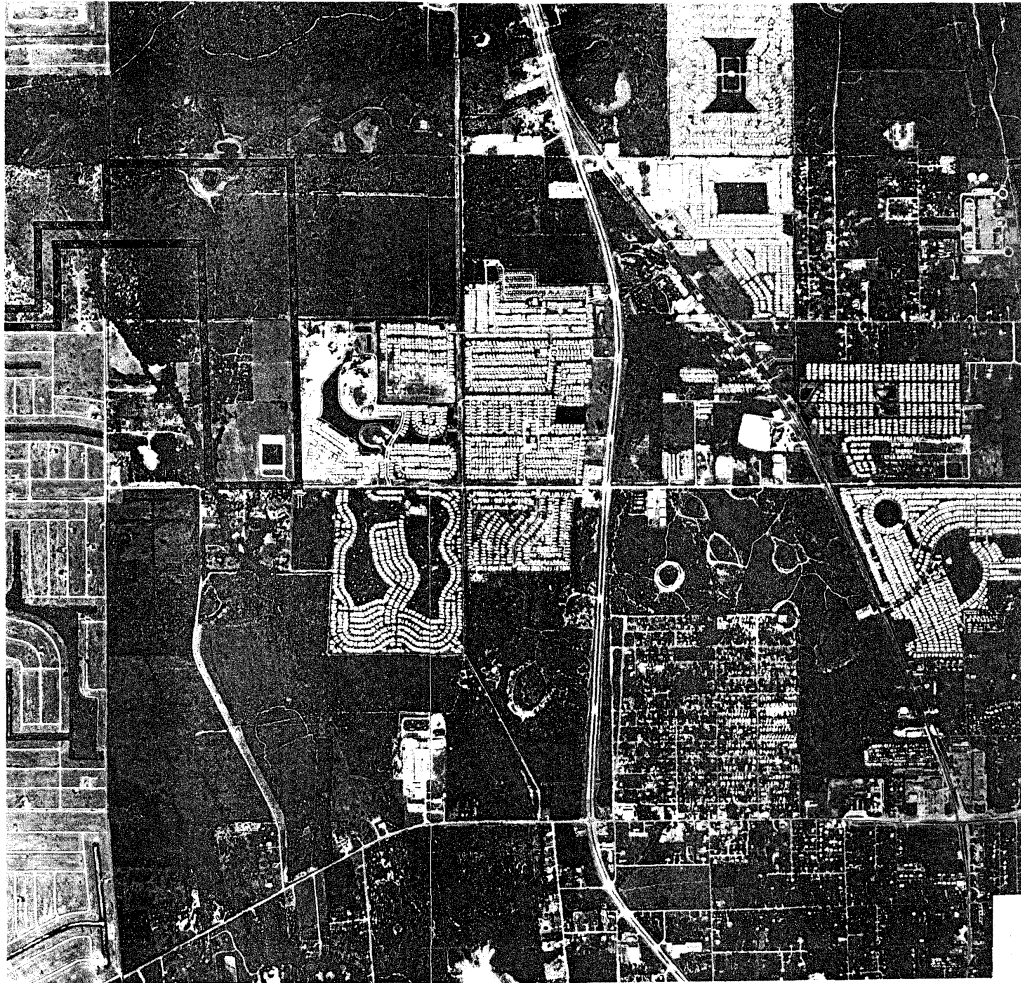


Figure 1-2 TRANSMISSION LINE CORRIDOR SOUTH OF CECIL M. WEBB
WILDLIFE MANAGEMENT AREA TO LEE SUBSTATION
(PAGE 4 OF 4)

**Hardee
Power Station**

**11.13 JOINT APPLICATION - DEPARTMENT OF THE ARMY/FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION FOR
PIPING AND ACCESS ROAD CORRIDOR**

JOINT APPLICATION
DEPARTMENT OF THE ARMY/FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
For Activities in the Waters of the State of Florida

CORPS APPLICATION NUMBER (official use only)

DER APPLICATION NUMBER (official use only)

1. APPLICANT'S NAME AND ADDRESS

S e m i n o l e E l e c t r i c C o o p e r a t i v e
NAME

1 6 3 1 3 N . D a l e M a b r y H i g h w a y
STREET

T a m p a F L 3 3 6 8 8 2 0 0 0
CITY STATE ZIP

TELEPHONE NUMBER (Day) (813) 963-0994 (Night) () Same

2. Name, address, zip code and title of applicant's authorized agent for permit application coordination

Michael Opalinski
Seminole Electric Cooperative Incorporated
16313 N. Dale Mabry Highway
Tampa, FL 33688-2000
Telephone Number (813) 963-0994

3. NAME OF WATERWAY AT LOCATION OF THE ACTIVITY.

Wetlands with intermittent drainage to Payne Creek.

DER Code: _____
W/W Code: _____

4. LOCATION WHERE PROPOSED ACTIVITY EXISTS OR WILL OCCUR.

Hardee Power Station Site
Street, road or other descriptive location

1
Section

33S
Township

23E
Range

N/A
Incorporated city or town

Latitude

Longitude

Hardee
County

Tax Assessors Description: (if known)

Map No.

Subdiv. No.

Lot No.

5. NAME AND ADDRESS INCLUDING ZIP CODE OF ADJOINING PROPERTY OWNERS WHOSE PROPERTY ALSO ADJOINS THE WATERWAY.

CF Industries, P.O. Box 1549, Wauchula, FL 33873
Agrico Chemical Co., P.O. Box 1110, Mulberry, FL 33860

6. PROPOSED USE

Private Single Dwelling []
Commercial []

Private Multi-dwelling []
Other [X] (Explain in remarks)

Public []

energy facility

7. DESCRIPTION OF PROJECT (Use additional sheets, if necessary)

A. Structures: 1. New work ☒ Maintenance of existing structure ☐

2. Piers, docks and use: Commercial ☐ Private ☐ Public ☐

a. Single pier ☐ length _____ width _____

b. Number of piers ☐ length _____ width _____

c. Number of boat slips ☐ length _____ width _____

d. Number of finger piers ☐ length _____ width _____

e. Other (please describe) _____

3. Seawalls, revetments, bulkheads: length _____

a. Type: Vertical ☐ Riprap ☐ Slope: _____ Horizontal: _____ Vertical

b. Material to be used _____
Cooling water reservoir piping and access road

4. Other type of structure culvert, see Attachment A.

B. Excavation or Dredging: New Work ☒ Maintenance work ☐ Total acreage involved 0.033

1. Access Channel ☐ or Canal ☐ Length _____ ft. Width _____ ft. Depth _____ ft.

2. Boat Basin ☐ or Boat Slip ☐ Length _____ ft. Width _____ ft. Depth _____ ft.
Cooling water reservoir

3. Other piping and access road culvert Length 20 ft. Width 71 ft. Depth 2.0 ft.

4. Cubic yards: Total for project 105

a. 0 cyd. waterward/ 105 cyd. landward of ordinary/mean high water

b. Type of material to be excavated/dredged Overburden

C. Fill:

1. Amount of material

a. Cubic yards placed waterward of ordinary/mean high water 0.0

b. Cubic yards placed landward of ordinary/mean high water 2294

c. Total acreage to be filled 0.45 Total acreage of wetlands involved 0.45

2. Containment for fill

a. Dikes ☐ b. Seawall, etc. ☐ c. Other (please explain) _____

Turbidity control screens and mulching/seeding

3. Type of fill material to be used Overburden

4. Source of fill material to be used Previous mining operation

COE
Work Code

253
403

DER
Code
253
403

8. Date activity is proposed to commence October 1990 ; to be completed October 1995.

9. Previous permits for this project have been

DER #531224079

Corps #

Hardee County

A. Denied (date) _____

B. Issued (date) _____

C. Other (please explain) Agrico has received a permit under permit Application No. 531224079 for removal and reclamation of these wetlands as part of phosphate mining activities. Differentiate between existing work and proposed work on the drawings.

10. Remarks (See Instruction Pamphlet for additional information required for all applications and certain activities. Use additional sheets if necessary.)
See SCA/EA 1.0, 3.0 and 8.0 for description of Hardee Power Station Project, need of the project, and overall project alternatives. See Attachment A for detailed description of discussion of alternatives and impacts.

11. AFFIDAVIT OF OWNERSHIP OR CONTROL of the property on which the proposed project is to be undertaken

I CERTIFY THAT: (please check appropriate space)

[] I am the record owner, lessee, or record easement holder of the property described below.

[X] I am not the record owner, lessee, or record easement holder of the property described below, but I will have before undertaking the proposed work the requisite property interest. (Please explain what the interest will be and how it will be acquired.)

LEGAL DESCRIPTION OF PROPERTY SITUATED IN Hardee COUNTY, FLORIDA
(Use additional sheets if necessary)

Section 1, Township 33 south, Range 23 east, Hardee County, Florida.

Michael P. Polinski

Signature

Sworn and subscribed before me at

Alachua

County,

Florida, this 30th day of March, 1990

Mary Lynn Adams

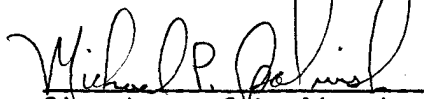
NOTARY PUBLIC

My commission expires: **NOTARY PUBLIC, STATE OF FLORIDA,
MY COMMISSION EXPIRES: NOV. 20, 1992,
BONDED THRU NOTARY PUBLIC UNDERWRITERS,**

12. Application is made for a permit(s) to authorize the activities described herein.

- A. I authorize the agent listed in Item #2 to negotiate modifications or revisions, when necessary, and accept or assent to any stipulations on my behalf.
- B. I understand I may have to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable State Water Quality Standards or other environmental standards both before construction and after the project is completed.
- C. In addition, I agree to provide entry to the project site for inspectors with proper identification or documents as required by law from the environmental agencies for the purpose of making preliminary analyses of the site. Further, I agree to provide entry to the project site for such inspectors to monitor permitted work if a permit is granted.
- D. Further, I hereby acknowledge the obligation and responsibility for obtaining all of the required state, federal or local permits before commencement of construction activities. I also understand that before commencement of this proposed project I must be granted separate permits or authorizations from the U.S. Corps of Engineers, the U.S. Coast Guard, the Department of Environmental Regulation, and the Department of Natural Resources, as necessary.

I CERTIFY that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.


Signature of Applicant

3/30/90
Date

NOTE: THIS APPLICATION MUST BE SIGNED by the person who desires to undertake the proposed activity or by an authorized agent. If an agent is applying on behalf of the applicant, attach proof of authority for the agent to sign and bind the applicant.

18 U.S.C. Section 1001 provides that: Whoever in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

NOTICE TO PERMIT APPLICANTS

This is a Joint Application; it is NOT a Joint Permit!

You Must Obtain All Required Local, State, and Federal

Authorizations or Permits Before Commencing Work!!

For your information: Section 370.034, Florida Statutes, requires that all dredge and fill equipment owned, used, leased, rented or operated in the state shall be registered with the Department of Natural Resources. Before selecting your contractor or equipment you may wish to determine if this requirement has been met. For further information, contact the Chief of the Bureau of Licenses and Motorboat Registration, Department of Natural Resources, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303. Telephone Number 904/488-1195. THIS IS NOT A REQUIREMENT FOR A PERMIT FROM THE DEPARTMENT OF ENVIRONMENTAL REGULATION.

ATTACHMENT A

1.0 DESCRIPTION OF THE PROJECT

The proposed project is located in Hardee County on currently mined lands (see Figures 1 through 4 and aerial photographs) and is part of the Hardee Power Station. Intake and discharge piping are required for the circulation of cooling water between the cooling reservoir and the Hardee Power Station (see SCA/EA, Sections 3.2 and 3.5.1 and Figure 3.2-1). An access road to the cooling reservoir will be colocated with the piping. A reclamation plan for the project area and adjacent mined lands has been submitted to Florida Department of Natural Resources (see Appendix 11.11 of the SCA/EA). The piping and access road will cross a small section [0.18 ha (0.45 acres)] of currently mined and to be reclaimed vegetated forested wetland (Figures 5, 6, and 7). This reclaimed wetland will act as a drainage to Payne Creek for a undisturbed wetland located east of the cooling reservoir.

The road will be located to the south of the circulating water pipe (and miscellaneous pipe) corridor (Figures 7 and 8). The colocation of the road will function to support the piping on the extended road embankment. Two reinforced concrete box culverts, each 10 feet (ft) wide and 5 ft tall, will be installed so that the reclaimed drainage channel along the east and west sides of the mined area will function as a permanent channel. The culvert will be sufficient to carry the peak discharge without overtopping the embankment. Riprap will be placed at the culvert outlet to minimize erosion. Fill will be provided as required to build the embankment and install culverts. Estimates of fill and excavation volumes are provided in Tables A-1 and A-2.

The drainage area for the channel will include the watershed for the preserved wetland area east of the reservoir. Watersheds and wetlands north of the reservoir will drain into the reservoir. The resulting drainage area for the reclaimed drainage channel is approximately 202 hectares (ha) (500 acres). Drainage calculations (based on the

conceptual design) included a design storm of the 100-year event yields a peak flow of 750 cubic feet per second (cfs). The 100-year storm was chosen to minimize the risk of damage to the embankments and piping systems from stormwater runoff overtopping the embankment. The culvert will be designed to minimize the height of the embankment and the quantity of fill needed.

2.0 DESCRIPTION OF IMPACTS

Currently, the permit area is disturbed by mining (Figure 3). As a part of the reclamation plan (Figure 6), the post-reclamation vegetation in the mined-out permit application area is proposed to be grass, crop, and pasture and a mixed forested wetland. The proposed piping corridor and access road project will result in the loss of 0.18 ha (0.45 acres) of reclaimed forested wetlands. This represents 2.0 percent of the total reclaimed forested wetlands [9.3 ha (23 acres)] on the plant size.

The environmental impacts of the proposed project are not considered adverse or significant. The wetland loss is a very small percentage (2.0 percent) of the total forested wetlands reclaimed on the site. No effects will occur to the connection of the upstream wetlands connected to Payne Creek. The drainage function of the reclaimed wetlands passing next to the cooling reservoir will be maintained during construction by the use of temporary culverting. Potential downstream sedimentation impacts during construction will be minimized by proper sediment control techniques. No impacts to Payne Creek are anticipated.

Table A-1. Determination of Fill Volume and Fill Area

Approximate Road Elevation	36.1 m (118.5 ft) MSL
Reclaimed Elevation at Approximate Limits of Wetlands	35.1 m (115 ft) MSL
Reclaimed Elevation at Centerline of Proposed Culvert	34.7 m (114 ft) MSL
Length of Fill Between the Approximate Limits of Wetlands	106.7 m (350 ft)
Top Width of Fill Section	9.8 m (32 ft)
Side Slopes of Fill Section	3:1
Bottom Width of Fill Section at the Approximate Limits of Wetlands	16.2 m (53 ft)
Bottom Width of Fill Section at the Centerline of Proposed Culvert	18.0 m (59 ft)
Cross-Sectional Area of Fill Section at the Approximate Limits of Wetlands	13.8 m ² (149 ft ²)
Cross-Sectional Area of Fill Section at the Centerline of Proposed Culvert	19.0 m ² (205 ft ²)
Average Fill Cross-Sectional Area	16.4 m ² (177 ft ²)
Total Length of Fill	106.7 m (350 ft)
Total Fill Volume	1,754 m ³ (61,950 ft ³ ; 2,294 yd ³)
Bottom Width of Fill Section at the Approximate Limits of Wetlands	16.2 m (53 ft)
Bottom Width of Fill Section at the Centerline of Proposed Culvert	18.0 m (59 ft)
Average Width of Fill	17.1 m (56 ft)
Total Length of Fill	106.7 m (350 ft)
Total Area of Fill	1,821 m ² (19,600 ft ²)
Total Area of Fill	0.18 ha (0.45 acres)

Table A-2. Determination of Excavation Volume and Area

Design Culvert Invert Elevation	34.1 m (112 ft)
Approximate Road Elevation	36.1 m (118.5 ft) MSL
Top Width of Fill Section	9.8 m (32 ft)
Side Slopes of Fill Section	3:1
Total Length of Culvert	21.6 m (71 ft)
Total Width of Culvert	6.1 m (20 ft)
Total Width of Excavation	6.1 m (20 ft)
Total Area of Culvert Excavation	131.9 m ² (1,420 ft ²)
Total Area of Culvert Excavation	0.013 ha (0.033 acres)
Reclaimed Elevation at Centerline of Proposed Culvert	34.7 m (114 ft) MSL
Design Culvert Invert Elevation	34.1 m (112 ft)
Depth of Excavation	0.6 m (2 ft)
Total Excavation Volume	80.4 m ³ (2840 ft ³ ; 105 yd ³)

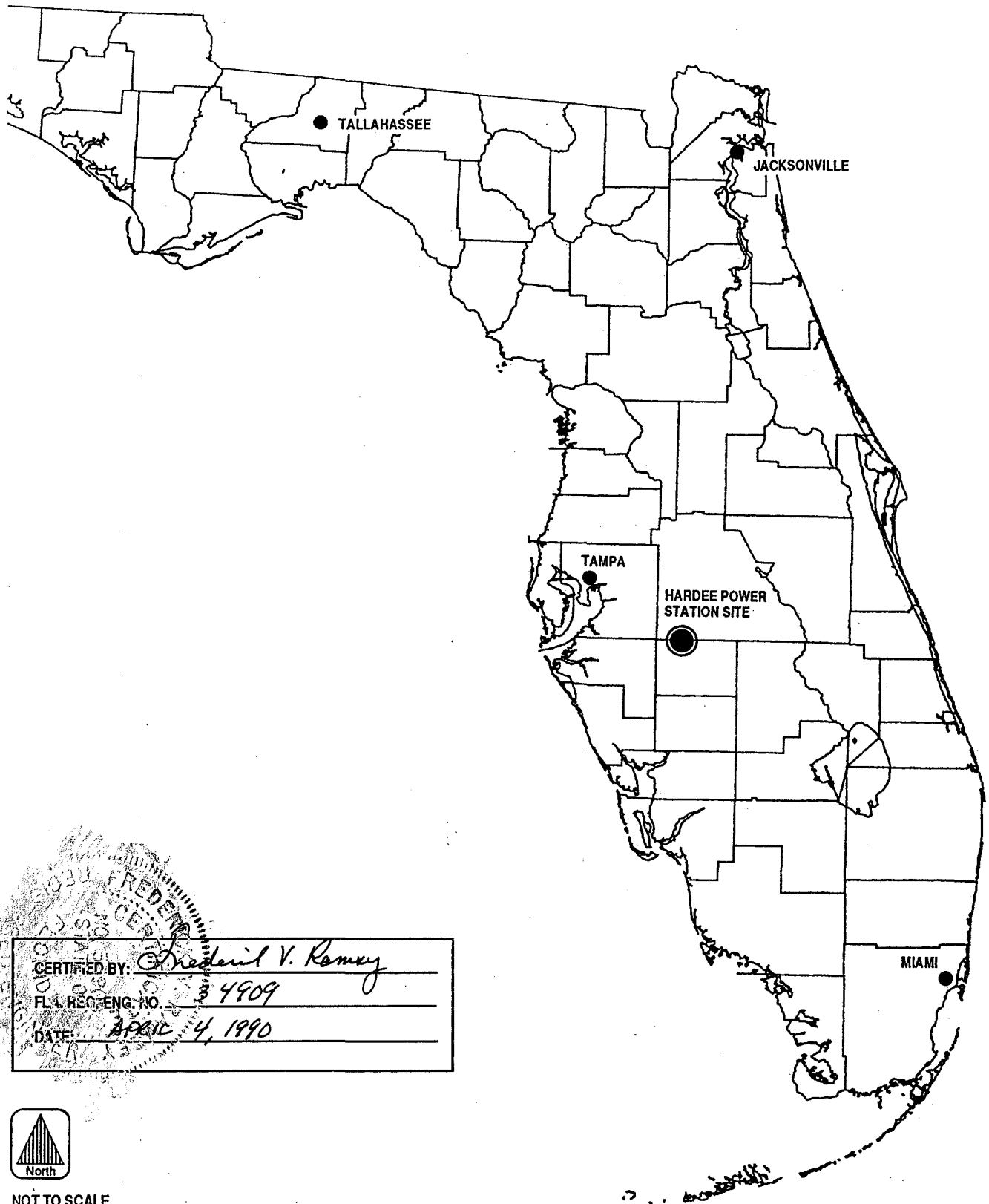


Figure 1 GENERAL LOCATION OF HARDEE POWER STATION PROJECT

Hardee Power Station

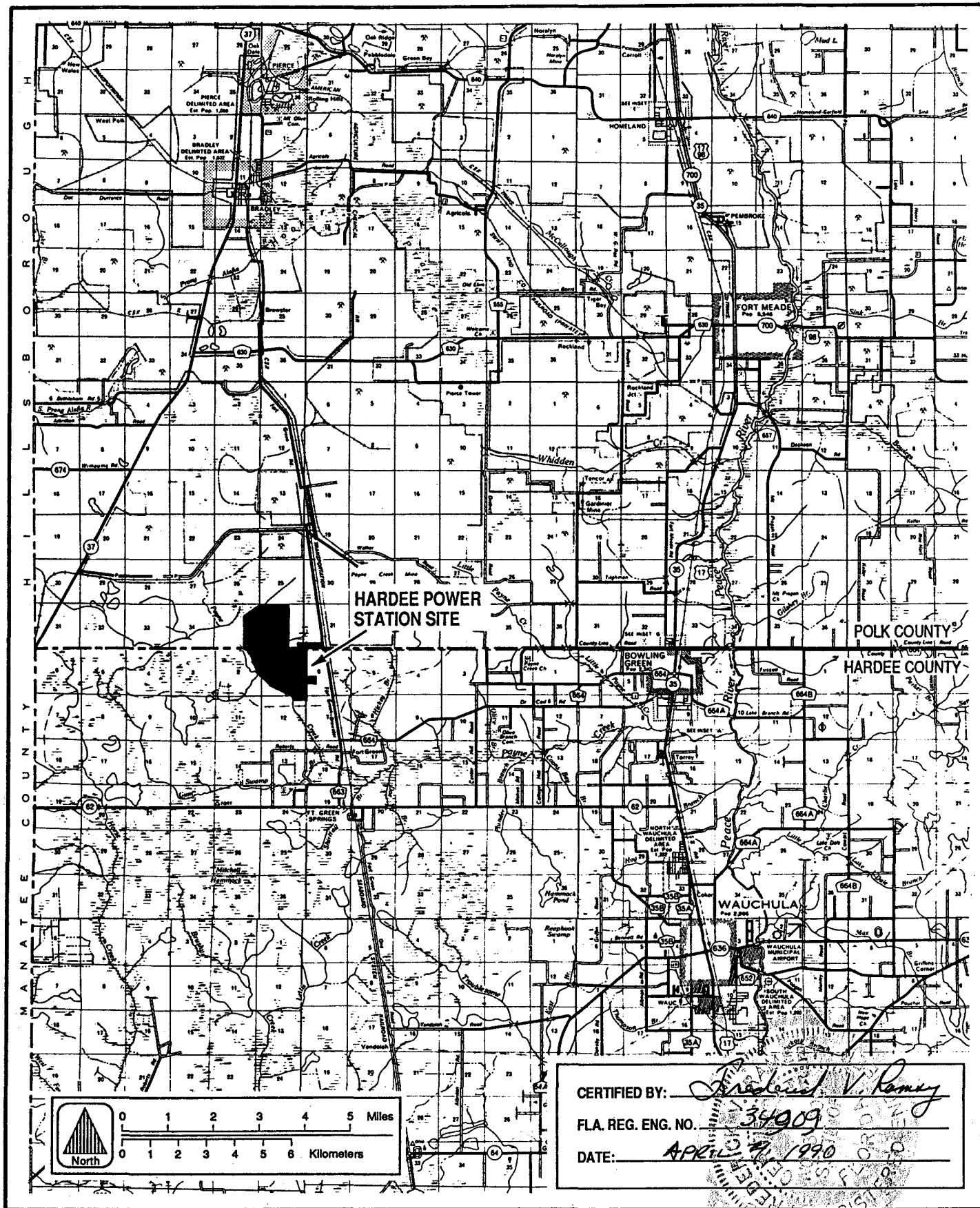


Figure 2 HARDEE POWER STATION SITE LOCATION

**Hardee
Power Station**

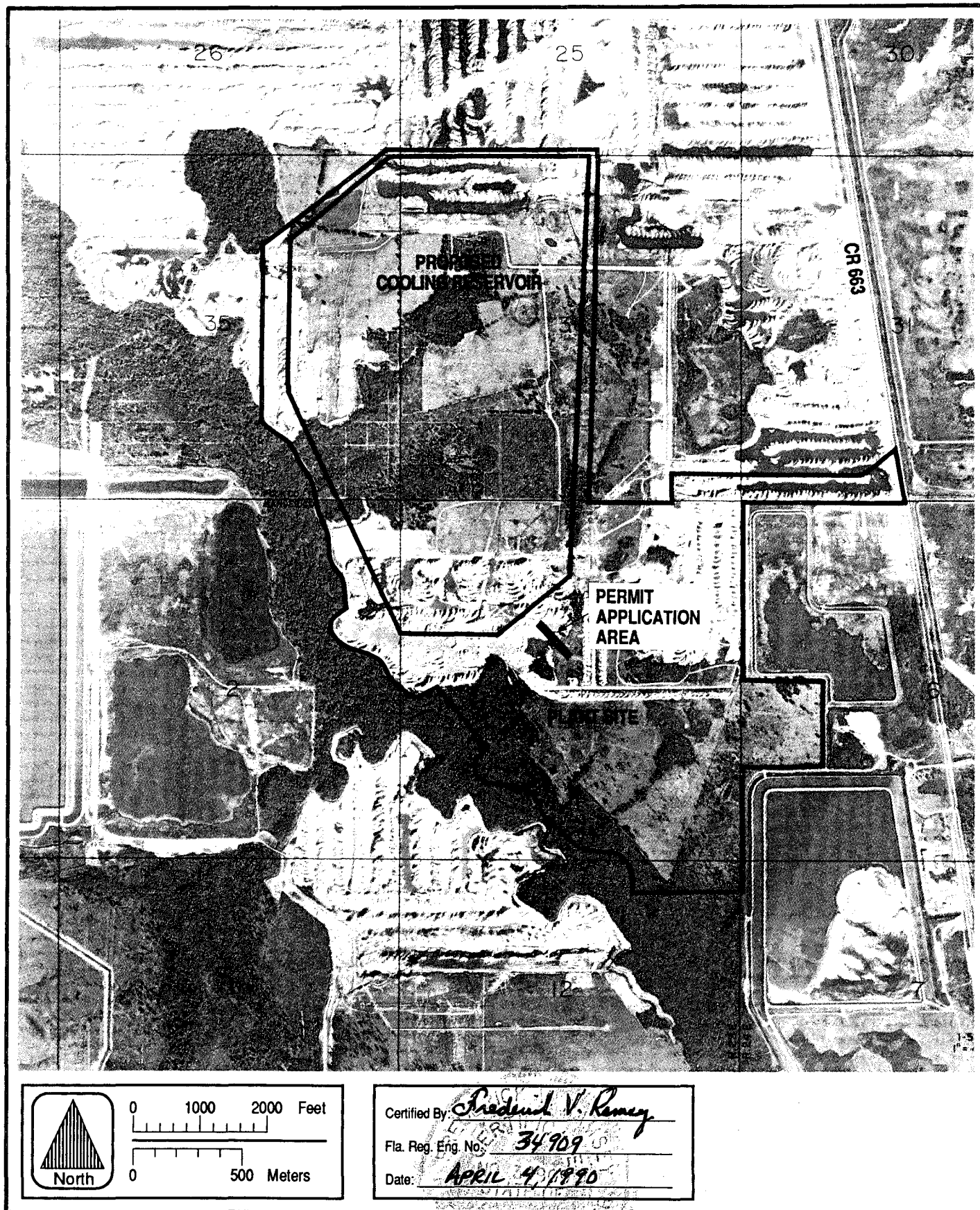


Figure 3 HARDEE POWER STATION SITE BOUNDARY AND PERMIT APPLICATION AREA

**Hardee
Power Station**

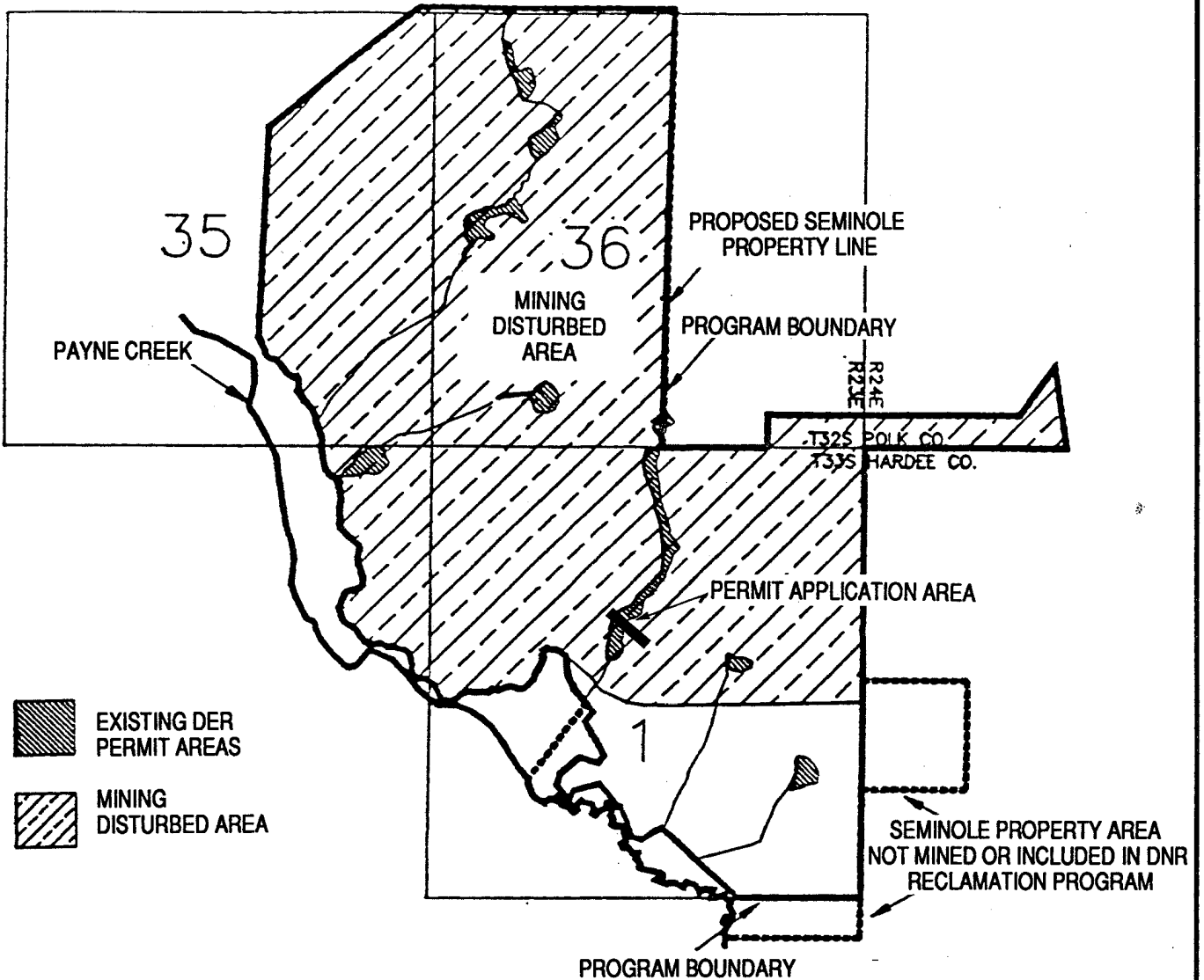
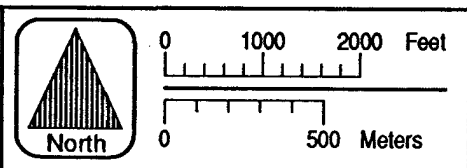
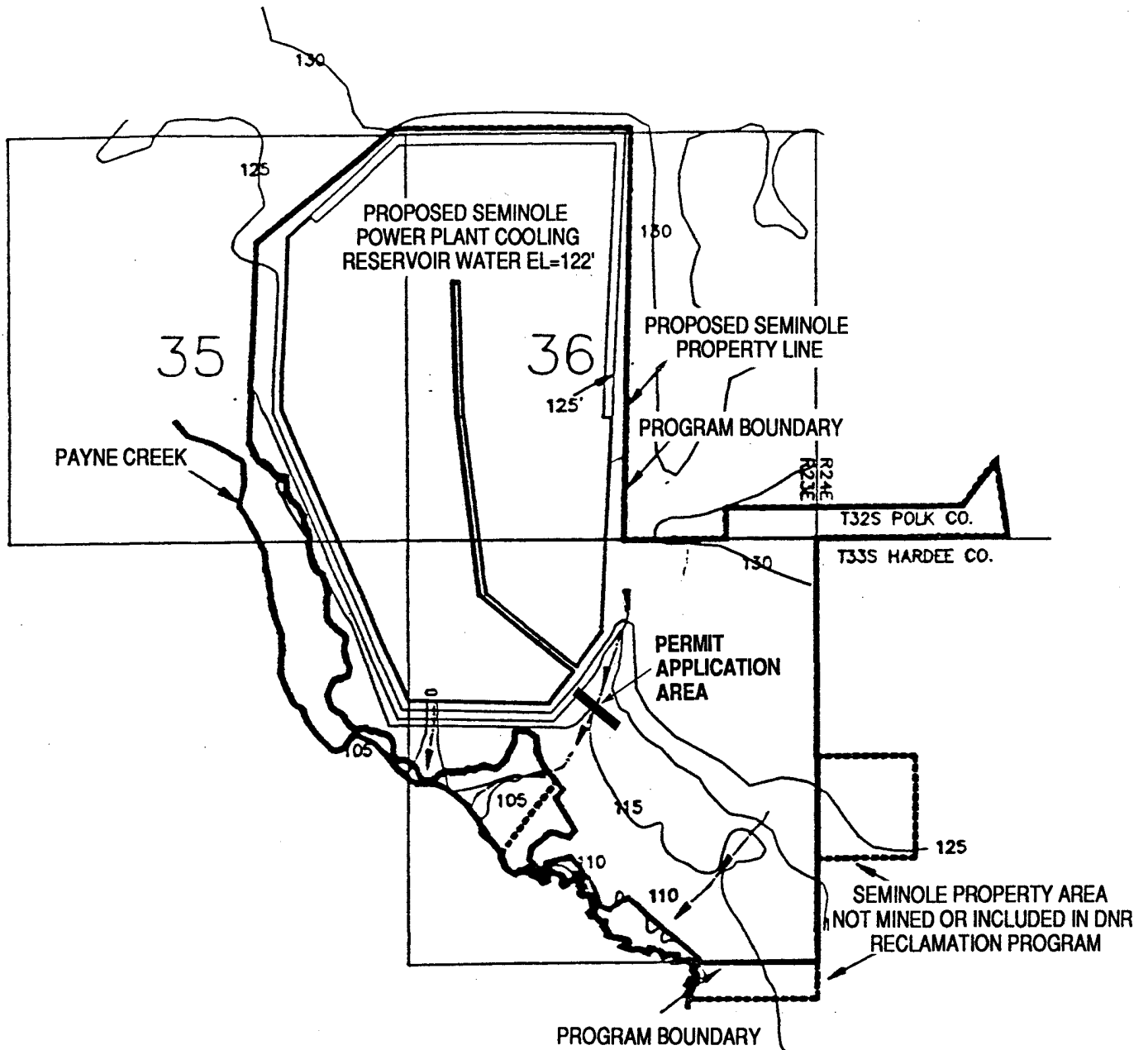


Figure 4 EXISTING MINED AND PERMITTED AREAS AT HARDEE POWER STATION SITE

SOURCE: AGRICO RECLAMATION PLAN: AGR-PC-1, 1990.

**Hardee
Power Station**



Certified By: *Frederick V. Ramsey*

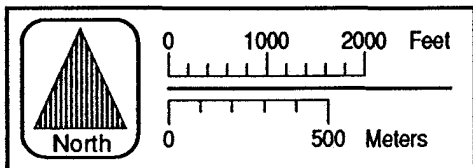
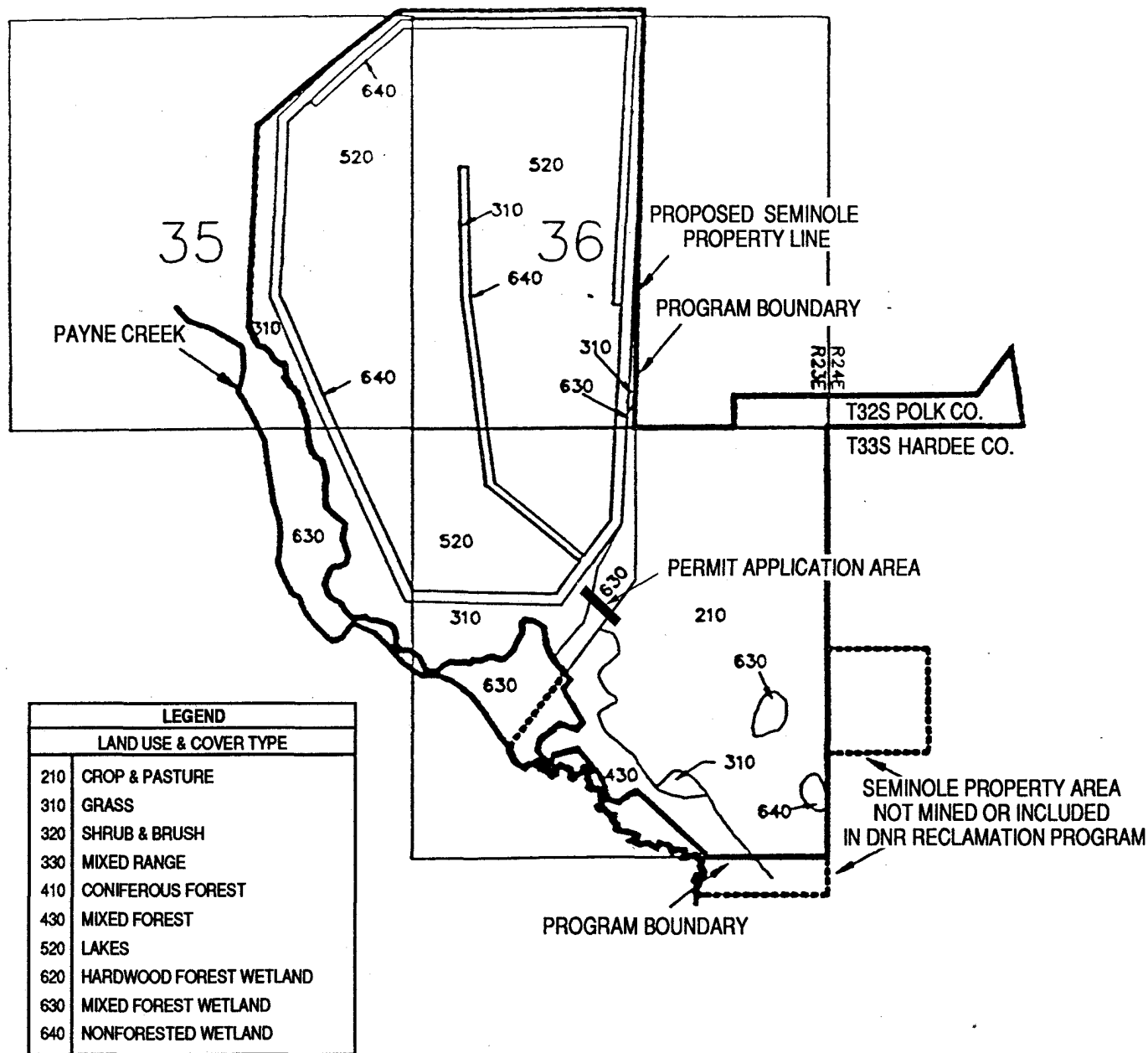
Fla. Reg. Eng. No. *34909*

Date: *APRIL 4, 1990*

Figure 5 POST-RECLAMATION TOPOGRAPHY AND DRAINAGE AND PERMIT APPLICATION AREA (SECTION 1, T33S, R23E)

SOURCE: AGRICO RECLAMATION PLAN: AGR-PC-1, 1990.

**Hardee
Power Station**



Certified By: Fredrick V. Roney
 Fla. Reg. Eng. No. 34909
 Date: April 4, 1990

Figure 6 POST-RECLAMATION VEGETATION AND PERMIT APPLICATION AREA (SECTION 1, T33S, R23E)

SOURCE: AGRICO RECLAMATION PLAN: AGR-PC-1, 1990.

**Hardee
Power Station**

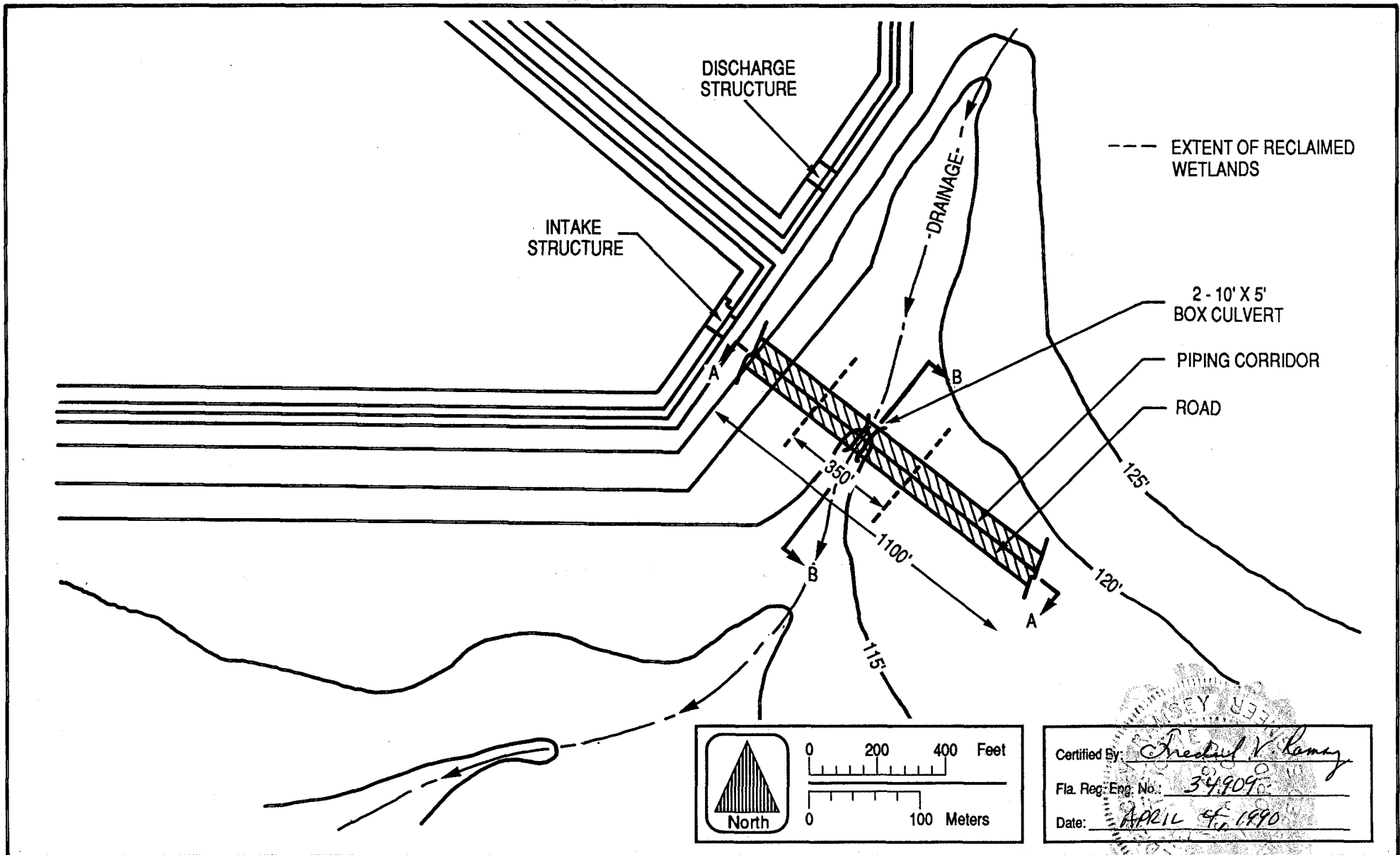
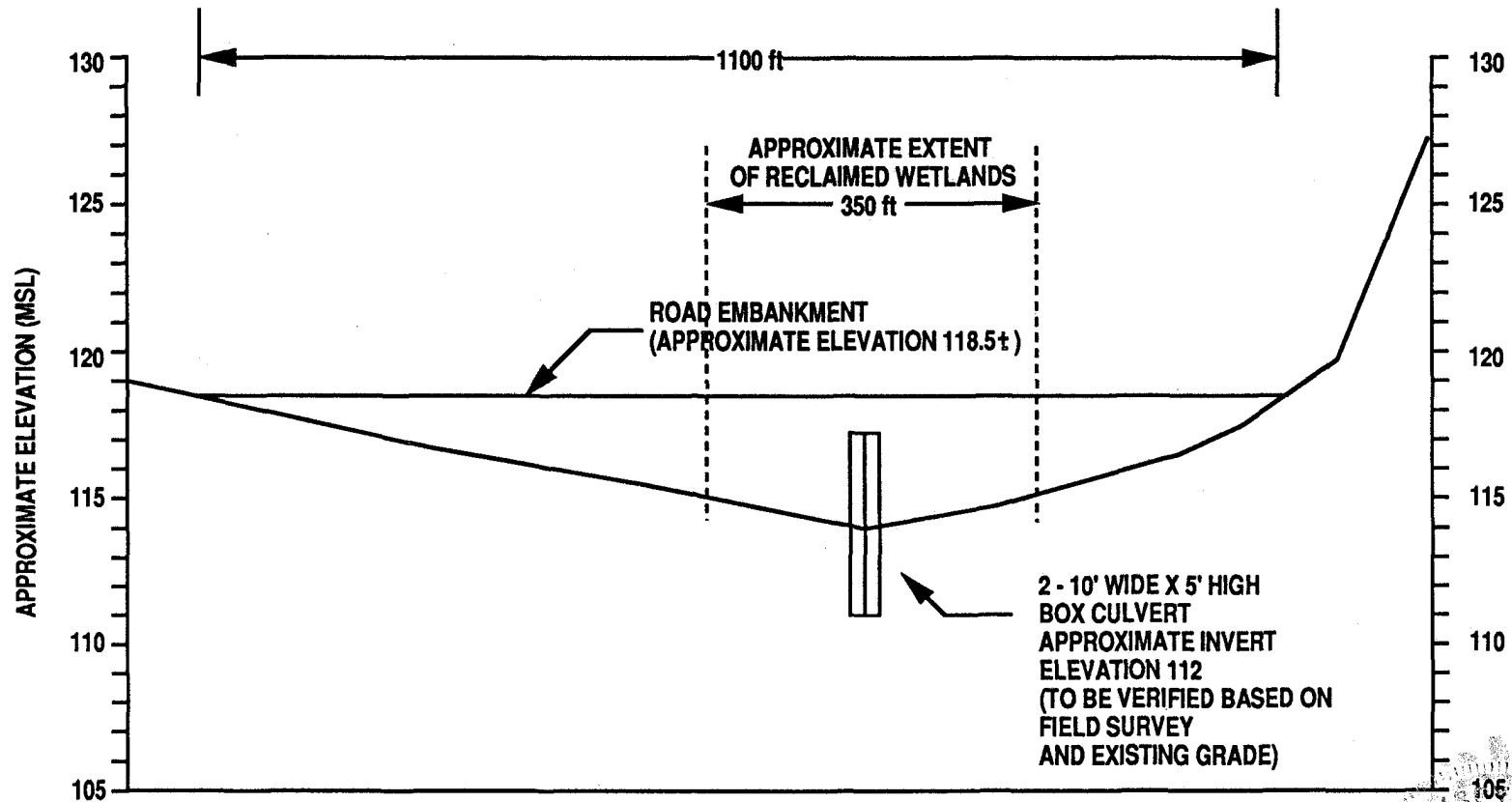


Figure 7 PLAN VIEW — LOCATION OF CROSS SECTIONS A-A AND B-B

**Hardee
Power Station**



APPROXIMATE SCALE: 1" = 200'

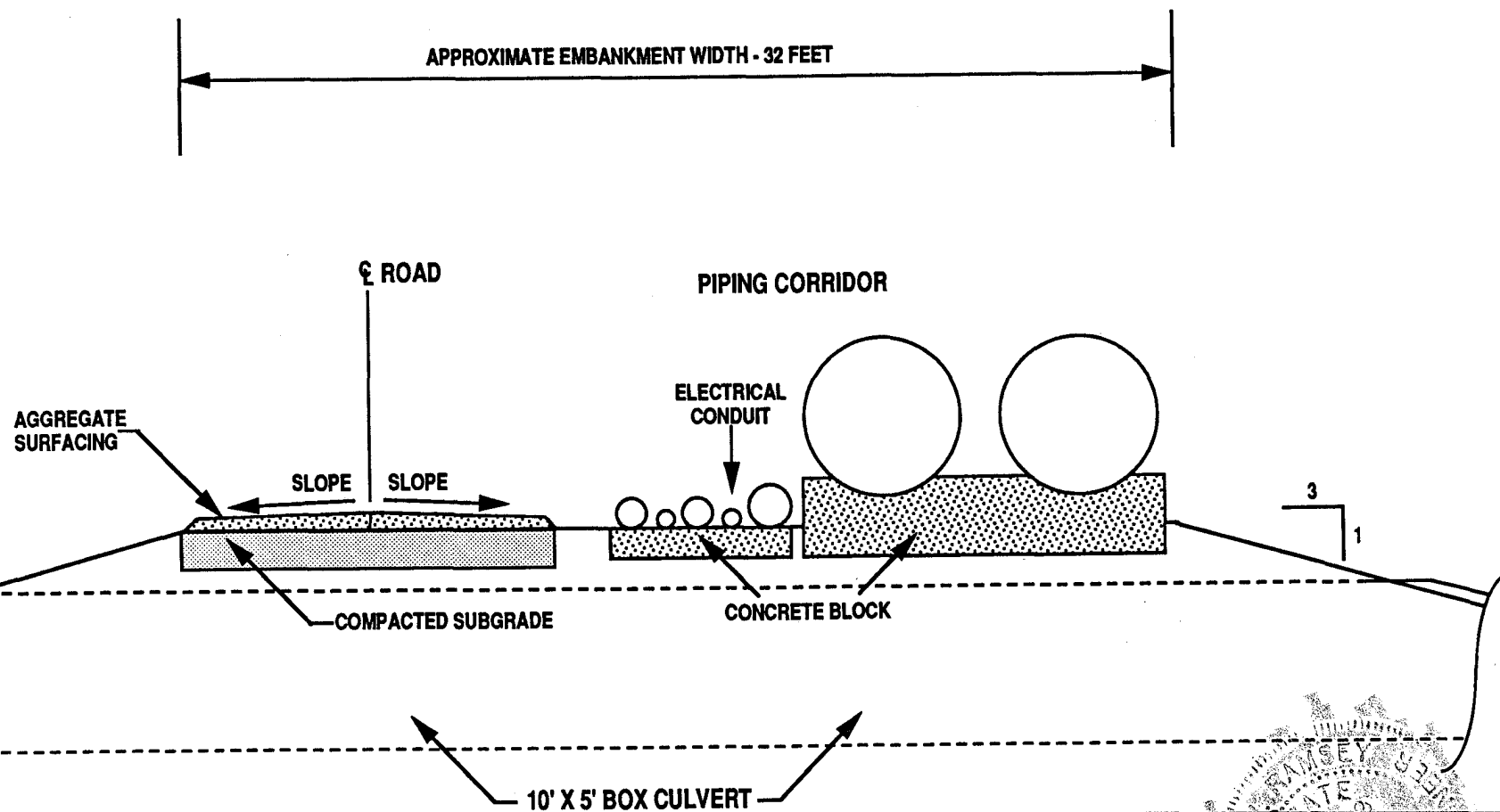
Certified By: *Fred V. Ramsey*

Fla. Reg. Eng. No. *34909*

Date: *April 4, 1990*

Figure 8 CROSS-SECTION A-A: LOOKING
SOUTHWEST (SECTION 1, T33S, R23E)

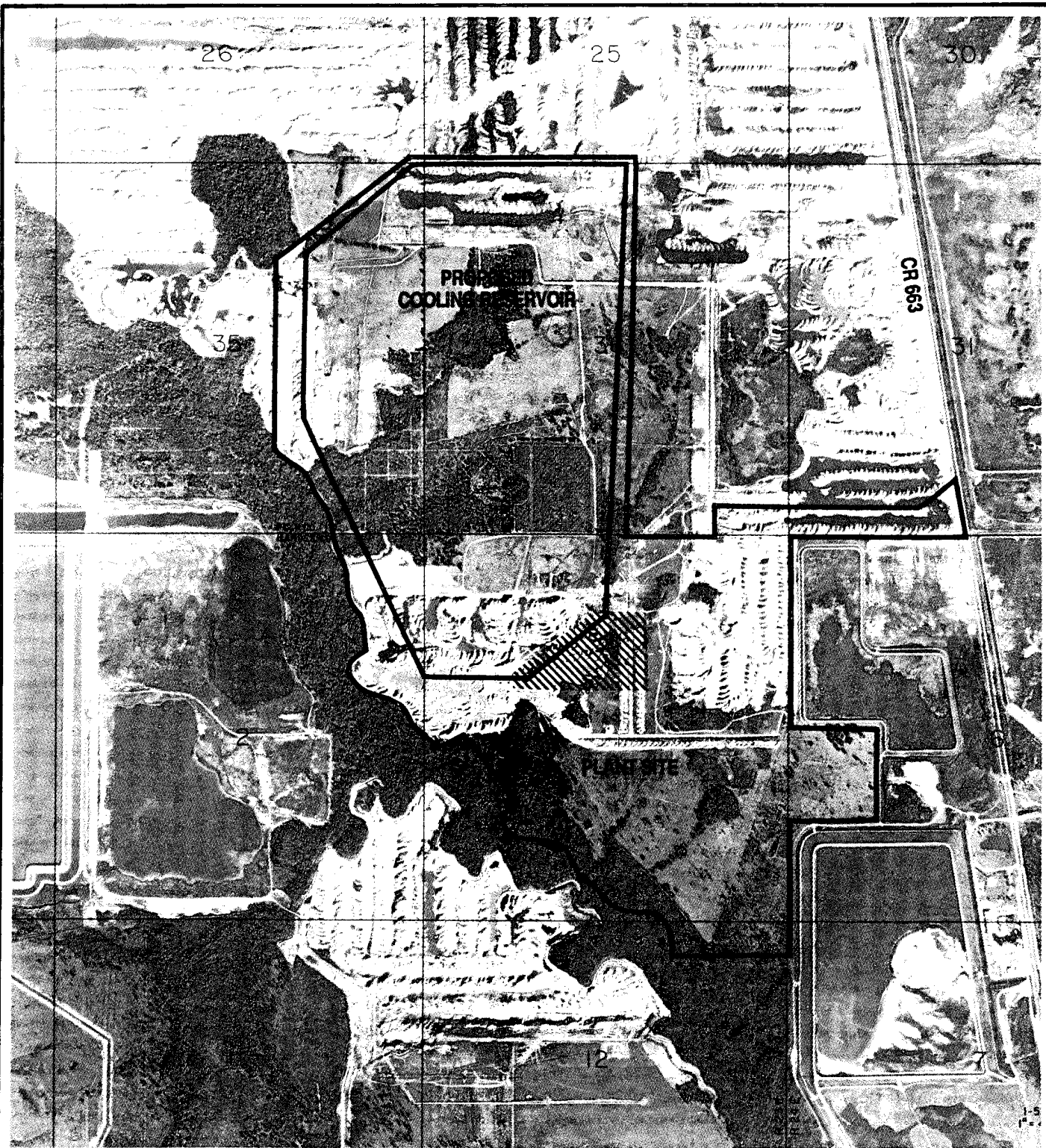
**Hardee
Power Station**



Certified By: *Michael V. Roney*
 Fla. Reg. Eng. No. *34909*
 Date: *APRIL 4, 1990*

Figure 9 CROSS-SECTION B-B: LOOKING
SOUTHEAST (SECTION 1, T33S, R23E)

**Hardee
Power Station**



0 1000 2000 Feet
0 500 Meters

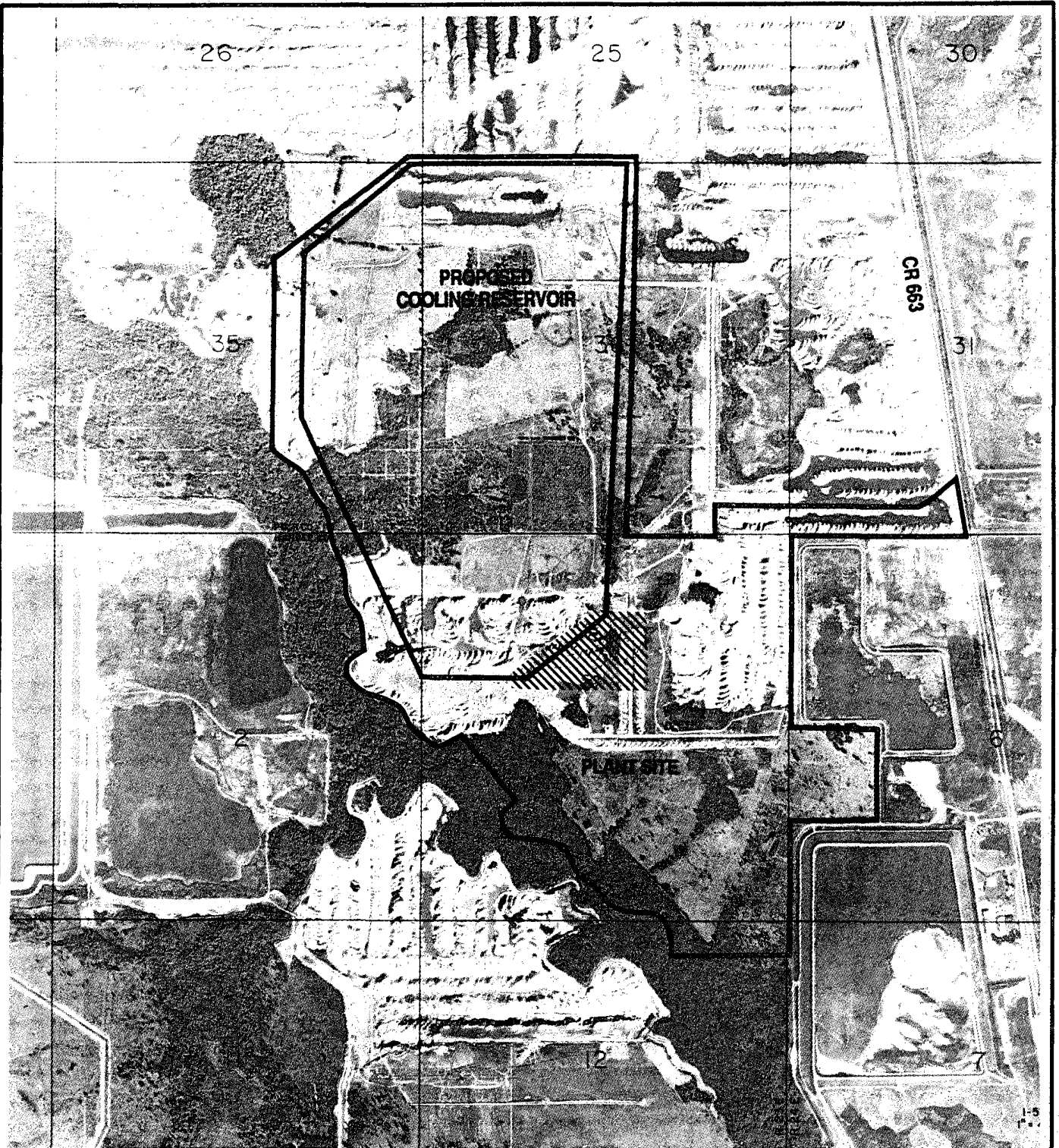
Certified By: *Donald V. Kamy*
Fla. Reg. Eng. No.: *34909*
Date: *APRIL 4, 1990*



PERMIT
APPLICATION
AREA

AERIAL PHOTO (AS OF 1/5/89) OF PERMIT
APPLICATION AREA

**Hardee
Power Station**



0 1000 2000 Feet
0 500 Meters

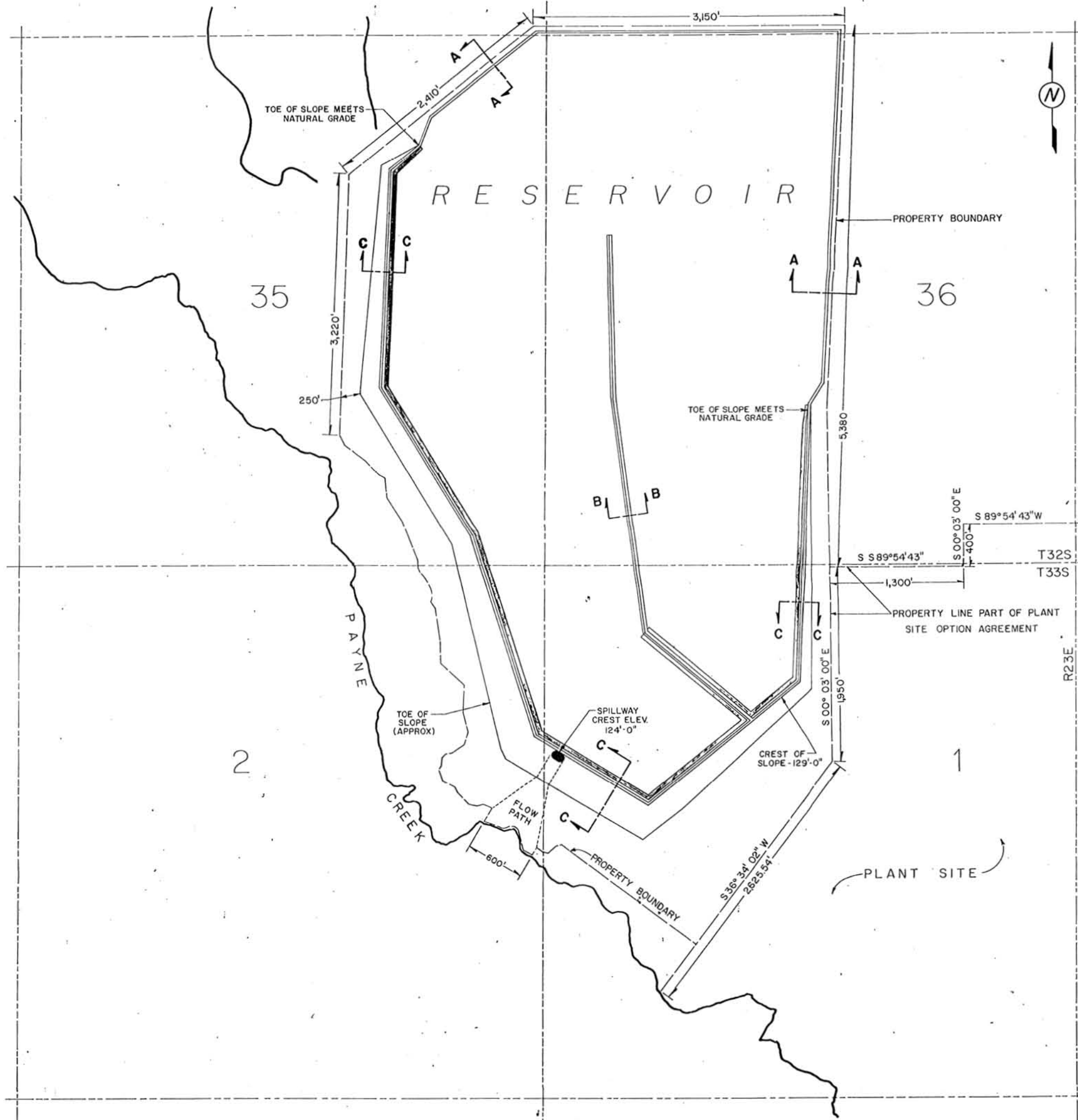
Certified By: *Freddie V. Ramsey*
Fla. Reg. Eng. No.: *34909*
Date: *APRIL 4, 1990*



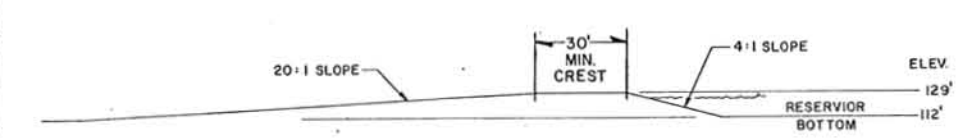
PERMIT
APPLICATION
AREA

AERIAL PHOTO (AS OF 1/5/89) OF PERMIT
APPLICATION AREA

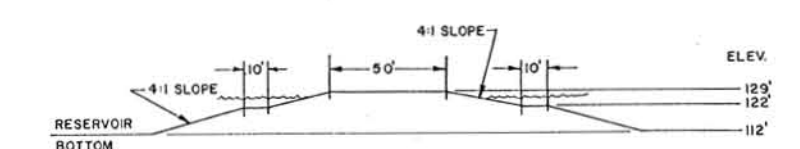
**Hardee
Power Station**



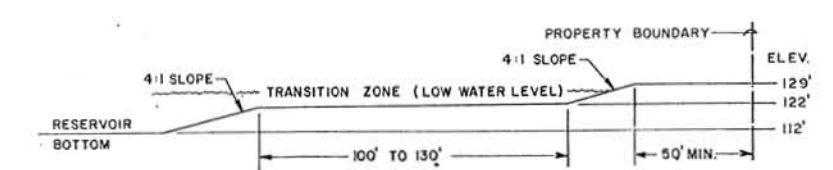
- Notes
1. Outside slope = 20 Feet Horizontal for 1 Foot vertical
 2. Inside slope: 4 Feet horizontal for 1 Foot vertical, except as shown in Sections A-A and B-B.
 3. Acres of water = 570
 4. Center dike crest to be flat, minimum 50 Foot width
 5. Maximum elevation of pond bottom = 112 Feet nominal
 6. Pond is to be constructed in accordance with requirements of the reclamation plan approved by the Florida Department of Natural Resources, including wet areas, vegetation on inside and outside slopes, etc.
 7. Vegetation on inside slopes shall include "rushes" or other similar plant to prevent erosion due to wave action.
 8. Grading of areas on the reservoir perimeter shall be adjusted where possible to maximize the rainfall runoff and groundwater infiltration into the reservoir.



SECTION C-C
SCALE: 1" = 40'

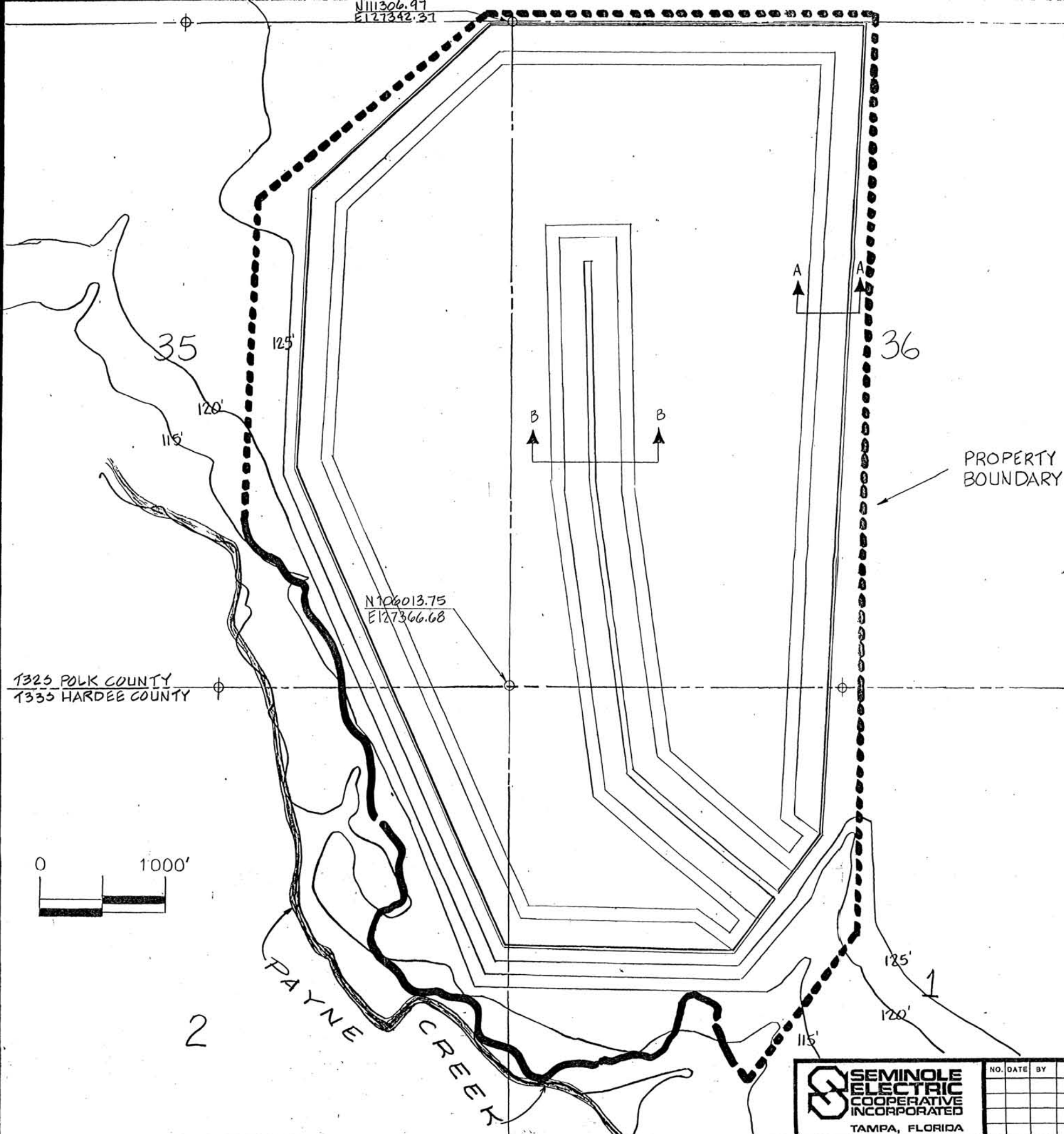


SECTION B-B
SCALE: 1" = 40'
CENTER DIVIDER EMBANKMENT



SECTION A-A
SCALE: 1" = 40'
UPLANDS INNER SLOPE

NO.		DATE	BY	REVISION				
 SEMINOLE ELECTRIC COOPERATIVE INCORPORATED TAMPA, FLORIDA					EXHIBIT B. COOLING RESERVOIR			
DRAWN:	R. DIAZ	DATE:	7/19/89	SCALE:	1" = 500'-0"	DWG. NO.		
DESIGN:	M. FEATHAM	DATE:	7/19/89	REA REF:		SHEET	OF	
CKD:	J. G. [Signature]	DATE:	7/17/89	REF NO.:				
APPV'D:	[Signature]	DATE:	7/27/89	PROJ. NO.		REV. 3 03/30/90		



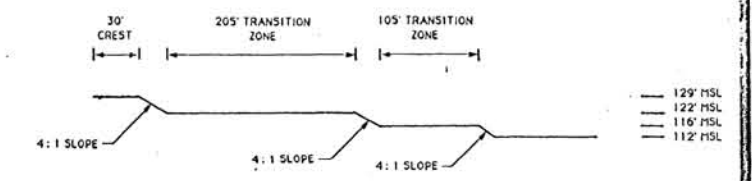
N 111303.38
E 132635.47

NOTES

1. Outside slope = 20 feet horizontal for 1 foot vertical.
2. Inside slope: 4 feet horizontal for 1 foot vertical, except as shown in Sections A-A and B-B.
3. Acres of water = 570.
4. Center dike crest to be flat, minimum 50 foot width.
5. Maximum elevation of pond bottom = 112 feet nominal.
6. Pond is to be constructed in accordance with requirements of the reclamation plan approved by the Florida Department of Natural Resources, including wet areas, vegetation on inside and outside slopes, etc.
7. Vegetation on inside slopes shall include "rushes" or other similar plant to prevent erosion due to wave action.
8. Grading of areas on the reservoir perimeter shall be adjusted where possible to maximize the rainfall runoff and groundwater infiltration into the reservoir.

(N)

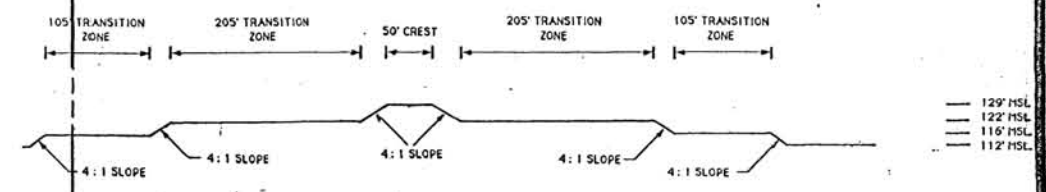
N 103011.59
E 132647.99



SECTION A - A

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 40'

PERIMETER BANK



SECTION B - B

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 40'

CENTER DIKE

SEMINOLE ELECTRIC COOPERATIVE INCORPORATED
TAMPA, FLORIDA

NO.	DATE	BY	REVISION	NO.	DATE	BY	REVISION	EXHIBIT C: COOLING RESERVOIR (REDUCED)			
								DRAWN: 1K-L	DATE: 2/23/90	SCALE: 1/4" = 100'	DRWG. NO.:
								DESIGN:	DATE:	REA REF.:	SH. NO. OF
								CHECKED: <i>[Signature]</i>	DATE:	REF. NO.:	
								APPROVED:	DATE:	PROJ. NO.:	REV. 3 03/30/90