TAMPA ELECTRIC COMPANY

POLK POWER STATION
Polk County, Florida

SITE CERTIFICATION APPLICATION

VOLUME 2

TAMPA ELECTRIC
A TECO ENERGY COMPANY

July 1992

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LIST OF ACRONYMS

7Q10	7-day, 10-year flow rate
AADT	average annual daily trips
AAQS	ambient air quality standard
ACSR	aluminum conductor steel reinforced
Agrico	Agrico Chemical Company
AM	amplitude modulation
A/RR	Agricultural/Residential Rural
ASTM	American Society for Testing and Materials
BACT	best available control technology
BEBR	Bureau of Economic and Business Research
BLIS	BACT/LAER information system
BOCC	Board of County Commissioners
BOD	biochemical oxygen demand
Btu	British thermal unit
Btu/ft^3	British thermal units per cubic foot
Btu/gal	British thermal units per gallon
Btu/lb	British thermal units per pound
°C	degree Celsius
$CaCO_3$	calcium carbonate
CC	combined cycle
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
cfs	cubic foot per second
CG	coal gasification
CGCU	cold gas cleanup
CITES	Convention on International Trade in Endangered Species
cm	centimeter
cm/sec	centimeter per second

CO	carbon monoxide
CO_2	carbon dioxide
COD	chemical oxygen demand
COS	carbonyl sulfide
CPT	cone penetration test
CR	County Road
CS_2	carbon disulfide
CSM	cubic foot per second per square mile
CT	combustion turbine
CUP	Conditional Use Permit
CWA	Clean Water Act
°	degree
d	Shannon Weaver diversity index
dBA	A-weighted decibel
dbh	diameter at breast height
DO	dissolved oxygen
DOE	U.S. Department of Energy
DSM	demand-side management
ECT	Environmental Consulting & Technology, Inc.
EEI	Edison Electric Institute
EIS	environmental impact statement
EIV	Volume of Environmental Information
EMF	electromagnetic field
EMS	emergency medical services
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
°F	degree Fahrenheit
F.A.C.	Florida Administrative Code
FCC	Federal Communications Commission

FCG	Florida Electric Power Coordinating Group
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FDACS	Florida Department of Agriculture and Consumer Services
FDCA	Florida Department of Community Affairs
FDER	Florida Department of Environmental Regulation
FDER/PSES	FDER Point Source Evaluation Section
FDHR	Florida Division of Historical Resources
FDLES	Florida Department of Labor and Employment Security
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FEECA	Florida Energy Efficiency and Conservation Act
FEMA	Federal Emergency Management Agency
FEPPSA	Florida Electrical Power Plant Siting Act
FGD	flue gas desulfurization
FGFWFC	Florida Game and Fresh Water Fish Commission
FGS	Florida Geological Survey
FGT	Florida Gas Transmission Company
FLUCCS	Florida Land Use and Cover Classification System
FLUCFS	FDOT Land Use, Cover, and Forms Classification System
FM	frequency modulation
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FPSC	Florida Public Service Commission
FR	Federal Register
F.S.	Florida Statutes
FSRI	Florida Sinkhole Research Institute
ft	foot
ft bls	foot below land surface
ft/day	foot per day

ft^2/day	square foot per day
ft^3/day	cubic foot per day
ft^3/day/ft^3	cubic foot per day per cubic foot
ft/ft	foot per foot
ft^3/hr	cubic foot per hour
ft-msl	foot above mean sea level
ft-NGVD	foot national geodetic vertical datum
FTE	full-time equivalent
GE	General Electric Company
GEESI	General Electric Environmental Systems, Inc.
gpd	gallon per day
gpm	gallon per minute
gpm/ft	gallon per minute per foot
gpm/ft^2	gallon per minute per square foot
gr/scf	grains per standard cubic foot
gr/100 scf	grains per 100 standard cubic feet
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid
HGCU	hot gas cleanup
HHV	higher heating value
HRSG	heat recovery steam generator
HUD	Housing Urban Development
IGCC	integrated coal gasification combined cycle
IWTP	industrial wastewater treatment plant
kg	kilogram
km	kilometer
kV	kilovolt
kV/m	kilovolt per meter
kw	kilowatt

kwh	kilowatt hour
LAER	lowest achievable emission rate
lb/day	pound per day
lb/ft^3	pound per cubic foot
lb/hr	pound per hour
lb/MMBtu	pound per million British thermal units
L_{dn}	day-night sound level
L_{eq}	equivalent noise level
$L_{eq}(24)$	equivalent sound level for 24-hour periods
LHV	lower heating value
LOLP	loss of load probability
LOS	level of service
LRU	logical reclamation unit
m	meter
m^2	square meter
MCR	maximum current rating
mG	milligauss
mg/L	milligram per liter
MGD	million gallons per day
mi^2	square mile
mL	milliliter
mph	miles per hour
MVA	megavolt amperes
MW	megawatt
NAS	National Audubon Society
NEPA	National Environmental Policy Act of 1969
NESC	National Electrical Safety Code
NESHAPS	National Emission Standard for Hazardous Air Pollutants
NGVD	National Geodetic Vertical Datum

NH_3	ammonia
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NSCR	non-selective catalytic reduction
NSPS	new source performance standards
NSR	New Source Review
NTU	nephelometric turbidity unit
NWS	National Weather Service
O_3	ozone
OAQPS	Office of Air Quality Planning and Standards
organisms/m^2	organisms per square meter
PCB	polychlorinated biphenyl
pCi/L	picoCurie per liter
persons/mi_2	persons per square mile
PHX	primary heat exchanger
PM	particulate matter
PM_{10}	particulate matter less than or equal to 10 micrometers aerodynamic diameter
POS	plan of study
POTW	publicly owned treatment works
ppb	part per billion
ppm	part per million
ppmv	part per million volumetric
ppmvd	dry volume parts per million
PRECO	Peace River Electric Cooperative
PSD	prevention of significant deterioration
psia	pound per square inch absolute
psig	pound per square inch gauge

Pt-Co	platinum-cobalt
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
R-1	Residence
RC	Rural Conservation
RCC	Rural-Cluster Center
R.O.	reverse osmosis
RCRA	Resource Conservation and Recovery Act
RMD	Rural Mixed-Use Development
rpm	revolutions per minute
RRD	Rural Residential
RV	recreational vehicle
SARA	Superfund Amendment and Reauthorization Act
SCA	Site Certification Application
scf	standard cubic foot
SCR	selective catalytic reduction
SCS	Soil Conservation Services
SF-1M	Single Family-Mixed
SIC	Standard Industrial Classification
SMSA	Standard Metropolitan Statistical Area
SNCR	selective non-catalytic reduction
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SOP	standard operating procedure
SPCC	Spill Prevention, Control, and Countermeasure
SPT	standard penetration test
SR	State Road
ST	steam turbine
stpd	short-tons per day

SUS	Saybolt Universal seconds
SWFWMD	Southwest Florida Water Management District
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
Texaco	Texaco, Inc.
tpd	ton per day
tpy	ton per year
TSP	total suspended particulate
TSS	total suspended solids
UE&C	United Engineers & Constructors
μg/L	microgram per liter
$\mu g/m^3$	microgram per cubic meter
μmhos/cm	micromhos per centimeter
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	volatile organic compound
WUP	water use permit

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CHAPTER 3.0
THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

This chapter provides descriptions of the proposed power plant facilities, the key components and systems of the plant and their operations, and the directly associated facilities which will comprise the Tampa Electric Company Polk Power Station. The descriptions include, to the extent possible, estimates of the expected character, quality, and quantity of discharges and emissions from the plant facilities and operations. Also, proposed measures and systems to control and, as necessary, treat the expected emissions and discharges are described in order to provide reasonable assurance that the plant operations comply with applicable regulatory requirements and standards. These descriptions are based on Tampa Electric Company's current plans and available engineering and design information for the proposed Polk Power Station project.

3.1 BACKGROUND

The proposed Polk Power Station project involves the phased construction and operation of electric generating units and associated facilities on a 4,348-acre site in southwest Polk County, Florida. The proposed generating units will include a nominal net 260-MW IGCC unit (i.e., Polk Unit 1), two nominal net 220-MW CC units, and six stand-alone nominal net 75-MW CT units. The construction and operation of these units will provide a total, ultimate generating capacity of approximately 1,150 MW (nominal net) at the Polk Power Station site.

Table 3.1.0-1 provides the phased schedule for construction and operation of the proposed generating units and overall site preparation and reclamation activities. As shown in this table, construction activities for the nominal net 260-MW IGCC unit will begin in January 1994 with the first component of the IGCC unit, a nominal net 150-MW advanced CT unit, scheduled to be in-service in July 1995. The schedule ends with the in-service date of the sixth and last stand-alone CT unit planned for the site in January 2010. The planned in-service dates for the generating units have

Table 3.1.0-1. Schedule for Construction and Operation of Generating Units at the Polk Power Station Site

Activity/Unit	Start Construction	Completion/ In-Service
Overall site preparation/reclamation, including cooling reservoir	January 1994*	July 1996††
150/190-MW advanced CT†	January 1994**	July 1995
CG and HRSG/ST for 260-MW IGCC unit	January 1994**	July 1996
75-MW CT	April 1998	January 1999
75-MW CT	April 1999	January 2000
HRSG/ST for conversion of two 75-MW CTs for 220-MW CC unit	April 2000	January 2001
75-MW CT	April 2001	January 2002
220-MW CC	April 2001	January 2003
75-MW CT	April 2005	January 2006
75-MW CT	April 2006	January 2007
75-MW CT	April 2007	January 2008
75-MW CT	April 2008	January 2009
75-MW CT	April 2009	January 2010

* Tampa Electric Company may request appropriate agency approvals to initiate certain site reclamation activities prior to this date.

† 150 MW when operated in simple-cycle CT or CC mode and fired on fuel oil. 190 MW when operated in IGCC mode with gasifier and air separation unit.

** Construction activities may be initiated prior to this date if all applicable regulatory approvals, licenses, and permits are obtained prior to December 1993.

†† Certain reclamation activities (e.g., vegetation planting) may extend beyond July 1996.

Source: Tampa Electric Company, 1992.

been phased to match Tampa Electric Company's power resource needs to meet its currently projected Customer demands in the 1995 through 2010 timeframe. The units have also been selected and sized to most reliably and cost-effectively meet these future Customer electricity demands. The schedule presented in Table 3.1.0-1 may be subject to some revisions in the future (i.e., the construction and in-service dates for certain units may be accelerated or delayed) based on the results of the company's ongoing Customer demand forecasting and power resource planning programs in the future as well as future orders determining the need for new generating capacity additions from the FPSC. At this time and by this SCA, Tampa Electric Company is requesting certification of the Polk Power Station site for an ultimate generating capacity of approximately 1,150 MW (nominal net).

Also, as shown in Table 3.1.0-1, overall preparation and reclamation of the Polk Power Station site are scheduled to begin in January 1994. Since the majority (i.e., more than 94 percent) of the site has been, is currently, or will be mined or disturbed by phosphate mining activities, overall site preparation involves not only activities to make the site suitable for development of the proposed generating units and associated facilities, but also required reclamation activities to comply with the mined land reclamation requirements of FDNR (Chapter 16C-16, F.A.C.) and Polk County Phosphate Mining Ordinance 88-19. Tampa Electric Company's proposed plans to comply with these requirements will require a modification of the currently-approved reclamation plans and programs for the site and are presented in Chapter 9.0 of this SCA and in a separate document submitted to FDNR and Polk County entitled Conceptual Reclamation Plan Application.

Tampa Electric Company's proposed project development plans have been selected and designed to take full advantage, environmentally and economically, of the site conditions existing after the mining activities have ceased and fulfill regulatory reclamation requirements. The main power plant facilities and structures will be developed on lands to the east of SR 37 which were not mined but disturbed by mining-related activities. Fill materials for this plant site area will be obtained from the development activities for the cooling reservoir. The use of existing mined-out areas on the site for the cooling reservoir allows the reservoir to be developed as a primarily below-grade facility which lessens groundwater withdrawals for cooling water makeup to and water discharges from the cooling reservoir as well as reduces construction and maintenance costs for the facility. The proposed development/reclamation plans for the 1,511-acre portion of the site to the west of SR 37 will result in an environmentally significant wildlife habitat and corridor resource area in southwest Polk County. Other mined-out areas on the site will be reclaimed to uplands and wetlands and integrated into the overall stormwater runoff management plans for the proposed project. These areas will also provide wildlife habitat resource areas on the site after development of the project.

As indicated in Table 3.1.0-1, the overall site preparation and reclamation activities are currently scheduled to begin in January 1994 after receipt of the final state site certification and federal agency approvals. However, during the review process of this SCA, Tampa Electric Company may request approvals from FDER and FDNR to initiate certain site reclamation activities prior to January 1994. The earlier initiation of these activities would be advantageous to the overall project in order to meet the statutory time limitations required by FDNR to initiate reclamation of mined lands and to provide as much time as possible for reclaimed, re-vegetated wetland and upland areas to become established and develop as wildlife habitat resources. Any reclamation activities conducted prior to the final site certification by the Siting Board will be conducted in accordance with the modified reclamation plans submitted to FDNR and Polk County in conjunction with this SCA and will not adversely affect any agency programs or future use of the site should the final site certification for the Polk Power Station not be approved.

The following sections provide overall descriptions of the proposed electric generating units, the operations of major processes and systems, and other associated facilities which will comprise the Tampa Electric Company Polk Power Station project. These descriptions will provide reviewers of this SCA with a detailed understanding of the proposed facilities and processes. Also, as appropriate, specific references are provided to other sections in this chapter and elsewhere in this SCA which present more detailed descriptions of the proposed facilities, systems, and processes.

3.1.1 INTEGRATED COAL GASIFICATION COMBINED CYCLE UNIT AND PROCESS DESCRIPTIONS

As discussed in Section 1.4.4, Tampa Electric Company will develop the proposed IGCC unit in conjunction with a cooperative agreement with DOE under the Clean Coal Technology Demonstration program. Under this agreement, DOE will provide $120 million in partial funding for construction of the unit and its operation for 2 years to demonstrate the integration of CG and CC technologies and a new, potentially more efficient technology (i.e., HGCU) for removing sulfur from syngas prior to combustion. These demonstration aspects of the IGCC unit provide Tampa Electric Company with the opportunity to commercially demonstrate an environmentally acceptable and economical means of generating electricity using coal which is the most abundant energy resource in the United States. Therefore, if successful, this demonstration could assist in reducing future reliance on the use of foreign energy oil resources for electricity generation in the United States.

As shown in Table 3.1.0-1, the first electric generating unit and initial component of the IGCC unit at the Polk Power Station site will be a nominal net 150-MW advanced CT unit which will be placed in service in July 1995. This unit will be a GE 7F CT. This advanced CT unit will be fired on low-sulfur No. 2 fuel oil during its first year of operation and will be used up to a maximum capacity factor of 10 percent to meet Tampa Electric Company's peak demands for electricity. Annual capacity factor is defined as the actual megawatt hours produced by a generating unit versus the maximum possible megawatt hours that could be produced, expressed on a percent basis.

After the first year of operation, this advanced CT unit will be integrated with HRSG and ST generator facilities to form a CC generating unit and CG facilities to comprise the proposed nominal net 260-MW IGCC generating unit. The CG facilities will be based on the Texaco oxygen-blown, entrained flow, gasification system. The proposed IGCC unit, known as Polk Unit 1, is scheduled to be operational in July 1996 in order to meet Tampa Electric Company's baseload power resource needs as approved by the FPSC. As a baseload generating unit, the proposed IGCC unit will be capable of operating at up to 100-percent capacity factor when fired on the syngas produced in the CG facilities. When fired on the syngas and operated with the addition of nitrogen gas from the proposed air separation unit to the CT, the advanced CT unit is expected to have a nominal net generating capacity of 190 MW.

After conversion of the advanced CT to the IGCC unit, the facilities will be designed to maintain the capability to fire No. 2 fuel oil as a backup fuel and operate in a CC mode, to provide required flexibility in meeting Customer demands in the event of unanticipated disruptions in the delivery of coal or unplanned unavailability of the CG facilities. Tampa Electric Company anticipates and is proposing to permit operations in this CC mode using the backup No. 2 fuel for a maximum annual capacity factor of 10 percent.

Air emission controls for the stand-alone advanced CT during the first year of operation and the CC module of the IGCC unit when fired on the backup No. 2 fuel oil will consist of a combination of measures. SO_2 emissions will be controlled by the use of fuel oil with a low sulfur content (i.e., maximum sulfur content of 0.05 percent). NO_x emissions will be controlled by water injection in the advanced CT which controls the combustion temperature to limit the formation of NO_x. Other potential air pollutants (e.g., CO, VOCs, PM_{10}, and trace elements) will be controlled primarily by the fuel oil characteristics (i.e., only trace contents of potential pollutants) and by the efficient design and operation of the CT unit. Section 3.4 of this SCA and the PSD Permit Application in Appendix 11.1.3 provide additional discussions on the selection and design of these proposed air emission control measures.

The IGCC unit will consist of the following major systems and processes:

- Coal grinding and slurry preparation;
- Air separation unit;
- Gasification system;
- Slag handling and storage;

- Syngas scrubbing and cooling systems;
- Gasification process black water handling and brine concentration system;
- Acid gas removal unit;
- Sulfur by-product recovery, handling, and storage;
- Tail gas treating unit;
- HGCU system and H_2SO_4 by-product handling and storage; and
- Power block.

Figure 3.1.1-1 provides an overall block flow diagram of these major systems and processes. Each of these major systems and processes is described in the following subsections. General descriptions of other facilities directly associated with the IGCC unit and, in some cases, with the other generating units proposed for the site (e.g., potable and process water supply and treatment, fuel delivery and storage, cooling reservoir, and by-product storage) are provided in Section 3.1.4.

3.1.1.1 Coal Grinding and Slurry Preparation

The coal grinding and slurry preparation system for the IGCC unit will prepare the coal for input to gasifier. Figure 3.1.1-2 presents a schematic of this system.

As shown in Figure 3.1.1-2, coal will be withdrawn from the coal storage area and fed to the grinding mill with recycled process water and makeup water from the water supply system. The grinding mill may also be fed fine coal recovered by the dust collection system. Ammonia may be added to the mill for pH adjustment, if necessary. The pH of the slurry will be maintained between 6 and 8 to minimize corrosion in the carbon steel equipment. A slurry additive for reducing viscosity will also be pumped continuously to the grinding mill.

The grinding mill will reduce the feed coal to the design particle size distribution. The mill will be a conventional rod-type system with an overflow discharge of the slurry. Slurry discharged from the grinding mill will pass through a trommel screen

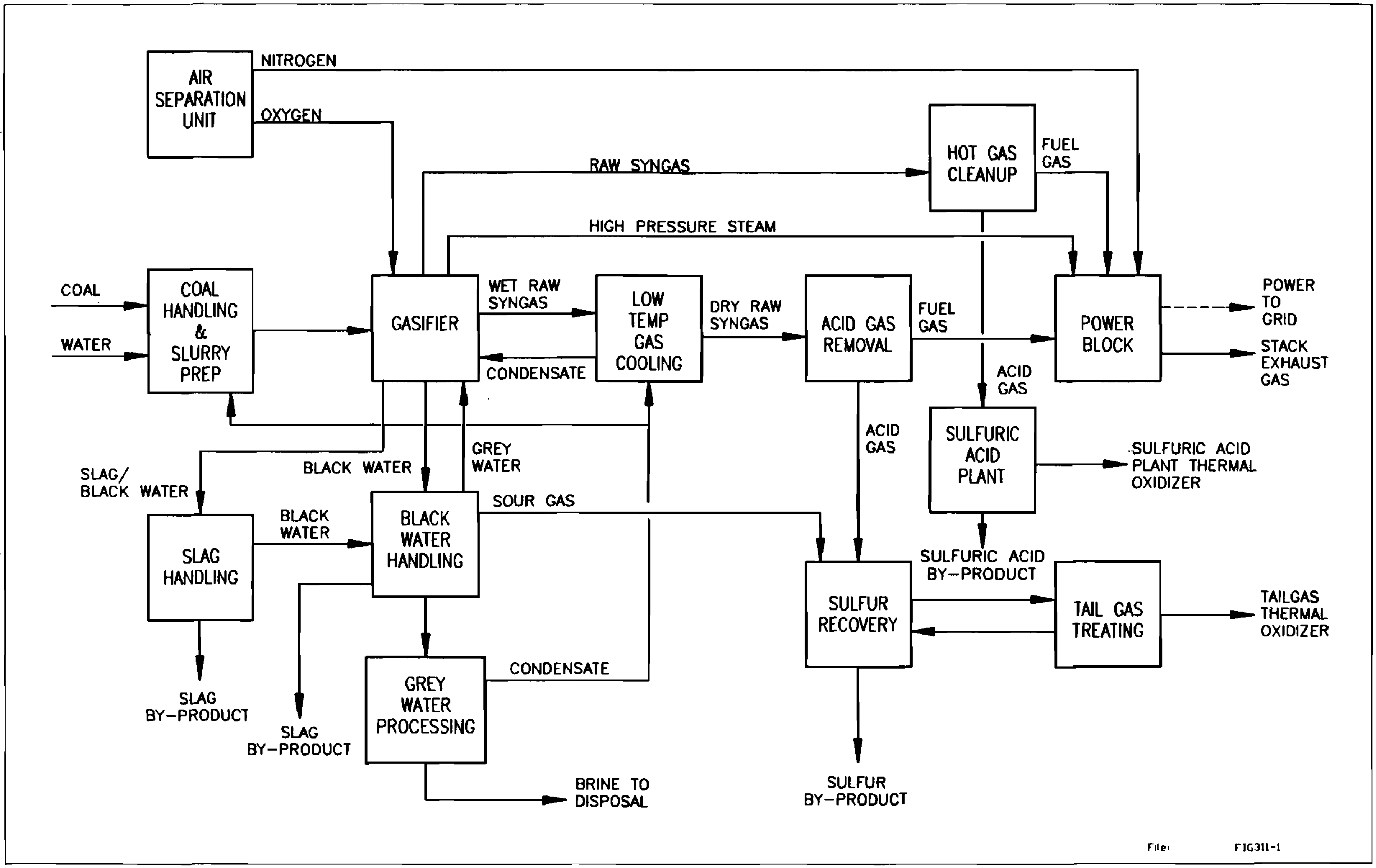

FIGURE 3.1.1-1.

GENERALIZED FLOW DIAGRAM OF IGCC SYSTEMS AND PROCESS

Source: ECT, 1992.

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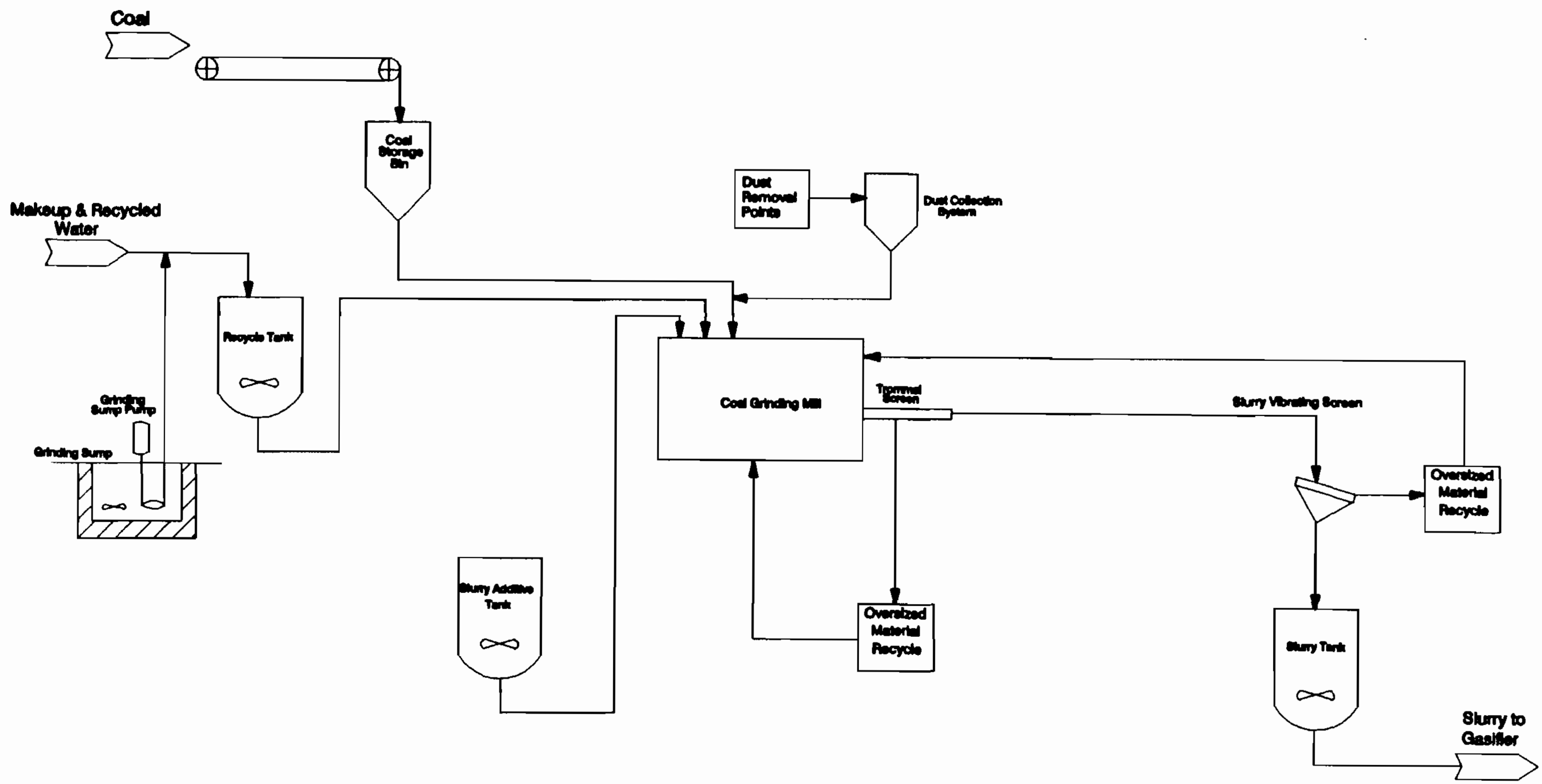

FIGURE 3.1.1-2.

COAL GRINDING AND SLURRY PREPARATION SCHEMATIC

Source: Texaco, 1992.

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and over a vibrating screen to remove any oversized particles before entering into the slurry tank. Oversized particles will be recycled to the grinding mill.

A below-grade grinding sump will be located centrally within the coal grinding and slurry preparation area to handle and collect any slurry drains or spills in the area. Materials collected in the sump will be routed to the recycle tank for reuse in the process.

In order to minimize groundwater withdrawals and use, water for the slurry preparation system will be provided from several sources. Water for the system will be provided primarily by moisture contained in the coal feed, and recycled feed and grinding sump water. Additional makeup water to the slurry system will be provided from the overall plant service water system. Through the collection and recycling process, there will be no water discharges from the coal grinding and slurry preparation system. All water from the system is fed to the gasifier in the coal slurry.

Potential particulate matter air emissions from the coal storage bin, grinding mill, and rod mill overflow discharge will primarily be controlled by the wet nature of these subsystems and by the use of enclosures for the subsystems with vents through fabric filters or baghouses. The grinding sump and slurry tank vents will each be equipped with carbon canisters for absorption of potential H_2S or ammonia (NH_3) emissions.

3.1.1.2 Air Separation Unit

The air separation unit will use ambient air to produce oxygen for use in the gasification system and sulfur recovery unit, and nitrogen which will be sent to the advanced CT. The addition of nitrogen in the CT combustion chamber has dual benefits. First, since syngas has a substantially lower heating value than natural gas, a higher fuel mass flow is needed to maintain heat input which also results in higher CT unit output. Therefore, the addition of nitrogen increases the fuel mass flow and power output of the IGCC unit. Second, the nitrogen acts to control potential NO_x

air emissions by reducing the combustor flame temperature which, in turn, reduces the formation of NO_x in the fuel combustion process. The process of using nitrogen to control the flame temperature and NO_x formation is similar to that achieved by steam or water injection NO_x control methods; however, the use of nitrogen does not require the use and consumption of water as with the water/steam injection methods.

Figure 3.1.1-3 presents process flow schematics of the air separation unit. As shown in the figure, ambient air will be filtered in a two-stage air filter designed to remove particulate material. The first filter stage will consist of a blanket roll filter; the second filter stage will consist of removable elements, which are periodically replaced. The air will then be compressed in a multistage centrifugal air compressor equipped with inter-cooling between stages and a condensate removal system.

The compressed air will be cooled and scrubbed in an aftercooler. Chilled air from the aftercooler will be fed to the molecular sieve contaminant absorbers. The molecular sieves will remove any remaining water vapor, CO_2, and unsaturated and saturated hydrocarbons from the air. The air will then be filtered in the dust filter to remove any entrained molecular sieve particles. Regeneration of the molecular sieve adsorbent will be accomplished by heating a nitrogen stream in the regeneration heater and passing it through the off-stream bed to drive off the adsorbed contaminants. The regeneration gas will then be vented to the atmosphere.

The purified air will be fed to the cold box where it is cooled against returning gaseous product streams in a primary heat exchanger (PHX). A small fraction of the air will be extracted from the PHX at its midpoint and expanded through the compressed air turboexpander to provide refrigeration for the cryogenic process. The cooled, expanded air will then be fed to the low pressure distillation column for separation.

The remaining air will exit the cold end of the PHX a few degrees above its dew point. The air will be fed to the high pressure distillation column and then to the

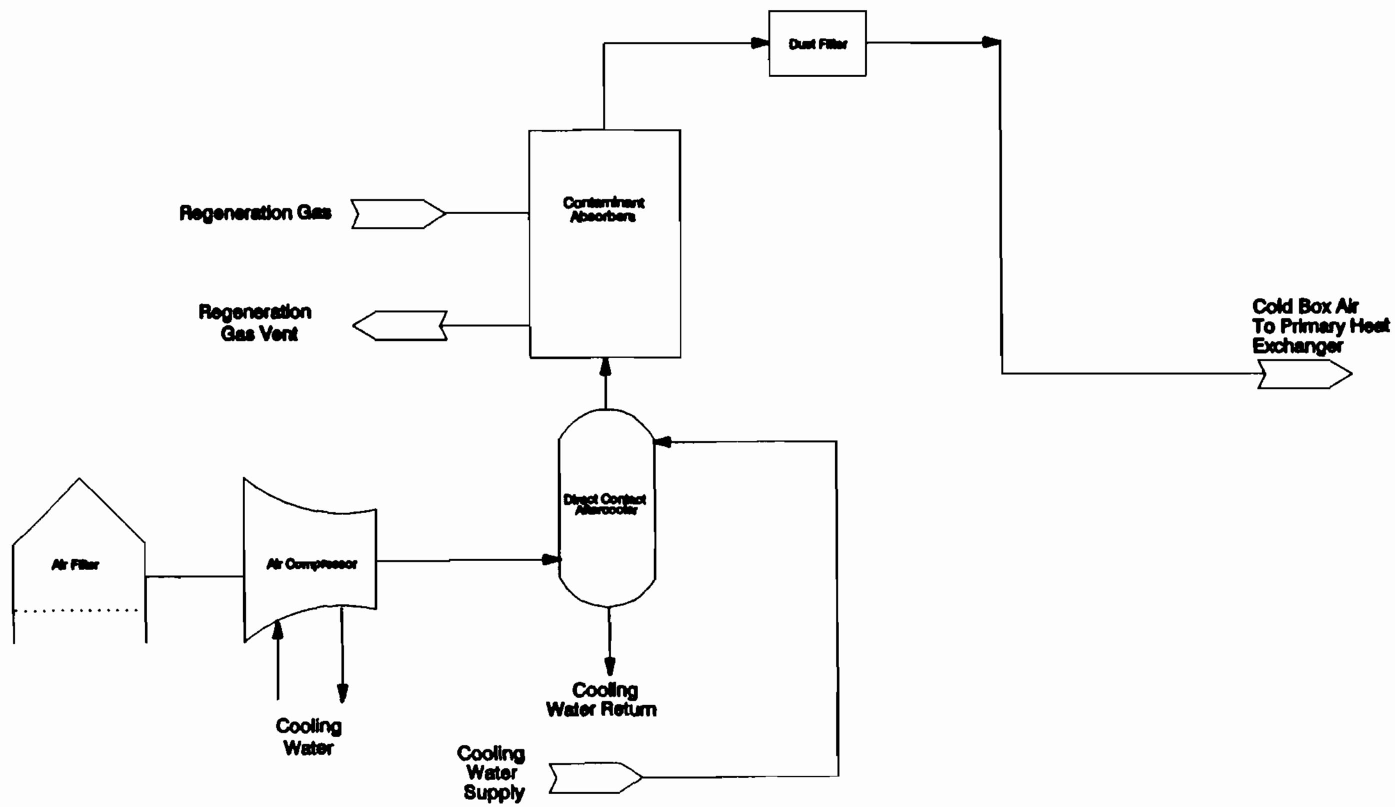

FIGURE 3.1.1-3.

AIR SEPARATION UNIT SCHEMATIC (PAGE 1 OF 2)

Source: Texaco, 1992.

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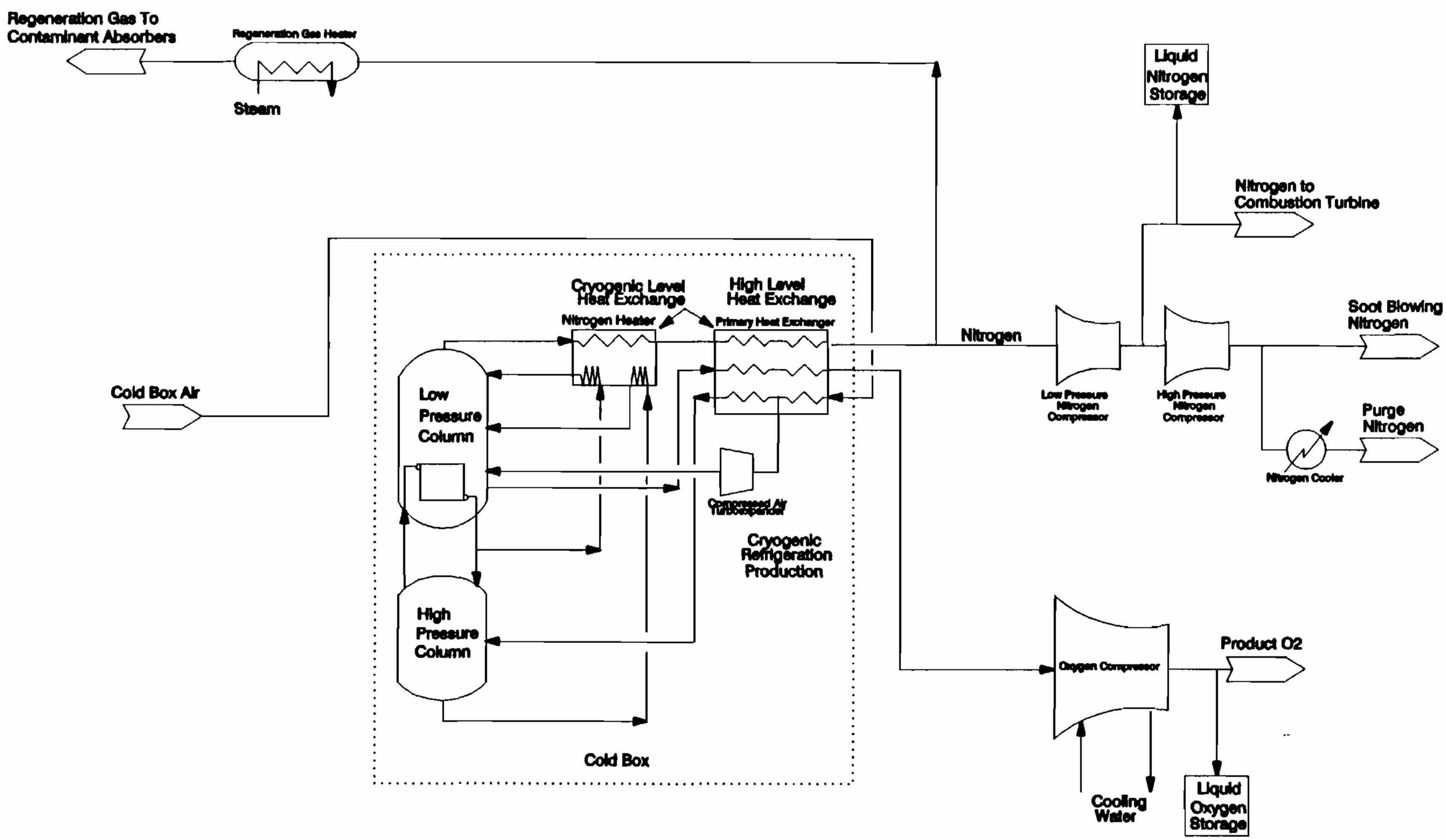

FIGURE 3.1.1-3.

AIR SEPARATION UNIT SCHEMATIC (PAGE 2 OF 2)

Source: Texaco, 1992.

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low pressure distillation column where it will be separated into a gaseous nitrogen vapor and an oxygen-enriched liquid stream. The nitrogen vapor will be condensed in the high pressure distillation column condenser against boiling liquid oxygen. The liquid nitrogen will be used as reflux in the high and low pressure distillation columns.

The liquid nitrogen reflux, kettle liquid, and turbine discharge will be fed to the low pressure distillation column where they will be separated into oxygen and nitrogen. Heat from the condensing air vapor will provide reboiler action in the liquid oxygen pool at the bottom of the low pressure distillation column. The oxygen vapor will be warmed to near-ambient temperature in the PHX and fed to the oxygen compressor, where it will be compressed to the pressure required by the gasification unit.

Nitrogen vapor from the low pressure distillation column will be warmed slightly in a superheater against subcooling nitrogen reflux liquid. The nitrogen will then be warmed to near-ambient temperature in the PHX. The nitrogen vapor will be compressed and sent to the advanced CT.

As potential backup systems to the air separation unit, liquid oxygen and nitrogen storage systems may be provided. If these systems are provided, the backup liquid oxygen and nitrogen systems will be maintained in a cold, ready-to-start state.

The air separation unit process will neither consume water nor produce or discharge wastewaters. The unit will require water only for non-contact cooling purposes which will be provided from the makeup water system and/or the cooling reservoir. Only minor, intermittent particulate matter air emissions may result from the venting of the regeneration gas.

3.1.1.3 Gasification System

The proposed IGCC unit will use the Texaco oxygen-blown, entrained flow, gasification system to produce syngas for the advanced CT. The proposed gasification system will involve a single-train gasifier which will be capable of converting approximately 2,325 tpd of coal, on a dry basis, to syngas. While the proposed gasification train will be the largest Texaco train in operation to date, the proposed system involves commercially proven technologies, processes, and equipment. Currently, licensed Texaco CG plants are being operated commercially by Tennessee Eastman in Kingsport, Tennessee; by Ube Ammonia in Ube City, Japan; and by SAR in Oberhausen, Germany. To date, these plants have gasified more than 5 million tons of coal and coke.

Also, although currently not in operation, the Texaco gasification system and a GE CT unit were successfully operated at the 120-MW Cool Water IGCC facility in Daggett, California. The Cool Water plant was developed jointly by Texaco, the Electric Power Research Institute (EPRI), Southern California Edison, Bechtel Power Corporation, GE, and a Japanese partnership.

The Cool Water facility was operated between June 1984 and June 1989 and is currently maintained in a long-term standby status. During its operation, the Cool Water IGCC plant was operated for more than 26,000 hours, generated more than 2.7 billion kilowatt hours (kwh) of electricity, and achieved a capacity factor of 87 percent in its final quarter of operation. The successful demonstration aspects of the Cool Water plant involved not only the commercial viability of the gasification technology for power generation, but also the environmental acceptability of the technology under stringent State of California and EPA regulations regarding air emissions, water quality, and solid wastes.

The Texaco gasification system has also been successfully operated in demonstration plants in Muscle Shoals, Alabama, and in Oberhausen, Germany, as well as in Texaco's gasification pilot plant and testing facilities in Montebello, California.

Figure 3.1.1-4 presents the process flow schematic for the proposed gasification system. As shown in this figure, coal slurry from the slurry feed tank and oxygen from the air separation unit will be fed to the gasifier and sent to the process burner. The gasifier will be a refractory lined vessel capable of withstanding high temperatures and pressures. The coal slurry and oxygen will react in the gasifier at high temperatures to produce syngas. The syngas will consist primarily of hydrogen, CO, water vapor, and CO_2, with small amounts of H_2S, COS, methane, argon, and nitrogen. Coal ash and unconverted carbon in the gasifier will form a liquid melt called slag.

Hot syngas and slag from the gasifier will flow downward into a radiant syngas cooler, which is a high pressure steam generator equipped with a water wall to protect the vessel shell. Heat will be transferred primarily by radiation from the hot syngas to the boiler feed water circulating in the water wall. High pressure steam produced in this boiler will be routed to the HRSG in the power block area which will supplement the heat input to the HRSG and increase the efficiency of the generating unit.

The syngas will pass over the surface of a pool of water at the bottom of the radiant syngas cooler and exit the vessel. The raw syngas will then be sent to the high temperature syngas cooling system in the CGCU system for further heat recovery and to the demonstration HGCU system. The slag will drop into the water pool and will be fed to the slag sump tank.

Gasification process water called black water will also collect with the slag in the bottom of the radiant syngas cooler and flow with the slag into the slag sump tank. The proposed system for handling and processing the black water is described in Sections 3.5.4.5 and 3.5.4.6. Potential air emissions or leaks from the gasifier to the atmosphere will be negligible since it will be designed to maintain pressure and control syngas flows.

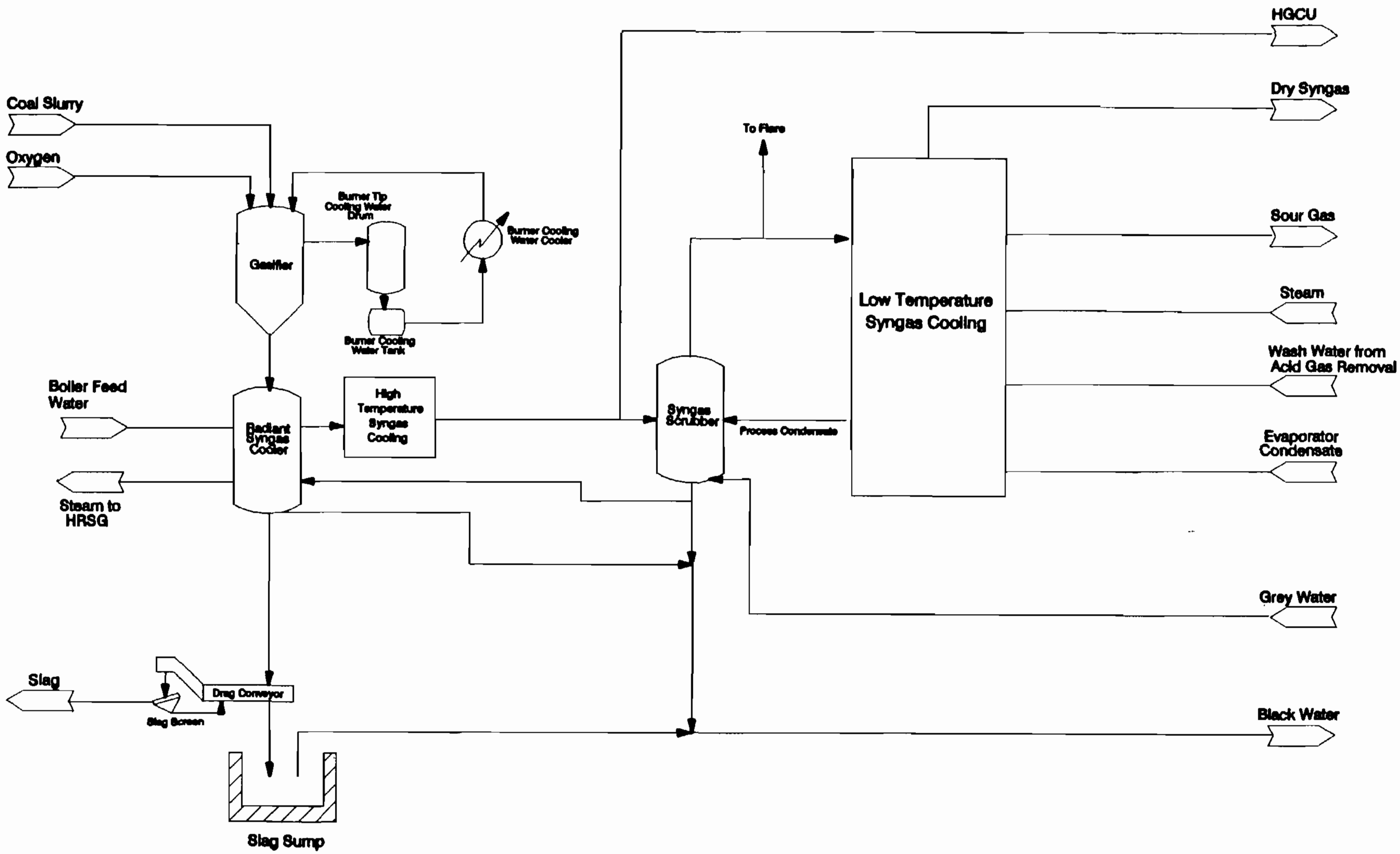

FIGURE 3.1.1-4.

GASIFICATION, SLAG HANDLING, AND SYNGAS COOLING SYSTEM SCHEMATIC

Source: Texaco, 1992.

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3.1.1.4 Slag Handling

The slag handling system will remove ungasified solids from the gasification process equipment. These solids consist of the coal ash and unconverted coal components (primarily carbon) that exit the gasifier in the solid phase. The schematic presented in Figure 3.1.1-4 also shows the slag handling process flow.

In the gasification system, coarse solids and some of the fine solids will be flushed from the radiant cooler into the slag sump tank. Solids flushed to the slag sump tank will settle onto the drag conveyor and will be carried out of the sump. Next, the solids will fall onto the slag screen where they are dewatered. The slag will then be transported by conveyors to a concrete dewatering pad. The concrete dewatering pad will be bunkered to prevent runoff from the area and have a sump to collect the dewatering water. From the dewatering pad, the slag will either be loaded into trucks for transport and use offsite or transported to the temporary, onsite slag storage area which is described in Section 3.1.4. The water removed from the slag and sumps will be pumped to the gasification process black water handling and processing system.

Again, all waters produced in this slag handling system will be collected and routed to the black water handling system for processing and reuse. Also, potential particulate matter air emissions from the system will be minimal due to the wet nature of the slag and processes.

This system will generate the coarse slag material at a maximum rate of approximately 210 short-tons per day (stpd) on a dry basis and the material will contain approximately 25-percent moisture. As discussed in Section 3.7.1.5, the slag is classified as non-hazardous and non-leachable and will be marketed and sold for various offsite commercial uses.

3.1.1.5 Syngas Scrubbing and Cooling Systems

The raw, hot syngas from the gasifier will be routed to the separate conventional CGCU and demonstration HGCU systems for appropriate treatment. The CGCU system will be designed to treat 100 percent of the syngas flows for the unit, while the HGCU system will be capable of treating approximately 50 percent of the syngas when the unit is operating at full capacity. The CGCU system is described in the following subsections, and descriptions of the HGCU system are provided in Section 3.1.1.10.

The initial treatment process for the raw syngas within the CGCU system involves the syngas scrubbing and cooling systems.

The raw, hot syngas from the gasifier will contain entrained solids or fine slag particles which must be removed to produce the clean syngas fuel. Also, the raw hot syngas needs to be cooled in order to be effectively cleaned in the acid gas removal unit or CGCU system. The flow schematic for these syngas scrubbing and cooling processes is presented in Figure 3.1.1-4.

As shown in Figure 3.1.1-4, the raw hot syngas from the gasifier will be fed through the high temperature syngas cooling system to the syngas scrubber where entrained solids are removed. The syngas will then be routed to the low temperature gas cooling section. The low temperature gas cooling section will cool the syngas by recovering its useful heat and will condense out much of the water from the syngas prior to its routing to the acid gas removal system.

During startups, shutdowns, and upsets, syngas will be routed to the flare for short periods of time.

The syngas scrubber bottoms stream will contain all the solids which were not removed in the radiant syngas cooler sump. The solids in the bottoms stream will be routed to the black water handling system.

All water used in the syngas scrubbing and cooling processes will be provided by recycled water streams. Also, all process water streams will be sent to the black water handling system and/or reused within other CG plant systems. The syngas scrubbing and cooling processes will have no potential ambient air emissions.

3.1.1.6 Gasification Process Black Water Handling and Brine Concentration System

In the gasification and slag handling systems, water removed from the slag contains fine particles of slag and ungasified solids. This process water is referred to as black water due to its coloration from the suspended particles. As discussed previously in Section 3.1.1.5, the syngas scrubber also generates black water, which contains the fine particles entrained in the syngas exiting the gasifier and removed in the scrubbing process.

All black water from the gasification and syngas cleanup processes will be collected, processed, recycled to the extent possible, and contained within the processes. There will be no liquid discharges of these process waters to other systems or to the cooling reservoir. The effluent remaining after processing of this black water will be condensed and crystallized into a solid consisting primarily of salt called brine which will be stored in lined landfill on the site with appropriately designed leachate and stormwater runoff collection and treatment systems. The black water handling, processing, and crystallization systems and processes are described in Section 3.5.4, and the brine storage area is described in Section 3.7.1.

3.1.1.7 Acid Gas Removal Unit

After removal of the entrained solids, the syngas will still contain acid gases such as CO_2 and H_2S which will be removed prior to firing the syngas in the advanced CT unit to control potential SO_2 air emissions. The acid gas removal unit will remove the acid gases from the syngas. The process flow schematic for this unit is provided in Figure 3.1.1-5.

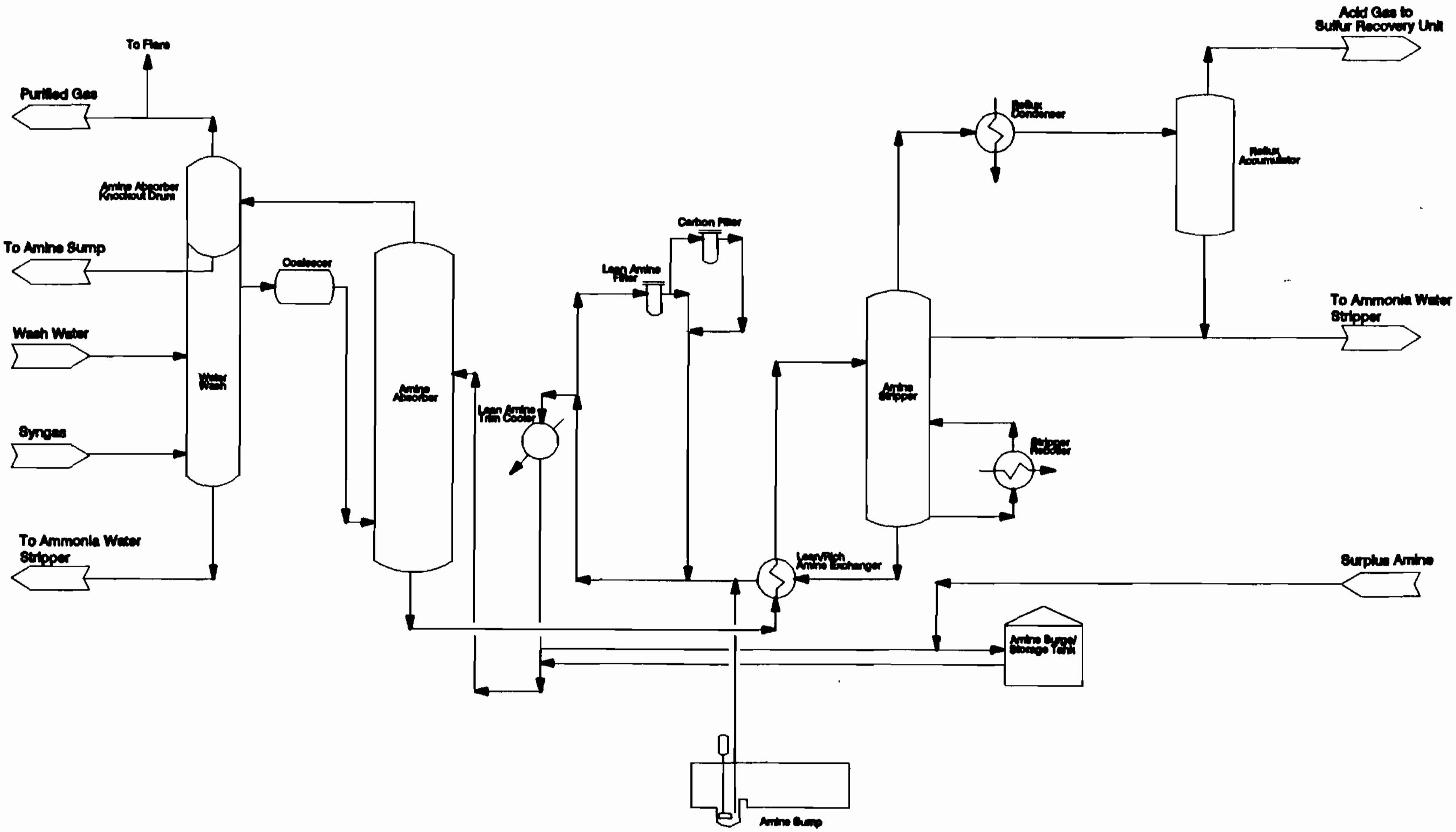

FIGURE 3.1.1-5.

ACID GAS REMOVAL UNIT SCHEMATIC

Source: Texaco, 1992.

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In this unit, the cooled syngas will first be water-washed in the water wash column. Wash water will be pumped to the column to remove contaminants which would potentially degrade the amine from the syngas. The wash water from the column will be sent to the NH_3 water stripper. The washed syngas will flow through a liquid coalescer to collect entrained water droplets and then flow to the amine absorber.

The syngas will be contacted with amine in the amine absorber. Acting as a weak base, the amine will absorb acid gases such as CO_2 and H_2S by chemical reaction. The purified syngas will flow through a knock-out drum located on top of the water wash column to remove entrained amine. The recovered liquid will be returned to the amine sump.

During startups, shutdowns, and upsets, syngas will be routed to the flare for short periods of time.

The rich amine will be stripped of the acid gas in the amine stripper by steam generated in the stripper reboiler. The acid gas overhead will be partially condensed by the reflux condenser and collected in the reflux accumulator. The acid gas, primarily H_2S and CO_2, from the reflux accumulator will go to the sulfur recovery unit, and the condensed liquid reflux will be returned to the amine stripper.

3.1.1.8 <u>Sulfur Recovery Unit</u>

The sulfur recovery unit, shown schematically in Figure 3.1.1-6, will convert H_2S gas to a liquid molten sulfur by-product. Approximately one-third of the feed H_2S will be oxidized in the thermal reactor to form SO_2. The SO_2 will then be reacted with the remaining H_2S to form elemental sulfur and water. NH_3 from the NH_3 stripper will also be oxidized to nitrogen and water. Any hydrocarbons in the acid gas feed will be oxidized in the thermal reactor to CO and water.

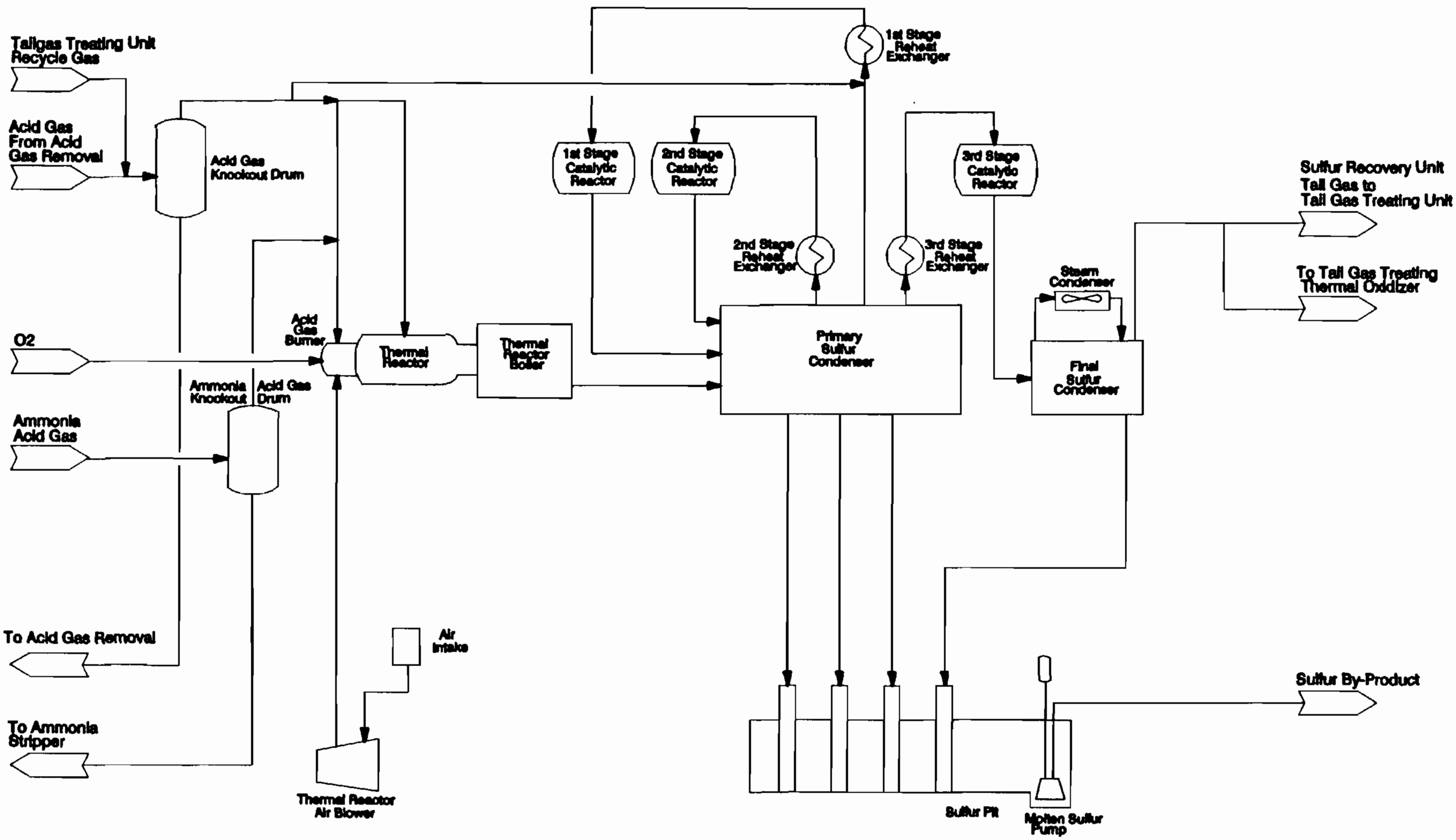

FIGURE 3.1.1-6.

SULFUR RECOVERY UNIT SCHEMATIC

Source: Texaco, 1992.

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The basic reactions are:

1. $H_2S + 1.5\ O_2 \rightarrow SO_2 + H_2O$, and
2. $2H_2S + SO_2 \rightarrow 1.5\ S_2 + 2H_2O$.

Depending on the concentration of H_2S in the acid gas feeds, as much as half of the unit's total sulfur by-product production will come from the non-catalytic reactions in the thermal reactor. This sulfur will be condensed and removed from the stream prior to feeding the first catalytic reactor. The balance of the sulfur by-product production will be formed in the three catalytic reactors.

The acid gas knock-out drum and the NH_3 water stripper gas knock-out drum will be designed to remove entrained water and condensed hydrocarbons from the amine acid gas and the NH_3 water stripper gas feeds from the acid gas removal unit upstream of the thermal reactor. The NH_3 water stripper gas stream will be fed entirely to the thermal reactor burner located in the front chamber of the thermal reactor. The amine acid gas from the acid gas removal unit may be split to assist the reaction. Pure oxygen will be added, if necessary, to maintain the front chamber temperature to ensure NH_3 combustion. If NH_3 is not present, then lower temperatures may be used. The remainder of the amine acid gas stream will be fed to the second chamber of the thermal reactor or by-passed to the inlet of the first stage reheat exchanger. Approximately one-third of the H_2S in the feed gas will be converted to SO_2 and water in the thermal reactor. Air from the air blower and oxygen will be supplied to the thermal reactor to oxidize the H_2S in the NH_3 stripper gas to SO_2 and water, to oxidize the NH_3 to nitrogen and water, and to oxidize any hydrocarbons in the NH_3 stripper gas to CO_2 and water.

The hot combustion gas from the thermal reactor second chamber will enter the boiler where the gas is cooled. The effluent gas from the boiler will enter the primary sulfur condenser. Sulfur produced in the thermal reactor will be condensed in the primary sulfur condenser as the gas is cooled. Steam will be produced as the gas is cooled and the sulfur is condensed. The liquid sulfur will be separated from the gas in a separator chamber at the outlet end of the primary sulfur condenser and will be drained to the sulfur seal pot. The liquid sulfur seal in the pot will prevent the process gas from escaping to the sulfur pit. The uncondensed gas from the first pass of the primary sulfur condenser will be routed to the first reheat exchanger where the gas is re-heated. The steam condensate produced from the reheat exchanger will flow to the primary sulfur condenser.

The gas from the first reheat exchanger will pass through the first catalytic reactor where the reaction of the remaining SO_2 with H_2S occurs over a fixed bed of activated alumina catalyst. The heat given off by the reaction in the first bed will be the greatest of all the catalytic reactor beds. The catalytic reactor product gas, containing the newly formed elemental sulfur, will exit the catalytic reactor and enter the second pass of the primary sulfur condenser. Sulfur formed in the first catalytic reactor will be condensed and will be drained to the sulfur seal pot.

The uncondensed gas will then be routed to the second reheat exchanger where it is heated prior to being fed to the second catalytic reactor. The second catalytic reactor will be similar in size and function to the first catalytic reactor. Since the concentration of the reactants will be lower in the second catalytic reactor feed than in the first, less reaction will take place. The second catalytic reactor effluent gas will again enter the primary sulfur condenser, where the bulk of the sulfur formed in the reactor will be condensed, and will be drained to the sulfur seal pot.

The uncondensed gas from the third pass of the primary sulfur condenser will be routed to the third catalytic reactor via the third reheat exchanger. Again, the steam condensate from this reheat exchanger will be sent to the primary sulfur condenser. Since the concentrations of H_2S and SO_2 will be low in the third catalytic reactor, only a relatively small amount of sulfur will be formed in this reactor. The sulfur formed in the third catalytic reactor will be condensed in the final sulfur condenser as the stream cools and drained to the sulfur seal pot.

The uncondensed gas (tail gas) will exit the final sulfur condenser via a mist eliminator pad and will be routed either to the tail gas treating unit or to the thermal oxidizer based on the tail gas sulfur content.

The thermal oxidizer will be designed to oxidize the tail gas from the sulfur recovery unit. Any unreacted H_2S, CS_2, COS, elemental sulfur, and any other combustible sulfur compounds in the gas will be oxidized almost entirely to SO_2 in the thermal oxidizer. The design thermal oxidizer combustion temperature will be maintained by burning a syngas stream or a low-sulfur fuel oil or natural gas in addition to the process effluent vapor. The oxidized products will be dispersed to the atmosphere via a 199-ft high stack. Under normal operations, only the tail gas treating unit vent gas will be oxidized in the thermal oxidizer.

The sulfur by-product will be of marketable-grade quality (i.e., greater than 90 percent purity). Approximately 90 tpd of sulfur by-product will be generated from the sulfur recovery unit when the IGCC unit is operating at full load and 100 percent of the syngas for the unit is treated in the CGCU system. The sulfur recovery unit will have a sulfur day tank within a concrete pit. The tank will have approximately a 10-day storage capacity. Heat will be provided by steam coils at the bottom of the pit. The tank will have pumps to transfer the molten sulfur to either the truck loading rack or the railcar loading rack for transport offsite. Additional storage capacity for the sulfur by-product may also be provided in specially-designed rail cars.

3.1.1.9 Tail Gas Treating Unit

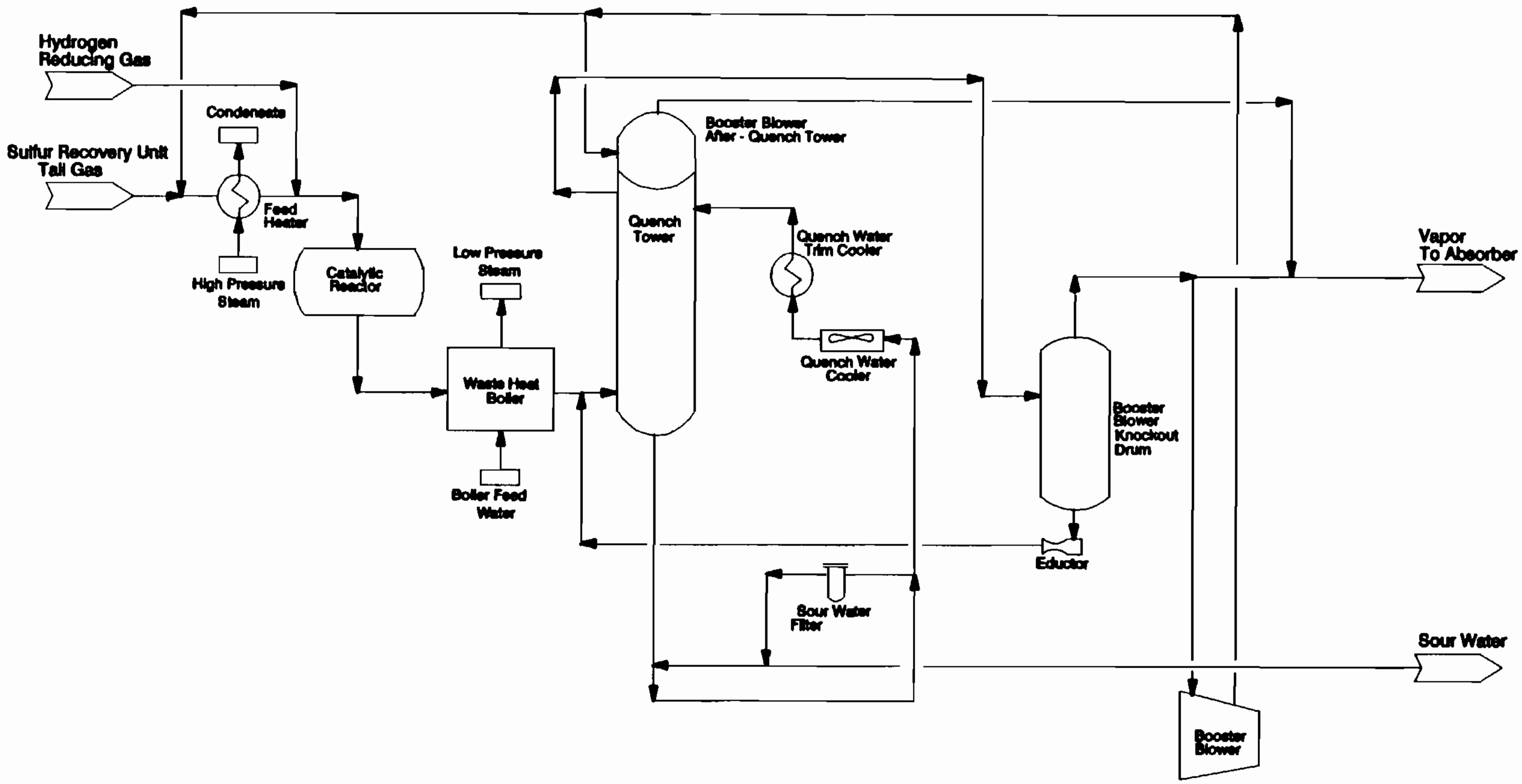
The sulfur recovery unit will typically convert approximately 96 percent of its H_2S feed gas to molten liquid sulfur. However, the concentration of H_2S and SO_2 in the tail gas from the sulfur recovery unit may still be too high to release to the atmosphere under normal operating conditions. The tail gas treating unit will be designed to recover this remaining H_2S and SO_2 for recycle back to the sulfur recovery unit and meet applicable emission levels in the tail gas vented to the atmosphere. Reaction and recovery sections of the tail gas treating unit are presented schematically in Figures 3.1.1-7 and 3.1.1-8, respectively.

As shown in Figure 3.1.1-7, the sulfur recovery unit tail gas will be fed to the feed heater, and hydrogen-rich reducing gas will be added to the heated gas leaving the feed heater. The mixed gas stream will be fed to a catalytic reactor. The reactor feed gas will pass downward through the catalyst bed and virtually all of the SO_2, sulfur, COS, and CS_2 will be converted to H_2S. In the reactor, the following basic reactions of SO_2 and elemental sulfur will take place:

1. $SO_2 + 3H_2 \rightarrow H_2S + 2H_2O$, and
2. $S + H_2 \rightarrow H_2S$.

The COS and CS_2 will be hydrolyzed by the water vapor present in the sulfur recovery unit tail gas to H_2S and CO_2. A small portion of the COS and CS_2 may not be hydrolyzed by water vapor present and may be reduced by hydrogen directly to H_2S. To assure complete reaction of the COS and CS_2 to H_2S, a minimum excess of approximately 50 percent of the stoichiometric requirement of hydrogen-rich gas will be fed to the reactor. The CO in the sulfur recovery unit tail gas will also act like hydrogen as a reducing gas; i.e., it reacts with the water vapor in the reactor to form hydrogen and CO_2. Therefore, minimal unreacted sulfur compounds will remain in the reactor outlet.

The hot gas leaving the reactor will be cooled in the waste heat boiler, which will generate steam. Water will be condensed out of the gas when it is further cooled by direct contact with the circulating quench water in the quench tower. The temperature of the quench water will increase as it cools the gas in the tower. The quench water bottoms will be pumped through the quench water cooler and quench water trim cooler before being returned to the top section of the quench tower. A slipstream of the quench water flow will be routed through the quench water filter to remove solids in the quench water.



3.1.1-24

FIGURE 3.1.1-7.

TAIL GAS TREATING UNIT REACTION SECTION SCHEMATIC

Source: Texaco, 1992.

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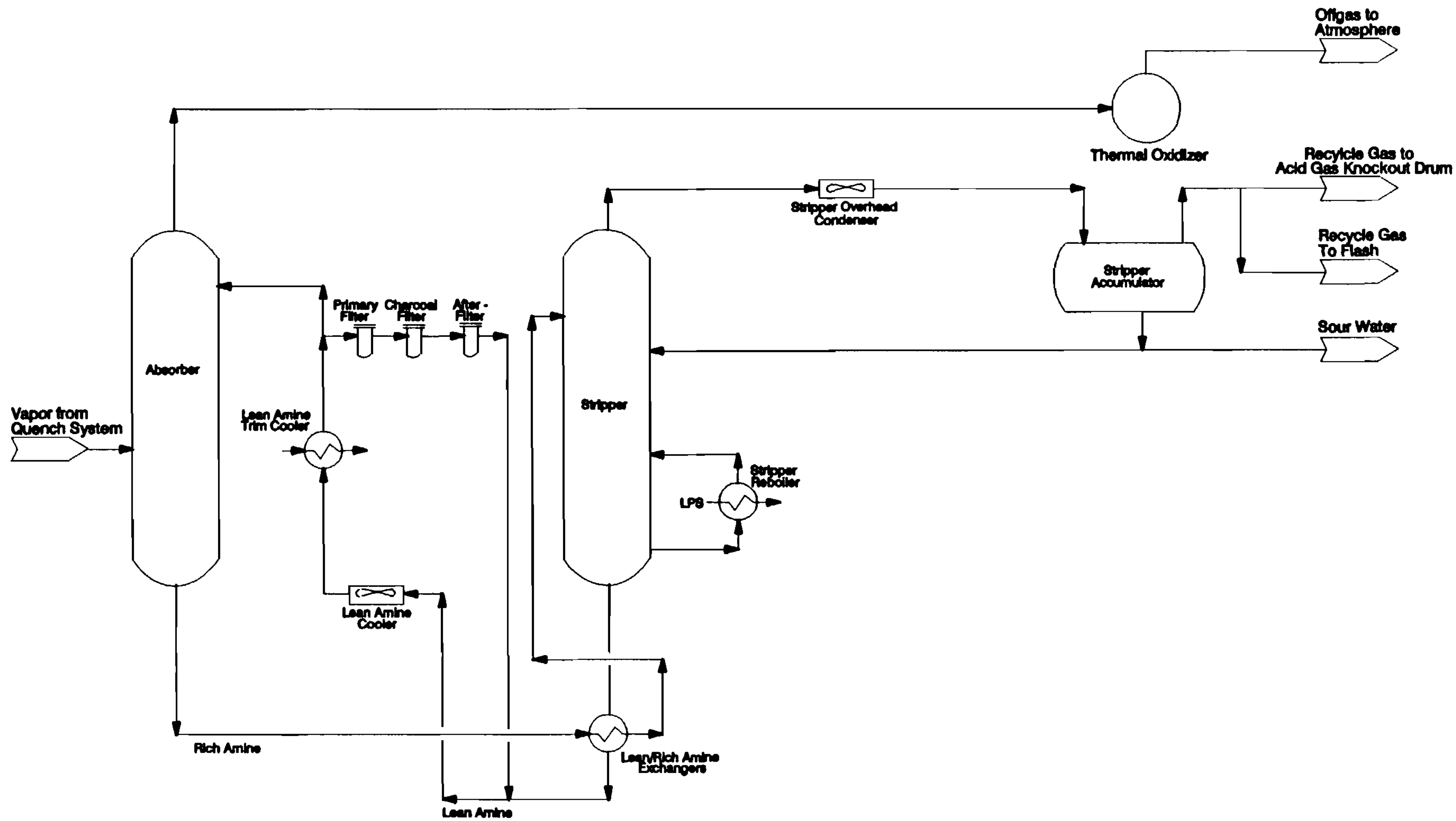

FIGURE 3.1.1-8.

TAIL GAS TREATING UNIT RECOVERY SECTION SCHEMATIC

Source: Texaco, 1992.

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The quench tower overhead gas stream will be fed to the booster blower knockout drum where any entrained liquid will be separated from the gas. The separated liquid will then be removed and returned to the quench tower bottoms above the normal liquid level. From the booster blower knockout drum, the gas normally will go to the absorber where it flows upward through the absorber through lean amine flowing downward in the absorber to remove the H_2S. The absorber overhead gas, which will have less than 260 parts per million volumetric (ppmv) of H_2S, will be fed to the thermal oxidizer. In the thermal oxidizer, H_2S and any other remaining sulfur compounds will be converted to SO_2 and vented to a stack.

3.1.1.10 Hot Gas Cleanup and Offgas Treating Systems

A schematic of the HGCU system is presented in Figure 3.1.1-9. For the system demonstration, a portion of the hot raw syngas will be routed from the gasifier to the HGCU system for cleanup prior to firing in the advanced CT.

Particulate Removal

Entrained fine particles in the syngas from the gasifier will be removed in the primary high efficiency cyclone as shown in Figure 3.1.1-9 and recycled to the black water handling system. A large fraction of the remaining PM entering the absorber will be captured by the bed, reducing particle concentration to below 30 ppm. A small amount of zinc titanate fines will be entrained from the absorber and collected in a high efficiency secondary cyclone. The high efficiency secondary cyclone will effectively capture most of the high-density zinc titanate dust and will practically eliminate all fines larger than 5 microns. Entrained particles from the regenerator will be captured in a cyclone located downstream of the regenerator. The solids from both the high efficiency secondary cyclone and the regenerator cyclone are non-hazardous and will be sent offsite for disposal. Larger fines will be sieved on screens at the regenerator sorbent outlet. Fugitive fines from the screens will be collected in a small, low temperature bag filter. The sorbent fines from both collection points will be recycled to the catalyst supplier. A high temperature barrier filter, employing

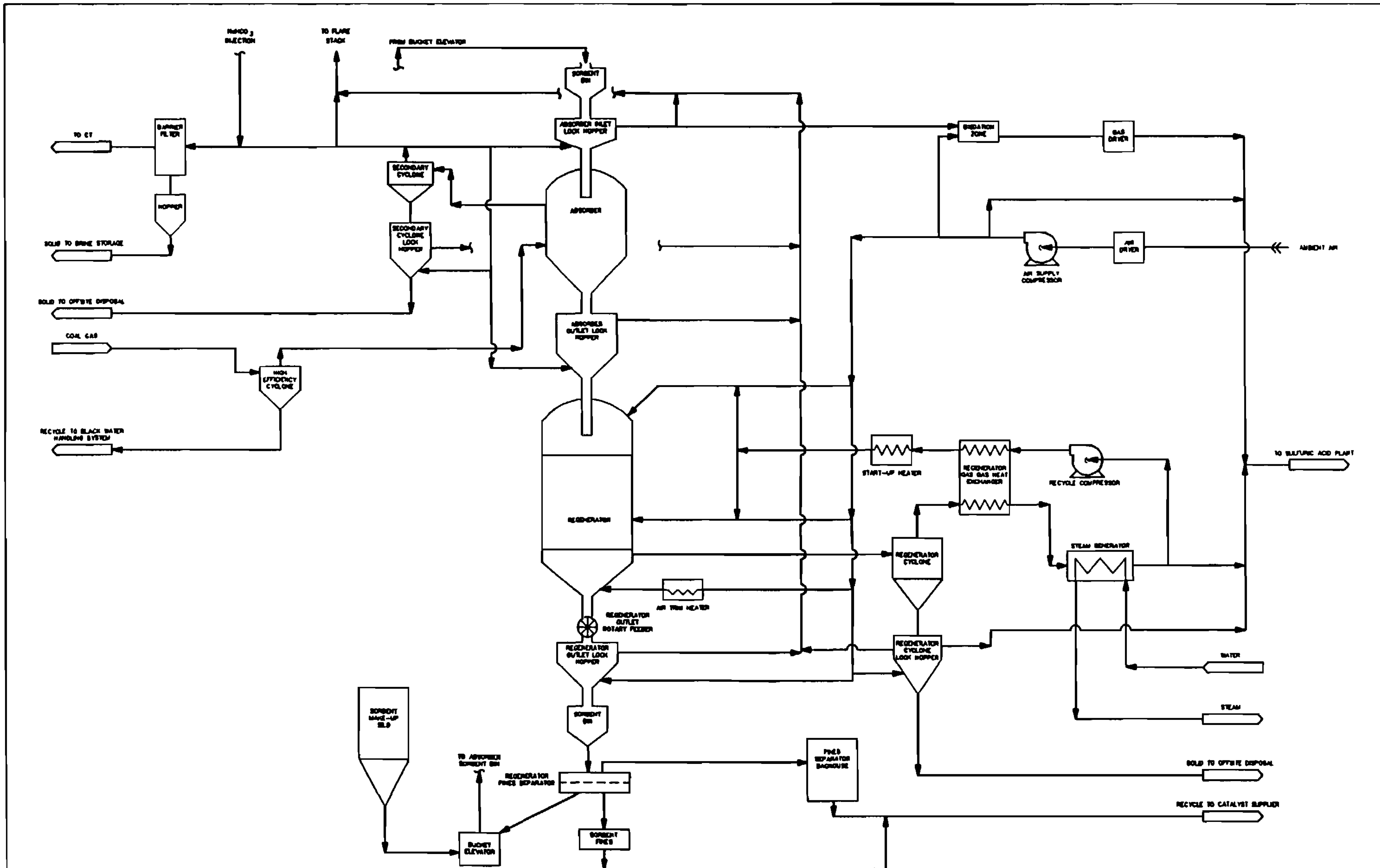

FIGURE 3.1.1-9.

HOT GAS CLEANUP SYSTEM

Source: GEESI, 1992.

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pulse cleaning, will remove greater than 99.5 percent of the residual PM prior to the CT. The collected solids will be sent to the onsite brine disposal area.

Desulfurization

The absorber is the intermittently moving bed reactor shown schematically in Figure 3.1.1-9. The sulfur-laden coal gas from the primary cyclone will enter the absorber through a gas manifold at its bottom and flow upward countercurrent to the moving bed of zinc titanate pellets.

The sulfur compounds, mainly H_2S, in the syngas react with the sorbent according to:

$$ZnO + H_2S \rightarrow ZnS + H_2O$$

The syngas leaving the absorber is expected to contain less than 30 ppmv of H_2S and COS.

The absorber bed will be stationary at low H_2S outlet concentrations and will be moved upon H_2S breakthrough. The H_2S breakthrough control signal will activate solids flow from the bottom of the absorber into the absorber's outlet lockhopper, causing the bed and the reaction zone to move downward by gravity. The displaced sulfided zinc titanate will be replaced by regenerated sorbent from the absorber's inlet lockhopper.

When regenerated zinc titanate sorbent is loaded into the absorber's inlet lock-hopper, a slip stream of syngas can be activated. This stream will decompose any zinc sulfate residual from the regeneration step according to:

$$2ZnSO_4 + 5H_2 \rightarrow ZnO + ZnS + SO_2 + 5H_2O$$

The reductive regeneration stream will flow through the absorber's inlet lockhopper until complete sulfate decomposition, detected by low SO_2 concentration, is achieved. The amount of sulfate in the regenerated zinc titanate will depend on the quality of the regeneration step, and is expected to be very small.

Regeneration

The ability to regenerate and recycle the sorbent is essential for economically viable hot syngas desulfurization. The regeneration step is a highly exothermic oxidation process requiring careful temperature control. Too high a temperature will sinter and destroy the sorbent structure and reduce its ability to react with sulfur in consecutive absorption steps. Low temperature will result in sulfate formation and a loss of reactive sorbent to the desulfurization process.

In order to effectively control the reaction and achieve a complete regeneration, the reactor will be divided into up to three zones. As the sorbent moves down the reactor zones, the reaction proceeds in a controlled atmosphere. Nearly continuous sorbent movement in the regenerator will be controlled by the rotary feeder at its bottom. The chemical reactions in the regenerator are:

$$ZnS + 1.5O_2 \rightarrow ZnO + SO_2$$

$$ZnO + SO_2 + 0.5O_2 \leftrightarrow ZnSO_4$$

The sulfation reaction will be reversible and favor the formation of sulfate at low temperatures in the presence of oxygen. Zinc sulfate will be formed in the initial stage of regeneration, but will decompose under the high-temperature, low oxygen concentration conditions at the lower end of the regenerator prior to introduction of the pure air stream.

Sulfided zinc titanate will be fed from the absorber's outlet lockhopper to the top of the regenerator where partial oxidation of the sulfided sorbent occurs. The sorbent will move down the reactor in cocurrent flow with the regeneration gas. The regeneration gas will flow downward from the top of the regenerator into the second-stage regeneration zone. Oxygen concentration will be controlled to limit the gas temperature. Under these conditions, no thermal damage will occur to the sorbent. The relatively low temperature in the first regeneration stage will result in the formation of some sulfate. This sulfate will decompose at the higher temperature during further regeneration.

The sorbent and the regeneration gas, mixed with the gas stream from the primary stage, will flow concurrently downward into the final regeneration stage. The oxygen concentration will be controlled by the ratio of air to recycle gas to limit the temperature in the bed. The recycle flow rate will be controlled to maintain oxygen concentration at the gas outlet from the regenerator. The high outlet temperature of the gas and sorbent at the end of secondary regeneration will ensure complete sulfate decomposition.

The final polishing phase of regeneration will be accomplished at the lower end of the reactor where dry air flows countercurrent to the sorbent. This stream will cool the sorbent to a temperature acceptable for downstream equipment, purge the SO_2-rich gas, and ensure complete regeneration. The gas streams from the cocurrent and countercurrent flows will mix to form the recycle gas stream.

Regeneration Gas Recycle Subsystem

The regeneration gas recycle is shown in Figure 3.1.1-9 and operates in a closed loop with dry air as an input and an SO_2-rich gas as a product output. The regeneration gas recycle loop will be designed as an internal diluent that will reduce the oxygen concentration in the air to the desired levels without the use of externally provided diluents such as steam or nitrogen. Using recycle rather than external inert diluent will also enrich the SO_2 concentration of the product stream.

The heat exchangers in the recycle loop will be designed to control the temperature of the regenerator inlet streams. The steam generator will remove the heat generated during the regeneration reaction by cooling the recycle gas stream. The recycle compressor will operate at a sufficient suction temperature to avoid H_2SO_4 condensation and a regenerative gas heat exchanger will reheat the compressed gas for recycle to the regeneration process. The heat of combustion of the sulfur will be transferred to the CC power block through the steam generated prior to recycle compression of the recycle gas stream.

Halogen Removal

Commercial grade sodium bicarbonate, trade named Nahcolite, will be injected with a small quantity of high temperature nitrogen, upstream of the barrier filter as shown in Figure 3.1.1-9. Chloride and fluoride species will be removed by direct contact reaction and on the barrier filter media with the sodium bicarbonate forming stable solids. These salts will be routed to the barrier filter hoppers for disposal in the onsite brine disposal area.

Sulfuric Acid Plant

In the HGCU process, an offgas is produced which has a high SO_2 concentration. For the proposed project, this offgas will be treated by converting the SO_2 to H_2SO_4. The conversion involves a multi-step catalytic process based on proven technology in widespread commercial use, especially within the chemical fertilizer industry in central Florida. The liquid H_2SO_4 produced by this process is commercial grade and will be marketed and sold by Tampa Electric Company for offsite uses.

A skid-mounted H_2SO_4 unit will be constructed adjacent to the CG facilities on the site. The facilities will include an aboveground tank to provide for temporary storage of the H_2SO_4 by-product and appropriate handling and loading equipment. The H_2SO_4 will be transported offsite for commercial use in specially-designed rail cars or trucks. Assuming the HGCU system is used to cleanup approximately 50 percent of the syngas for the IGCC unit at 100-percent generating capacity, the unit would produce approximately 45,000 tons per year (tpy) of liquid H_2SO_4 by-product.

3.1.1.11 Power Production

The power production system for the IGCC unit is illustrated in Figures 3.1.1-10 and 3.1.1-11. The key components are the advanced CT, HRSG, and ST generator. The advanced CT will be a GE 7F. The unit will be designed for low-NO_x emissions firing syngas, with low sulfur fuel oil for startup and as backup fuel.

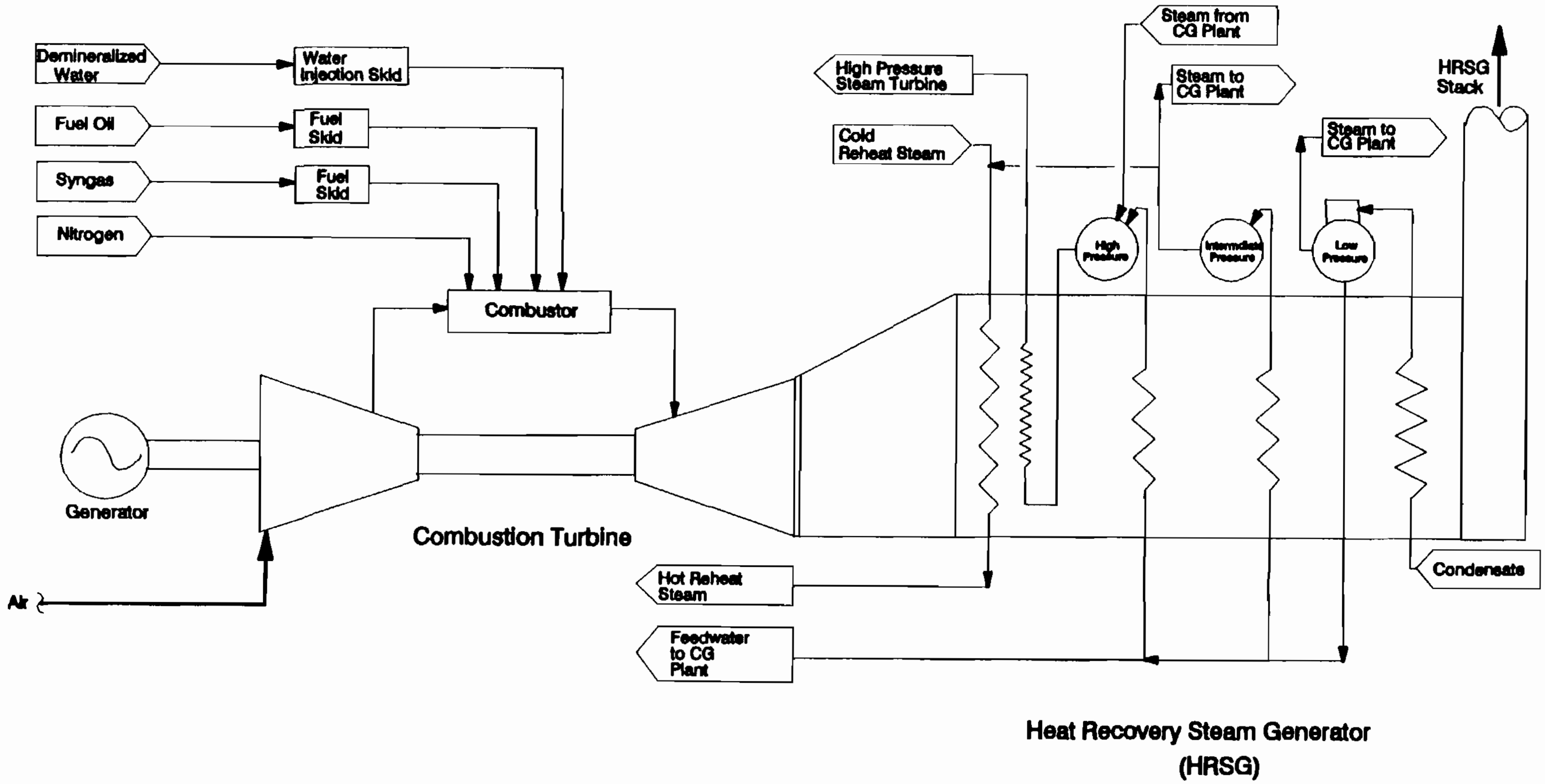

FIGURE 3.1.1-10.

COMBUSTION TURBINE PROCESS FLOW SCHEMATIC

Source: GE, 1992.

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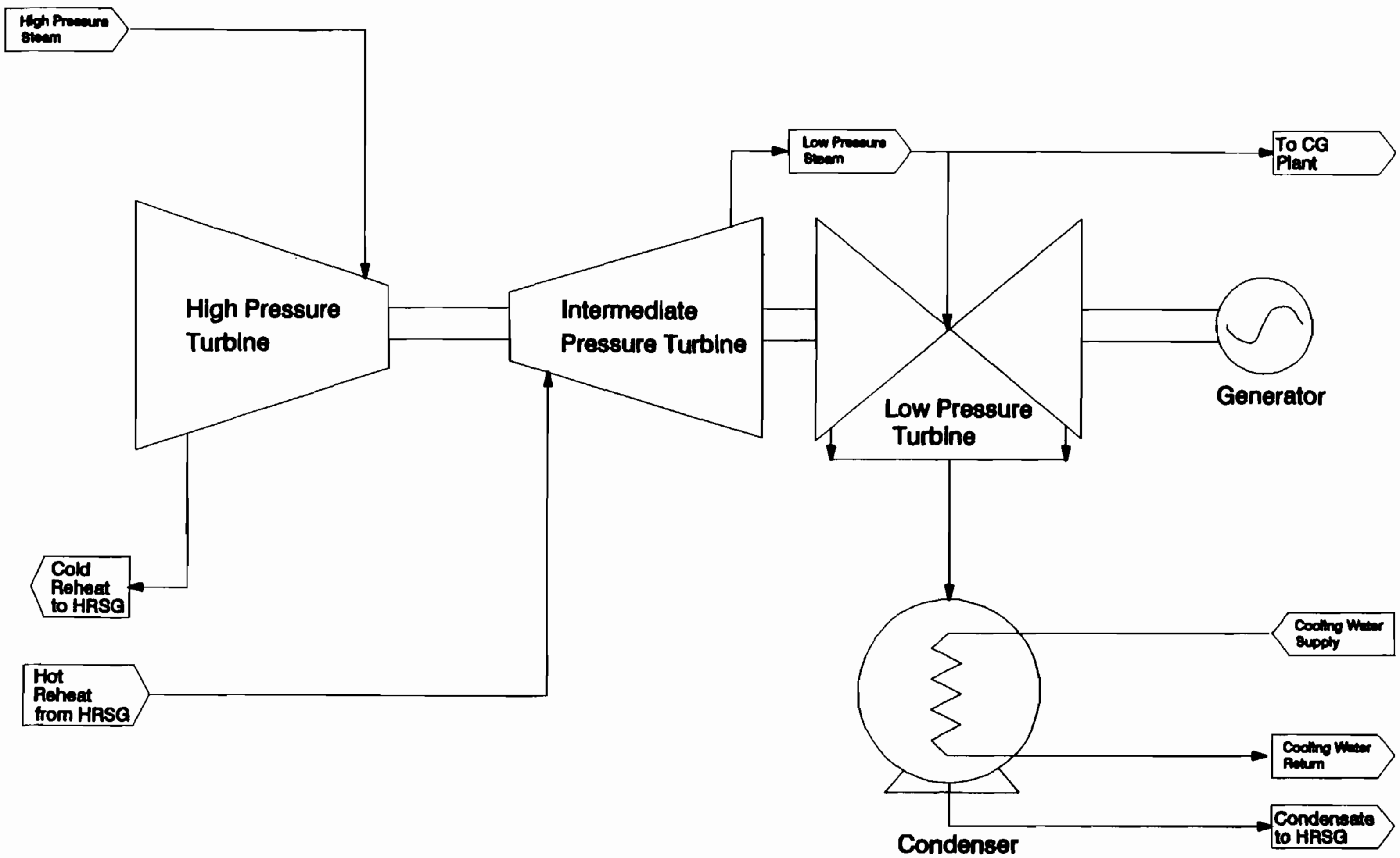

FIGURE 3.1.1-11.

STEAM TURBINE PROCESS FLOW SCHEMATIC

Source: GE, 1992.

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One HRSG will be employed to recover the CT exhaust heat and generate steam to power the ST. The HRSG will be a three-pressure level, reheat, natural circulation design. The HRSG will produce high pressure superheated steam for the high pressure ST, and will reheat the high pressure turbine exhaust steam for admission into the intermediate pressure ST. The HRSG will also produce intermediate pressure steam which is combined with high pressure turbine exhaust steam (cold reheat steam). Low pressure steam will be produced for supply to the CG facilities for process use. The HRSG will receive additional high pressure steam and heat energy from the CG facilities to supplement the steam cycle power output. No auxiliary firing is proposed within the HRSG system.

The ST will be designed as a double flow reheat with low pressure crossover extraction. The ST generator will be designed specifically for highly efficient CC operation with nominal turbine inlet throttle steam conditions of approximately 1,450 psig and 1,000°F with 1,000°F reheat inlet temperature.

The operation of the CC power plant will be coordinated with the startup and operation of the CG process plant. The initial startup of the power plant will be carried out on low-sulfur distillate fuel oil. Transfer to syngas will occur upon establishment of fuel production from the CG plant.

Under normal operation, syngas and nitrogen from the air separation unit will be provided to the CT. The syngas/nitrogen mix in the CT combustion chamber will be regulated by the CT control system to control the NO_x emission levels from the unit.

Hot exhaust from the CT will be channeled through the HRSG to recover the CT exhaust heat energy. The HRSG high pressure steam production will be augmented by high pressure steam production from the CG plant. All high pressure steam will be superheated in the HRSG before delivery to the high pressure ST.

Cold reheat steam from the high pressure turbine exhaust and HRSG intermediate pressure steam will be combined before reheating in the HRSG and subsequent admission to the intermediate pressure ST. Some intermediate pressure steam will also be supplied from the HRSG to the sulfur recovery unit.

Additional low level energy integration will occur between the HRSG and the CG plant. Low pressure steam will be provided by the HRSG to the CG facilities for process use, and some low level waste heat in the CG facilities will be used for condensate heating for the HRSG. Extraction steam from the low pressure crossover will be available to supplement the HRSG low pressure steam production for the CG facilities when necessary. The low pressure turbine will exhaust to a water cooled condenser which will receive cooling water from the cooling reservoir. Condensate from the ST condenser will be returned to the HRSG/integral deaerator by way of the CG facilities, where some condensate preheating occurs.

Emissions from power production will result from the combustion of fuels in the advanced 7F CT. During the first year of operation (i.e., prior to conversion to IGCC), the CT emissions will exit via a temporary CT stack. After conversion, the temporary CT stack will be removed, and emissions will exhaust via the HRSG stack.

3.1.2 COMBINED CYCLE UNIT DESCRIPTIONS

General descriptions of the CC and CT unit electric generating technologies were provided in Section 1.5.

As shown in Table 3.1.0-1, the proposed Polk Power Station will include two nominal net 220-MW CC units. Each of the CC units is expected to be comprised of two 75-MW CTs, two HRSGs, and one ST generator. The CTs will be designed with dry low-NO_x combustors to control NO_x air emissions when firing natural gas which will be the primary fuel for the units. NO_x emission control will be by water injection when the units are fired on the backup low-sulfur distillate fuel oil. SO_2 air emissions from the units will be controlled by the use of fuels with low sulfur contents (i.e., natural gas with trace sulfur content and fuel oil with a maximum sulfur content of 0.05 percent). The CTs will also be designed with by-pass exhaust stacks to be capable of operating in both CC and simple-cycle modes.

For each CC unit, two HRSGs (one per CT) will be employed to recover exhaust heat from the CTs and produce steam to power the ST generator. The HRSG/ST generator facilities will have a nominal net 70 MW generating capacity.

The two CC units will be capable of operation of up to a 100-percent capacity factor annually when fired on natural gas and up to a 25-percent annual capacity factor when fired on the backup, low-sulfur distillate fuel oil.

The CC units will require water for the steam generating cycle (i.e., boiler makeup and condenser cooling) and other plant uses as well as air emissions control when fired on backup fuel oil (see Section 3.5.4.1). Makeup water for the HRSG boiler, emission control, and other plant process water will be provided by treated waters from onsite wells in the Floridan aquifer. When fired on backup fuel oil, water injected into the CTs for NO_x emission control is evaporated and creates no wastewater. All process wastewaters from the facilities will be treated, as appropriate, in the onsite industrial wastewater treatment system and routed to the cooling reservoir for reuse. A description of the industrial wastewater treatment system is provided in Section 3.5.4.3.

Water for condenser cooling will be provided from and returned to the cooling reservoir. Descriptions of the cooling reservoir and its operations are provided in Section 3.5.1.

3.1.3 COMBUSTION TURBINE UNIT DESCRIPTIONS

The proposed Polk Power Station will also include six stand-alone, simple-cycle CT units. Each of the CTs will have a nominal net generating capacity of 75 MW, similar to the CTs comprising the CC units. Also, like the CTs in CC mode, the stand-alone CTs will be designed with dry low-NO_x combustors to control NO_x air emissions when firing natural gas, the proposed primary fuel for the units. NO_x emission control will again be accomplished by water injection when the units are fired on the backup distillate fuel oil. SO_2 air emissions from the CTs will be controlled by the use of low sulfur fuels (i.e., natural gas with only trace sulfur content and distillate fuel oil with a maximum sulfur content of 0.05 percent).

The CT units will be capable of operating up to a 50-percent annual capacity factor when fired on natural gas and 10 percent when fired on the backup fuel oil.

When fired on fuel oil, the CTs will require demineralized water for NO_x emission control by water injection. The injected water is evaporated in this emission control process and creates no wastewater. The CTs will require water for periodic and low volume uses such as non-chemical cleaning, washdowns, pump and equipment gland seals, and flushes. Wastewaters from these uses will be collected and appropriately treated in the industrial wastewater treatment system.

3.1.4 ASSOCIATED FACILITIES DESCRIPTIONS

To support the overall operations of the proposed electric generating units for the Polk Power Station project, various associated facilities and reclaimed areas will be constructed and operated on the site and certain associated facilities will be developed offsite. In addition to the facilities previously described in this section, the proposed directly associated facilities and areas will include the following:

- Access roadways and rail spur;
- Coal delivery, handling, and storage facilities;
- Natural gas and fuel oil delivery and storage facilities;
- Process, service, and potable water supply facilities;
- Domestic and industrial wastewater treatment systems;
- Cooling reservoir and discharge facilities;
- By-product slag, sulfur, and H_2SO_4 handling, temporary storage, and shipping facilities;
- Stormwater collection and management systems;
- Substation and associated electric transmission line facilities; and
- Wildlife management/corridor area.

These associated facilities are described in the following subsections or references are provided to appropriate sections of this SCA which contain descriptions of these facilities and their processes and operations.

3.1.4.1 Access Roadways and Rail Spur

Roadway access to the main power plant facilities will be provided by two entrances on SR 37 and an entrance from Fort Green Road. All entrance roads will include appropriate geometric improvements at the intersections with the existing roadways in order to maintain acceptable LOS standards on the existing roadway network. Also, all entrance roads will have security gates to control access to the site. The southernmost entrance from SR 37 will be the main and employee entrance to the facilities. The northern entrance from SR 37, opposite Bethlehem Road, and the entrance from Fort Green Road will be used primarily for deliveries and for construction and operational contractor access to the site.

A railroad spur will be constructed from the existing CSX Railroad line which runs along the east side of Fort Green Road on the eastern boundary of the Polk Power Station site to the main power plant facilities area. Except for an approximately 200-ft segment to cross Fort Green Road, the rail spur will be located within the boundaries of the site. On the site, the rail spur will be approximately 1.5 miles with a rail loop at the end to provide for turning and storage of trains. The rail spur access to the site will be used for the delivery of coal and other materials and equipment to the site during construction and operation and for transport offsite of by-products (i.e., slag, sulfur, and H_2SO_4) from the IGCC facilities.

3.1.4.2 Fuel Delivery, Handling, and Storage Facilities

The coal handling system will receive, store, reclaim, and transport coal from unit railroad cars and/or trucks to the coal preparation system serving the IGCC unit. The coal will be stored in an approximately 10-acre area on the site, including the surrounding berm and runoff basin. The coal storage area will be lined with a synthetic material or other material with similar low-permeability characteristics and include leachate and stormwater collection systems. The onsite coal handling and storage facilities are described in detail in Section 3.3.1.

Natural gas will be used as the primary fuel for the stand-alone CT and CC units planned for the Polk Power Station. Natural gas will be delivered to the site via a pipeline from either the existing or future natural gas transmission system in the region. Natural gas will not be stored on the Polk Power Station site. The proposed natural gas supply and delivery plans are described in Sections 3.3.2 and 6.2.

Initially, No. 2 fuel oil will be used as a primary fuel for the advanced CT unit planned for the Polk Power Station during its first year of operation, after which the CT will be converted to the IGCC unit. Fuel oil will be delivered to the site by tanker truck and/or rail. Based on current fuel cost forecasts, Tampa Electric Company anticipates that fuel oil will serve primarily as a backup fuel for the stand-alone CT and CC units and IGCC unit in CC mode after the initial project phase. Tampa Electric Company's proposed plans for fuel oil supply, delivery, and storage are described in Section 3.3.3.

3.1.4.3 Water Supply Facilities

Water to supply the potable, process, and cooling reservoir makeup needs for the operations of the Polk Power Station will be provided from groundwater withdrawn from the Floridan aquifer through onsite wells. After full build-out of the proposed facilities, the onsite wellfield to provide these operational water requirements will ultimately consist of two 10-inch and two 24-inch production wells which will be screened within the Floridan aquifer starting at a depth of approximately 300 ft bls to approximately 900 to 1,000 ft bls. Also, after full build-out, the total estimated groundwater withdrawals for potable, process, and cooling water makeup uses will be approximately 9.3 MGD on a maximum daily basis and approximately 6.6 MGD under average annual operating conditions. These estimated withdrawals are based on the use of water injection for NO_x control for the stand-alone CC and CT units when fired on the backup fuel oil.

Descriptions of the water supply requirements for the Polk Power Station operations and proposed treatment systems to provide water of suitable quality for the required uses are provided in Section 3.5 of this SCA.

3.1.4.4 Domestic and Industrial Wastewater Treatment Systems

Domestic Waste Treatment System

Discharges from domestic water uses such as from showers, wash basins, bathrooms, and drinking fountains are expected to result in approximately 10,500 gpd of combined sanitary wastewater flow on an average daily basis. This wastewater flow will be treated in an extended aeration-type package unit which will be constructed on the site. After appropriate treatment, effluent from this proposed sanitary waste treatment system will be discharged to the cooling reservoir for reuse in the heat dissipation system. Sludge will be periodically removed from this system by vacuum truck for offsite disposal in an appropriately licensed landfill. Section 3.5.2 provides a detailed description of proposed sanitary wastewater treatment system and processes.

Industrial Wastewater Treatment System

An overall industrial wastewater treatment (IWT) system will be constructed on the site to collect and appropriately treat process and service wastewater from the stand-alone CC and CT units and the CC module of the IGCC unit (e.g., non-chemical cleaning wastes and boiler blowdown from HRSG); stormwater runoff from the coal, slag, sulfur, IWT sludge, brine, and H_2SO_4 storage areas; runoff from the power block equipment areas of the IGCC, CC, and CT units; and potable and process water treatment (filter backwash water and demineralizer regeneration waste). As discussed previously in Section 3.1.1.6, a separate zero liquid discharge water handling system will be provided for process waters from the CG and syngas cleanup systems. Also, wastewaters produced from the periodic chemical cleaning of equipment (i.e., HRSG boilers) will be collected and temporarily stored in a holding tank prior to being trucked offsite by a licensed contractor for appropriate treatment and disposal.

The proposed IWT system will be designed to treat wastewater on a continuous basis and will be comprised of the following basins and units:

- Oil/water separation;
- Wastewater equalization basin (in addition to the coal pile, slag pile, brine, and IWT sludge storage area runoff basins),
- Wastewater neutralization/oxidation tank,
- Clarification,
- Chemical restabilization tank,
- Filtration, and
- Sludge handling system.

After treatment, the effluent from the IWT system will be routed to the cooling reservoir for reuse in the heat dissipation and condenser cooling system. The sludge filter cake produced by the system will be temporarily stored onsite in a lined area with a stormwater collection system prior to transport offsite for commercial use or disposal in a licensed landfill. The proposed temporary sludge storage area will be capable of storing up to 5 years of sludge generated by the treatment system.

Sections 3.5.4.3 and 3.5.4.4 provide detailed descriptions of the process wastewater sources and the overall IWT system and processes.

3.1.4.5 Cooling Reservoir

The steam electric generating components of the proposed IGCC unit and two CC units require water to cool or condense the exhaust steam from the STs. The waste heat transferred to the cooling water must then be rejected to the atmosphere. The proposed cooling/heat rejection system for the Polk Power Station will be a cooling reservoir.

The proposed cooling reservoir will be constructed in areas which have been mined for phosphate and currently consist of water-filled mine cuts between rows of overburden spoil piles. The reservoir will occupy an area of approximately 860 acres, including the areas of the surrounding and internal earthen berms. The reservoir will be a primarily below-grade facility after final contouring and development of the site. The maximum elevation of the bottom of the reservoir will be approximately 120 ft-NGVD and the top of the surrounding and internal berms will be 145 ft-NGVD. The finish grade on the main power plant facility area will be between 140 and 145 ft-NGVD. Under normal operating conditions, water levels in the reservoir will be approximately 136 ft-NGVD, and the total water surface area will be approximately 727 acres.

The top of the earthen berms, both surrounding and internal, will be approximately 25 ft wide to provide access for inspection and maintenance purposes. The berms will be constructed with gentle slopes (4 ft horizontal to 1 ft vertical) to minimize potential erosion and visual quality effects. The berms will also be re-vegetated after construction and the vegetation will be appropriately controlled and maintained to prevent future erosion.

Intake and discharge structures to provide and subsequently discharge the condenser cooling water will be constructed within the cooling reservoir. The estimated circulating, condenser cooling water flow requirements are approximately 115,800 gpm for the IGCC unit, including the air separation unit, and a total of approximately 247,000 gpm after build-out of the two CC units. The discharged circulating water will have a higher temperature than the intake water. This warmed water will be routed throughout the reservoir area by the internal berm system and cooled through evaporation prior to intake and reuse in the system.

Water lost from the cooling reservoir by both naturally-occurring and forced (i.e., heat rejection) evaporative processes will be replaced by several water sources in order to minimize groundwater withdrawals for makeup purposes. The cooling reservoir makeup sources will include rainfall directly to the reservoir and runoff from the surrounding and internal berms; treated wastewater from the sanitary and IWT systems, including treated runoff from the coal, slag, and sulfur storage areas and power block areas; and groundwater seepage from the surficial aquifer. Additional makeup water will be provided from onsite wells in the Floridan aquifer. The pumped groundwater makeup requirements are estimated to be approximately 5.0 MGD on an annual average basis and 6.5 MGD on a maximum daily basis.

The cooling reservoir will be designed with an outfall control structure to provide for the discharge of water from the reservoir for water quality management, berm and vegetation maintenance, and unanticipated emergency purposes. Surface water discharges from the reservoir are estimated to be approximately 3.1 MGD on an annual average basis. The discharge will be routed to the reclaimed lake on the eastern edge of the site and then offsite to the Little Payne Creek system.

Section 3.5.1 provides a detailed description of the cooling reservoir heat dissipation system and processes, while Section 5.1 describes the expected effects of the system operations and discharges.

3.1.4.6 By-Product Slag, Sulfur, and Sulfuric Acid Storage Facilities

By-products from the CG and syngas cleanup processes will include slag, sulfur, and H_2SO_4. Each of these by-products have commercial uses and will be marketed and sold by Tampa Electric Company for those offsite uses. Therefore, only temporary storage facilities for these by-products will be provided on the Polk Power Station site and the proposed project will include facilities for the handling, loading, and transport of these by-products from the site.

Slag Storage Area

Slag will be produced in the CG process and fine slag filter cake material will be produced in the water scrubbing process to remove entrained solids from the syngas. Slag material is a vitrified or glass-like solid which is non-leachable and salable as an abrasive, roof material, industrial filler, aggregate for concrete, or road base material. Tampa Electric Company is currently seeking long-term contracts for the sale of the slag by-product.

In the event that the slag by-product cannot be sold for offsite uses in a timely manner, a temporary storage area will be developed on the site. Initially, an area will be developed to be capable of storing slag generated by approximately 1 year of operation of the IGCC unit at full capacity. Additional 1-year storage areas will be developed as needed in the unexpected event that sales of the slag for offsite uses are less than the slag production rates. The temporary slag storage area shown on the site layouts in Figures 3.2.0-1 and 3.2.0-2 would provide sufficient capacity for developing storage cells for up to 5 years of slag production from the IGCC unit operating at 100-percent capacity. The slag storage area will include a stormwater runoff collection basin and surrounding berm to prevent runoff from the area. Both the slag storage area and the runoff collection basin will be lined with a synthetic material or other materials with similar low permeability characteristics. The runoff basin will be designed to contain runoff water volumes equivalent to 1.5 times the 25-year, 24-hour storm event. Water collected in the runoff basin will be pumped to the overall IWT system.

Sulfur Storage Facilities

An elemental sulfur by-product will be produced in the proposed sulfur recovery process which will be used to treat the acid gas removed from the syngas and to treat tail gas from the sulfur recovery unit in the overall CGCU system. These systems were described previously in Sections 3.1.1.8 and 3.1.1.9. This sulfur by-product will also be marketable for offsite use, especially with the central Florida chemical fertilizer industry. Approximately 90 tpd of sulfur in a molten state will be produced in the sulfur recovery system, assuming that 100 percent of the syngas fuel for the IGCC is being treated in the CGCU system at a 100-percent generating capacity.

Temporary storage of the molten sulfur by-product will be provided on the site in tanks which will be contained within a concrete-lined pit. The sulfur will be maintained in a molten state by heat provided from steam coils at the bottom of the pit. The proposed temporary storage tankage will be capable of storing up to approximately 30 days of sulfur produced from the recovery system. The proposed sulfur handling system will include loading facilities to specifically designed tanker trucks or railcars for transport offsite. Specifically designed railcars could also be used to provide additional temporary, onsite storage capacity, if needed.

Stormwater runoff from the concrete-lined sulfur storage area and handling and loading facilities will be collected and routed to the IWT system for treatment.

Sulfuric Acid Facilities

Similar to the CGCU acid gas treatment system, the demonstration HGCU system produces an off-gas containing sulfur compounds which will require treatment. This off-gas will be treated by converting the sulfur compounds in the gas to H_2SO_4 which is again a marketable by-product especially with the central Florida chemical fertilizer industry.

The H_2SO_4 by-product will be produced in a skid-mounted plant. Approximately 45,000 tpy of H_2SO_4 will be produced in this plant, assuming that the demonstration HGCU system is being used to treat the 50 percent of the syngas fuel for operation of the IGCC unit at a 100-percent capacity factor. As necessary, the H_2SO_4 will be temporarily stored onsite in a tank or in specially-designed railcars prior to shipment offsite. These storage tanks will provide for up to approximately 30 days of temporary storage on the site.

Stormwater runoff from the H_2SO_4 storage, handling, and loading area will be collected and pumped to the IWT system for appropriate treatment prior to being routed to the cooling reservoir for reuse.

Additional descriptions of these slag, sulfur, and H_2SO_4 by-product storage areas are provided in Section 3.7.1.

3.1.4.7 Stormwater Management Systems

As discussed previously, stormwater runoff from the coal, slag, sulfur, H_2SO_4, and brine handling and storage areas and from the immediate areas of the power blocks for all the proposed generating units and structure and equipment areas associated with CG facilities will be collected and routed to the proposed overall IWT system. Stormwater runoff from the other areas associated with industrialized activity on the main power plant facilities site will be collected and routed to the two stormwater retention basins which will be constructed on the site. The primary stormwater retention basin will be approximately 26 acres and will receive the majority of runoff from the main power plant facility area. A small stormwater management basin will also be constructed to receive runoff from the area of the administration and general services building and associated parking lot.

Both of these stormwater management basins will be designed to detain in excess of the first inch of runoff resulting from the 25-year, 24-hour storm event in accordance with applicable SWFWMD and Polk County stormwater management regulatory requirements. Overflow discharges from these basins will be routed through a series of reclaimed wetland and lake areas prior to flowing offsite to the Little Payne Creek drainage system.

3.1.4.8 Substation and Associated Electric Transmission Line Facilities

To connect the proposed Polk Power Station with the Tampa Electric Company and Florida electric transmission grid, an onsite substation and four 230-kV transmission line circuits will be needed. The onsite substation will be constructed within an approximately 1,000-ft by 500-ft (i.e., approximately 11.5 acres) area to the north of the main power plant facilities.

Two of the 230-kV circuits from the substation will be constructed within a 400-ft wide transmission line corridor which will be located entirely within the Polk Power Station site boundaries and interconnect with the existing Tampa Electric Company 230-kV Hardee-Pebbledale transmission line which runs along the eastern border of the site. The other two circuits will be located within a corridor which runs west on the site from the substation to SR 37, then north along SR 37 approximately 5 miles, and interconnects with Tampa Electric Company's existing Mines-Pebbledale 230-kV transmission line at a point to the west of the community of Bradley Junction. Detailed descriptions of these associated transmission line corridors and the expected effects of their construction and operation are provided in Section 6.1 of this SCA.

3.1.4.9 Site Reclamation and Environmentally Enhanced Land Areas

In conjunction with the overall development of the Polk Power Station site, Tampa Electric Company will reclaim onsite lands previously mined or disturbed by phosphate mining activities as required under FDNR mined-land reclamation requirements (Section 211, F.S., and Chapter 16C-16, F.A.C.).

As part of these reclamation activities, Tampa Electric Company is proposing to create several areas which will develop into significant wildlife habitat and corridor areas and resources in the southwest Polk County region. The approximately 1,511-acre portion of the site located to the west of SR 37 will be reclaimed to an integrated system of forested and non-forested wetlands and uplands. After reclamation by Tampa Electric Company and with the company's planned controlled access to the area, this reclaimed area will develop into a wildlife habitat/corridor system between the headwater areas of the Little Manatee River and Payne Creek and South Prong Alafia River systems. The proposed wildlife habitat/corridor system will provide significantly enhanced environmental qualities to the area relative to conditions which existed prior to mining or which would have resulted from currently approved reclamation plans for the area.

In addition to the property to the west of SR 37, Tampa Electric Company's proposed reclamation/development plans include the creation of other environmentally enhanced areas on mined-out lands on the portion of the site to the east of SR 37. Again, these areas will include integrated, ecological systems of wetlands and upland wildlife habitats, including specifically designed areas for bird feeding and nesting.

Tampa Electric Company's proposed plans for reclamation of the Polk Power Station site are described in more detail in Section 9.0 of this SCA and in the Conceptual Reclamation Plan Application submitted separately to FDNR.

3.2 SITE LAYOUT

The proposed site layout plan for the entire 4,348-acre Polk Power Station site is presented in Figure 3.2.0-1. A more detailed scale map (i.e., 1 inch equals 1,000 ft) of this figure is provided in Appendix 11.16. This figure shows the locations of the proposed electric generating units and associated facilities on the site after full build-out (i.e., 1,150-MW capacity) as well as the proposed land use/land cover classifications of the site areas which will be reclaimed by Tampa Electric Company or will not be changed from existing conditions and will not include power plant facilities. These reclaimed, undeveloped areas will provide a combination of buffer, water management, and wildlife habitat/corridor functions on the site. Table 3.2.0-1 provides a summary of the approximate areas of the proposed power plant facilities and other land use/land cover classifications on the site after full build-out of the project.

As shown in Figure 3.2.0-1, the main power plant facilities will be located in the central area of the portion of the site to the east of SR 37. This plant site area was not mined for phosphate, but has been disturbed by the surrounding mining activities. The main power plant facilities (i.e., power blocks and fuel and by-product storage areas) will be located more than 2,500 ft from offsite properties and more than 1.5 miles from residential areas to the west along Bethlehem Road and 2.8 miles from residential areas to the southeast along Mills Road. Also, as shown in the figure, a vegetated buffer area will be provided along public roadways surrounding the eastern site tract (i.e., SR 37, CR 630, and Fort Green Road).

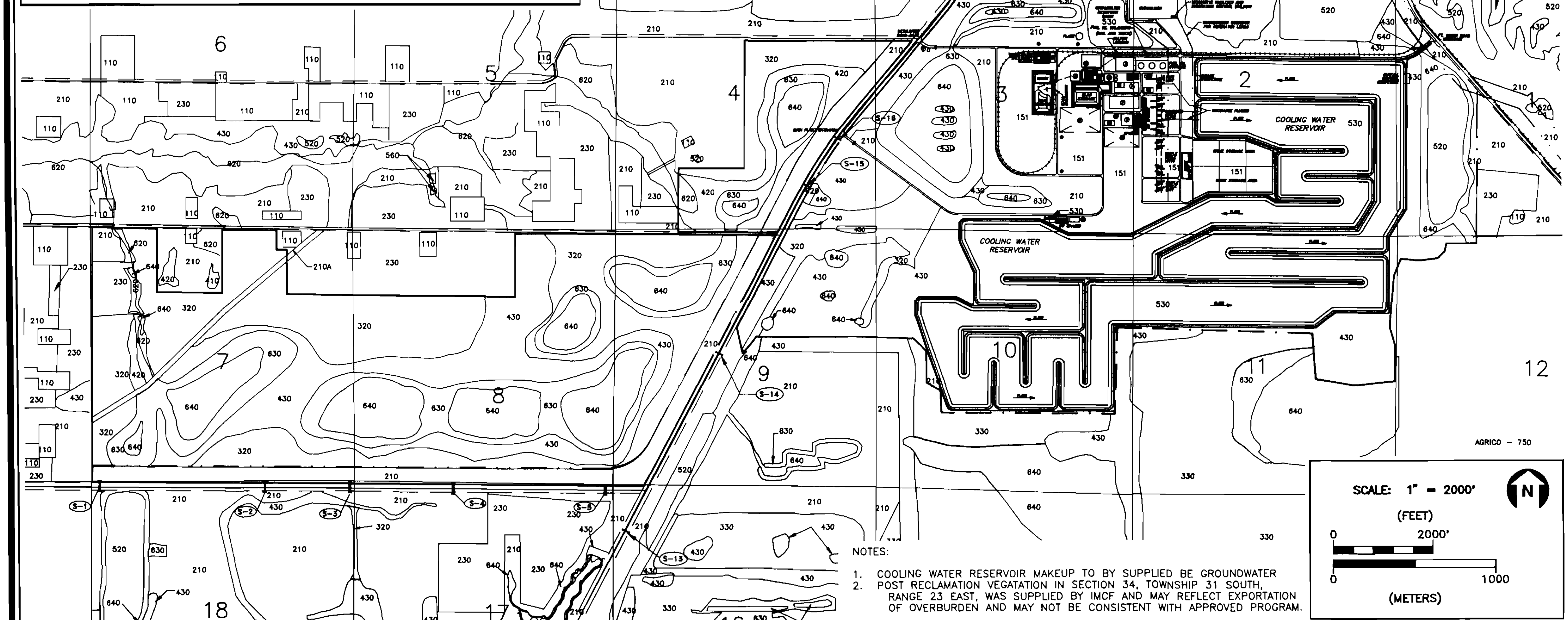
The proposed cooling reservoir will be constructed in mined-out areas located to the east and south of the main facility site. The other mined-out portions of the eastern site tract to the west and north of the main facilities will be reclaimed/developed into a series of wetlands and uplands which will be used for management of stormwater runoff from the plant site and to restore pre-mining drainage conditions for the Little Payne Creek system. The remaining areas of the eastern tract (i.e., the southwest corner, the 775-acre area north of the main plant site and cooling reservoir

POST RECLAMATION VEGETATION WITHIN PROJECT BOUNDARY

		NON-MANDATORY ACRES	MANDATORY ACRES	TOTAL ACRES
140	TRANSPORTATION	0	3	3
148	GAS TRANSMISSION SUBSTATION	0	1	1
151	ELECTRICAL POWER FACILITY	0	337	337
210A	PASTURE OVER GAS TRANSMISSION LINE	0	13	13
210	PASTURE	211	430	641
230	CITRUS	0	18	18
320	SHRUBLAND	4	577	581
330	MIXED RANGELAND	6	0	6
420	UPLAND HARDWOOD FOREST	29	72	101
430	UPLAND MIXED FOREST	34	722	756
520	LAKES	165	87	252
530	RESEVOIRS	0	840	840
620	WETLAND HARDWOOD FOREST	40	21	61
630	WETLAND MIXED FOREST	11	299	310
640	HERBACEOUS WETLAND	23	405	428
		TOTAL 523	TOTAL 3825	TOTAL 4348

BUILDING KEY

1 GASIFICATION & GAS COOLING
2 ACID GAS REMOVAL
3 OXYGEN PLANT
4 SULFUR RECOVERY & TAIL GAS TREATING
5 HOT GAS CLEANUP
6 MAKE-UP WATER TREATING
7 CONTROL AND GENERAL SERVICES BUILDING
8 COAL GRINDING
9 CONSTRUCTION POWER FACILITIES
10 ADMINISTRATION BUILDING & VISITORS CENTER
11 INDUSTRIAL WASTE TREATMENT FACILITY & HOLDING BASIN
12 SANITARY WASTE TREATMENT
13 48 V BATTERY, PBX, & RTU
14 CONSTRUCTION WAREHOUSE
15 MAINTENANCE SHOP
16 CONSTRUCTION LAYDOWN & TEMPORARY CONSTRUCTION PERSONNEL PARKING
17 MOBILE EQUIPMENT MAINTENANCE SHOP
18 OFF-GAS TREATMENT
19 IGCC WASTEWATER TREATMENT



NOTES:

1. COOLING WATER RESERVOIR MAKEUP TO BY SUPPLIED BE GROUNDWATER
2. POST RECLAMATION VEGATATION IN SECTION 34, TOWNSHIP 31 SOUTH, RANGE 23 EAST, WAS SUPPLIED BY IMCF AND MAY REFLECT EXPORTATION OF OVERBURDEN AND MAY NOT BE CONSISTENT WITH APPROVED PROGRAM.

FIGURE 3.2.0-1.

SITE LAYOUT AND POST-RECLAMATION PLAN

Sources: UEC, 1992; ECT, 1992.

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Table 3.2.0-1. Acreages of Land Use/Land Cover on Polk Power Station Site After Full Build-Out

Code	Land Use/Land Cover Classification*	Acres	Percent
140	Transportation	3	0.1
148	Gas transmission pipeline	14	0.3
151	Electrical power facilities	337	7.8
152	Electrical transmission line	141	3.2
210	Pastureland	500	11.5
230	Citrus grove	18	0.5
310	Grassland	0	0
320	Shrub and brushland	581	13.4
330	Mixed rangeland	6	0.1
410	Coniferous forest	0	0
420	Upland hardwood forest	101	2.3
430	Upland mixed forest	756	17.4
520	Lakes	252	5.8
530	Reservoirs	840	19.3
620	Wetland hardwood forest	61	1.4
630	Wetland mixed forest	310	7.1
640	Herbaceous wetland	428	9.8
	TOTAL	**4,348**	**100**

*The FLUCCS, 1976 was used for the land use and cover classification on the Tampa Electric Company Polk Power Station project. Level II FLUCCS is used for 200 to 600 series classifications, while urban or built-up (100) uses are classified at Level III.

Source: ECT, 1992.

extending to CR 663, and the reclaimed lake to the east of the reservoir) will not be significantly altered by the proposed project. The two proposed transmission line corridors will run through the northern site area.

As discussed previously, the 1,511-acre portion of the site to the west of SR 37 will be reclaimed to a wildlife habitat/corridor system consisting of an integrated series of forested and non-forested wetlands and uplands. No power plant facilities will be located on this tract and, after reclamation, the area will develop into a wildlife corridor between the headwater areas of the Little Manatee River and Payne Creek and the South Prong Alafia River system.

Figure 3.2.0-2 presents the proposed arrangement of the power plant and associated facilities on the eastern portion of the site at a more detailed scale, and Figure 3.2.0-3 presents the same arrangement on an aerial photograph showing the current conditions on the site. Figure 3.2.0-4 provides a conceptual rendering of the proposed IGCC facilities. As indicated in Table 3.2.0-1, approximately 337 acres (i.e., approximately 8 percent) of the entire site, excluding the cooling reservoir, will be classified for power plant facilities after full build-out of the proposed Polk Power Station. As shown on Figure 3.2.0-2, of this 337 acres, approximately 150 acres will actually be used for the main power plant facilities and structures, including the coal, fuel oil, by-product, and brine storage areas, and IWT systems.

Figure 3.2.0-2 also shows the proposed location of the outfall control structure for discharges from the cooling reservoir to the reclaimed lake on the eastern portion of the site (i.e., point of discharge No. 001) and the second point of discharge (i.e., No. 002) for stormwater runoff discharges from the plant site area. Water discharges from the Polk Power Station site offsite to the Little Payne Creek system will occur at the southern edge of the reclaimed lake to a man-made ditch which runs along the western side of Fort Green Road.

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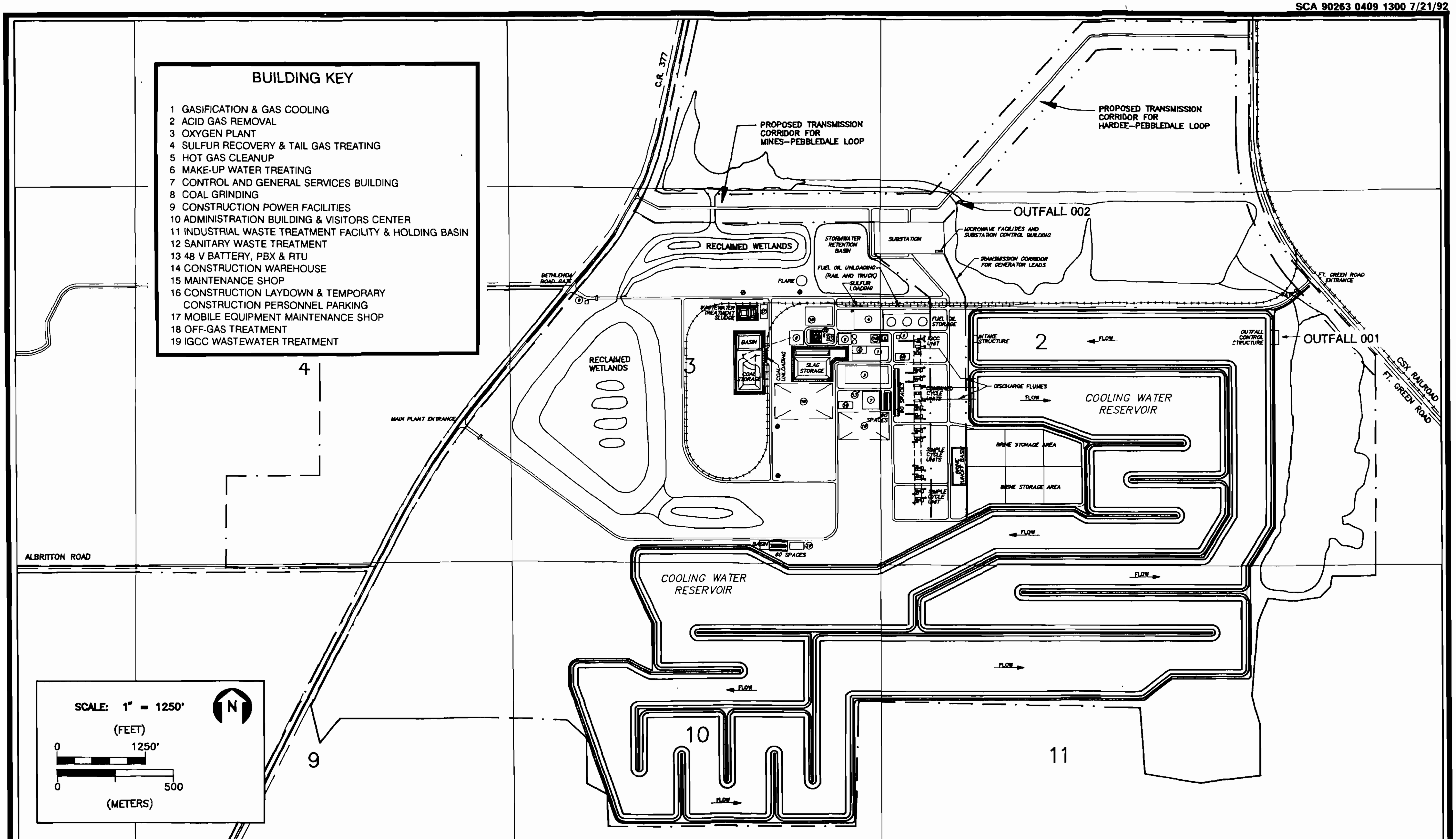

FIGURE 3.2.0-2

POWER BLOCK AND DIRECTLY ASSOCIATED FACILITIES ARRANGEMENT

SOURCES: UEC, 1992; ECT, 1992.

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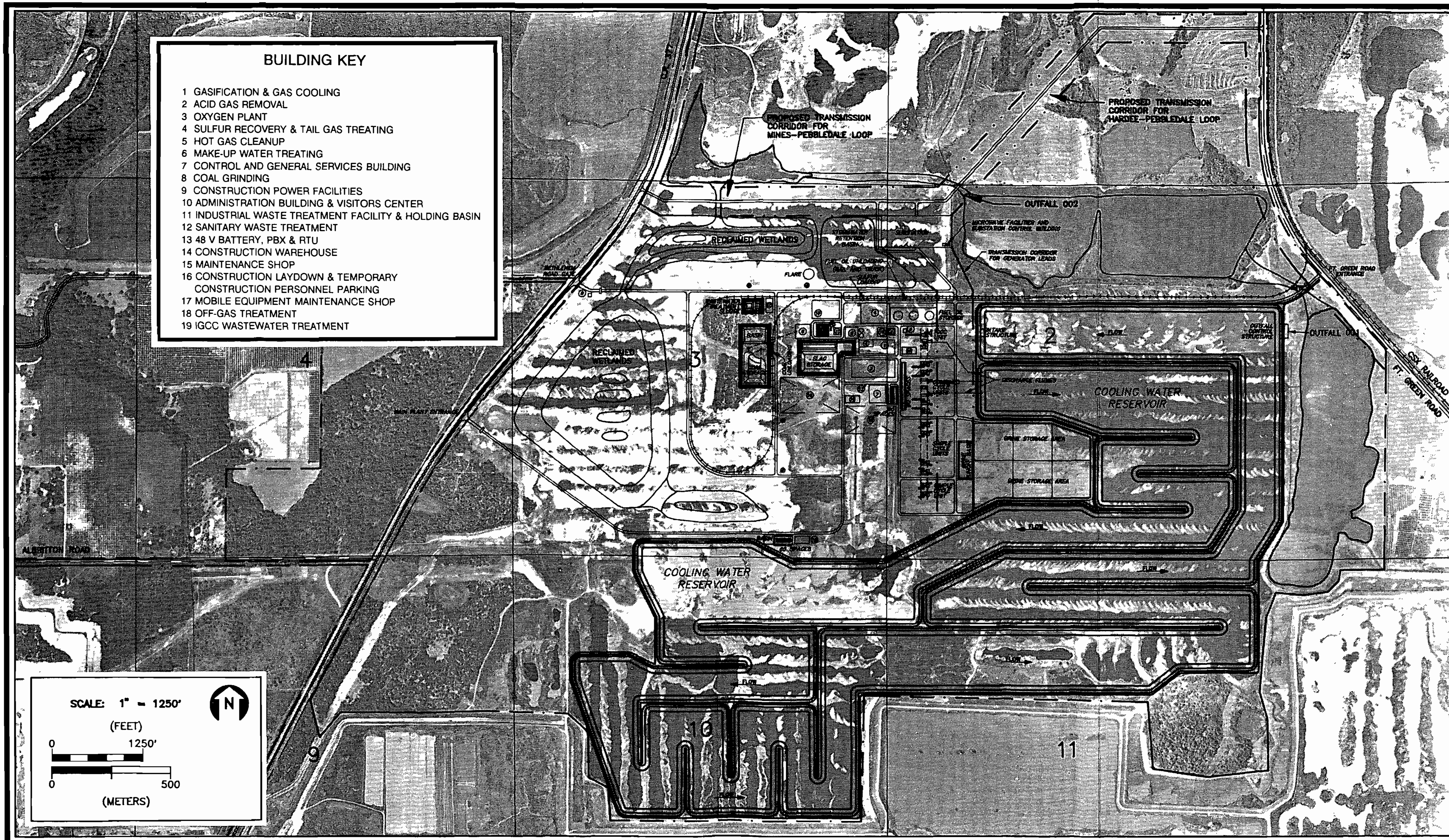

FIGURE 3.2.0-3

AERIAL PHOTOGRAPH WITH PROPOSED FACILITY ARRANGEMENT

SOURCES: SRMC, 1992; UEC, 1992; ECT, 1992.

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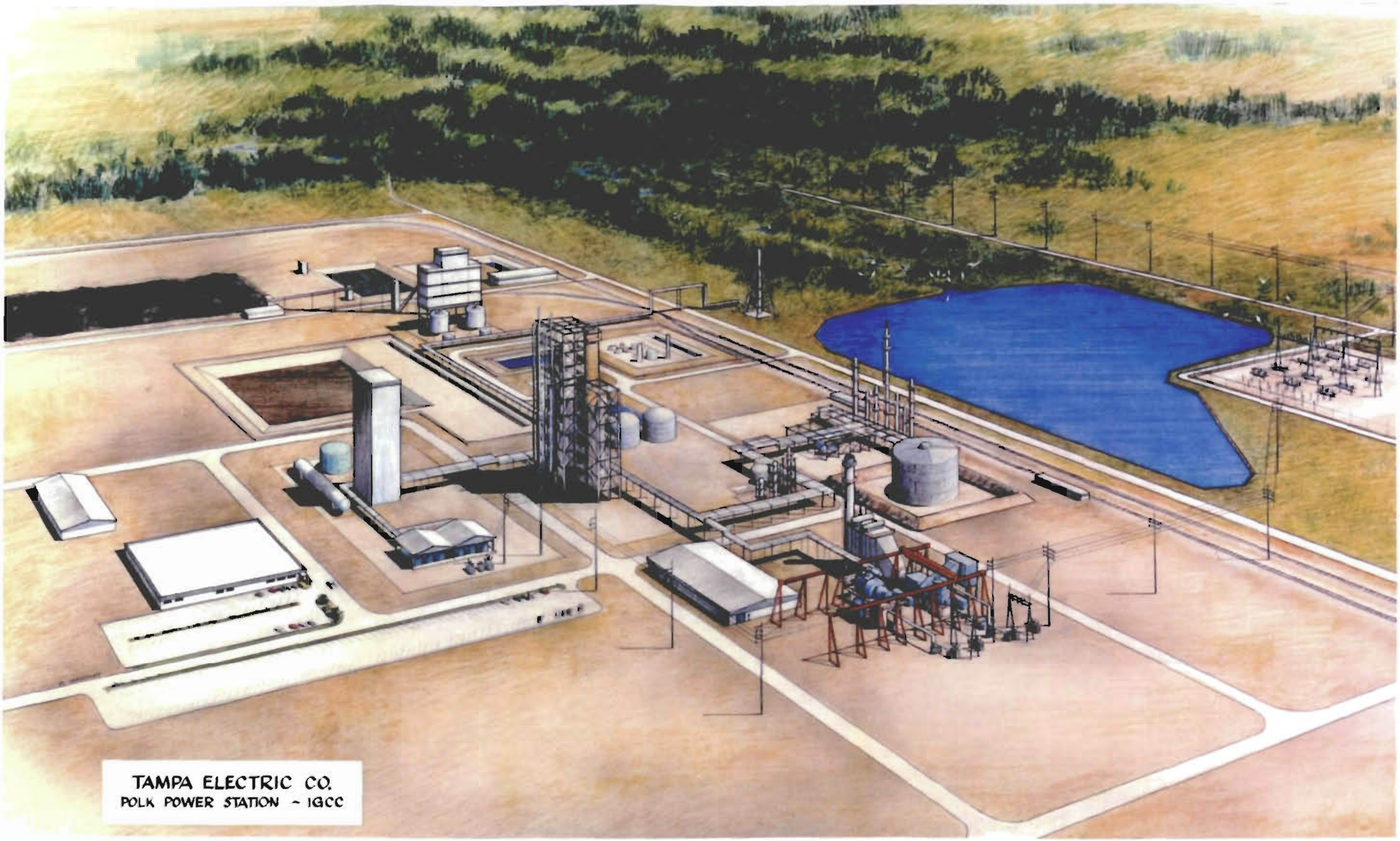

FIGURE 3.2.0-4.

CONCEPTUAL RENDERING OF PROPOSED IGCC FACILITIES

Source: Tampa Electric Company, 1992.

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Table 3.2.0-2 presents a listing and the dimensions of the proposed buildings and structures on the site which are expected to exceed 50 ft in height and the proposed exhaust air emission stacks. The locations of the exhaust stacks and other proposed combustion sources of air emissions are shown on Figure 3.2.0-5.

Table 3.2.0-2. Dimensions of All Structures Exceeding 50 Ft in Height and Exhaust Stacks on the Polk Power Station Site

Elements	Building Dimensions Length (ft)	Width (ft)	Height (ft)
Gasifier structure	90	60	250
Syngas cooling deck	50	35	175
Oxygen plant cold box	75	50	190
Coal grinding structure	125	35	175
HRSG	150	40	80
Tail gas treatment unit absorbers (2)	10	10	70
Tail gas treatment unit strippers (2)	10	10	120
Quench towers (2)	10	10	60
Acid gas removal stripper	10	10	140
Acid gas removal flash tower	10	10	140
Acid gas removal absorber	10	10	140
One day coal storage bin	25	25	70

Exhaust Stacks	Stack Height (ft)	Stack Diameter (ft)
IGCC HRSG stack	150	19
CC HRSG stacks (4)	150	14.5
Thermal oxidizer	199	5
Auxiliary boiler	20	5
Flare	75	4
CC/bypass stacks (10)	75	18 *
H_2SO_4 acid plant stack	199	3.6

*Equivalent diameter. Stack is usually square.

Source: Texaco, 1992.

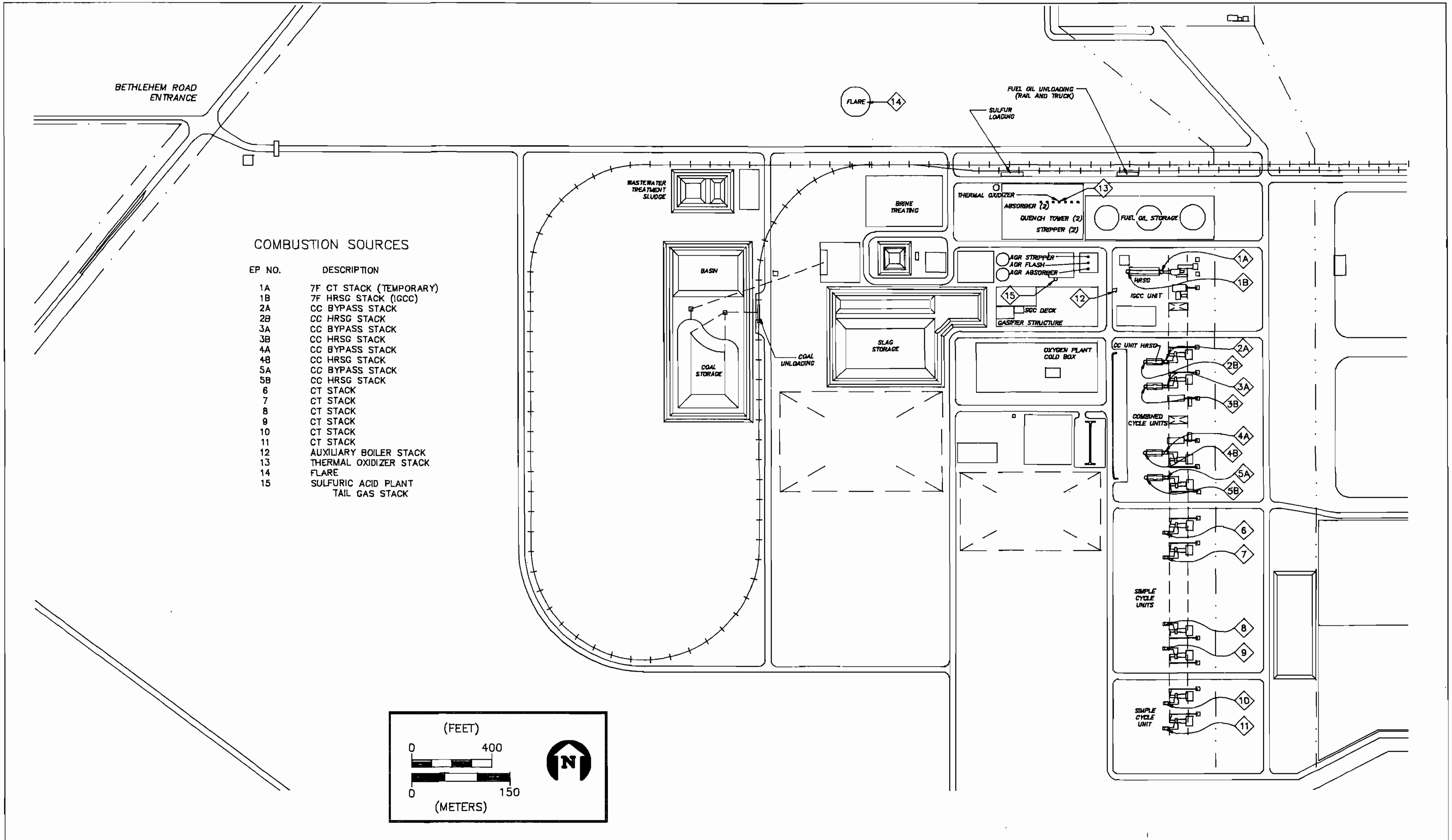

FIGURE 3.2.0-5.

LOCATION OF COMBUSTION SOURCES

Source: ECT, 1992.

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3.3 FUEL

The proposed electric generating facilities at the Polk Power Station will primarily utilize three types of fuels: natural gas, fuel oil, and coal. The CG facilities will also be capable of using petroleum coke and a coke/coal mixture as fuel. The nominal net 150-MW advanced CT, which will be used for the IGCC Polk Unit 1, will use No. 2 fuel oil during the first year of operation. Upon completion of the CG and HRSG facilities, the CT will be fired by coal-derived syngas with No. 2 fuel oil then serving as backup fuel when the unit is operated in a CC mode. The two CC units and six stand-alone CT units will use natural gas as the primary fuel and No. 2 fuel oil as backup. In addition to these fuels, the project will require electrical energy to run motors which power pumps, blowers, grinders, conveyor belts, and other machinery. Gasoline and diesel fuels will be used to fuel vehicles and certain other equipment within the site.

Also, in order to prevent refractory thermal shock, the gasifier and sulfur recovery unit will be preheated using a clean fuel (i.e., liquid propane or liquid or gaseous natural gas) prior to IGCC unit initial startup, cold startup, or after an extended shutdown (e.g., for maintenance purposes). Therefore, liquid propane or liquid natural gas fuel may be used on the site for short time periods (i.e., 2 to 3 days) for preheating purposes. As needed, these fuels will be delivered to the site by tanker truck and the fuel will be provided to the preheat systems directly from the truck tanks. These fuels will not be permanently stored on the site. Due to the short duration of fuel use, the clean quality of the fuels, and the fact that other emissions from the IGCC unit will not occur during these preheating activities, potential air emissions resulting from the use of these clean fuels will be negligible.

The quantities and qualities of the primary fuels which will be used at the Polk Power Station and the proposed fuel delivery, handling, and storage facilities are described in the following sections.

3.3.1 COAL SUPPLY AND DELIVERY, HANDLING, AND STORAGE

3.3.1.1 Coal Fuel Supply and Quality

In accordance with its cooperative agreement with DOE under the Clean Coal Technology Demonstration program, Tampa Electric Company will be required to use coal from various sources for the IGCC unit during the 2-year demonstration period. Also during the demonstration period, Tampa Electric Company will be required to gather extensive information on the performance of the overall IGCC unit and the HGCU system when using the various coals. The performance information will include data on the overall plant efficiency and cost-effectiveness in generating electricity as well as environmental data on emissions rates and characteristics. The potential coal supply sources during the demonstration period are expected to be from coal seams in the eastern and midwestern United States.

At the present time, Tampa Electric Company has not selected the specific coal supply source(s) for the long-term operation of the IGCC unit after the demonstration period. The company will consider and evaluate various sources based on economic, engineering, and environmental factors. The performance information obtained during the demonstration project will also provide valuable inputs to Tampa Electric Company's ultimate selection of the coal supply source(s) for the unit.

Based on its current analyses of potential coal source seams required for the DOE demonstration project and other potential sources for long-term operation of the IGCC unit, Tampa Electric Company has determined that coal supplied from the Illinois No. 6 seam would be most representative of coal properties with margins added for certain properties (i.e., heat content, chlorine, and certain trace elements) to encompass the range of properties expected in other potential coal supply sources. Table 3.3.1-1 presents the properties of this modified Illinois No. 6 coal which will be used as the assumed coal for the IGCC unit for environmental licensing purposes. From an environmental licensing perspective in terms of potential SO_2 air emissions, amount of coal delivered and used, and by-product volumes (i.e., slag, sulfur, and H_2SO_4), the key properties of this assumed coal on an as-received basis are the heat

Table 3.3.1-1. Assumed Properties of Modified Illinois No. 6 Coal

Property	Maximum Content (on as-received basis)
Proximate Analysis	
Moisture	15.00 percent
Ash	11.00 percent
Sulfur	3.05 percent
Volatile matter	32.20 percent
Fixed carbon	42.20 percent
Heating value	11,035 Btu/lb (minimum)
Ultimate Analysis	
Moisture	15.00 percent
Carbon	58.70 percent
Hydrogen	4.00 percent
Nitrogen	1.11 percent
Chlorine	0.20 percent
Sulfur	3.05 percent
Ash	11.00 percent
Oxygen	7.90 percent
Trace Elements	
Arsenic (As)	12.59 ppm
Beryllium (Be)	4.73 ppm
Cadmium (Cd)	1.93 ppm
Chromium (Cr)	28.00 ppm
Fluoride (F)	81.00 ppm
Mercury (Hg)	0.28 ppm
Lead (Pb)	4.70 ppm

Note: Percentages for proximate and ultimate analyses do not add to 100 percent since assumed properties are based on a combination of contents for several coals.

Source: Tampa Electric Company, 1992.

content of 11,035 British thermal units per pound (Btu/lb), sulfur content of 3.05 percent, and ash content of 11 percent.

Based on the properties of this assumed coal, the proposed IGCC unit will require approximately 2,325 tons of coal per day, on a dry basis, when operating at full load. This peak coal fuel input to the CG facilities will result in the production and firing of approximately 6.4 million standard cubic feet (scf) per hour of coal-derived syngas in the advanced CT unit of the overall IGCC generating facility.

The coal-derived syngas produced in the gasification process will be treated in the conventional CGCU system or the demonstration HGCU system prior to being fired in the advanced CT unit. The CGCU system will be capable of treating up to 100 percent of the syngas under full load conditions for the IGCC unit, while the demonstration HGCU system will be designed to treat up to approximately 50 percent of the syngas at full load operation of the unit. At this time, the quality of the syngas resulting from the conventional, proven CGCU system can be estimated with a greater degree of confidence than the quality of the syngas from the HGCU system since this system has not been demonstrated at a commercial scale. However, based on small-scale demonstrations, the HGCU system has the potential to exceed the estimated sulfur removal efficiency of the CGCU system, while also increasing the overall efficiency (i.e., cost-effectiveness) of the IGCC unit in generating electricity.

Table 3.3.1-2 presents the composition of the coal-derived syngas resulting from the CGCU system and based on the assumed coal fuel. If petroleum coke or a coke/coal mixture is used as fuel for the IGCC unit, the resulting syngas for firing in the CT will have an equivalent composition as that shown in Table 3.3.1-2.

3.3.1.2 Coal Delivery, Handling, and Storage Facilities

The purpose of the coal handling system is to receive, stack-out, store, reclaim, and transport coal from unit train railroad cars and/or from trucks to the coal

Table 3.3.1-2. Composition of Coal-Derived Syngas to the Combustion Turbine

Component	Mole Percent (by volume)
CO	45.38
H_2	33.94
CO_2	12.87
Water	0.36
Methane	0.18
Argon	1.19
Nitrogen	6.03
H_2S	0.02
COS	0.03

Note: Composition prior to nitrogen addition at the CT

Source: Texaco, 1992.

preparation system serving the IGCC unit Polk Power Station Unit 1. Figure 3.3.1-1 presents a flow diagram of the coal receiving and handling system.

Coal will be delivered to the plant site by unit trains and/or trucks. The unit trains will consist of approximately 70 to 100, 100-ton capacity rapid discharge, bottom dump rail cars. If all coal was delivered by rail, approximately two unit trains per week would be needed to meet the fuel requirements of the IGCC unit. The rail cars will be unloaded in motion with the train moving over an enclosed track hopper. If all coal was delivered by truck, delivery will be made by approximately 80 to 100 specialized bottom-dump trucks per day, each truck having a 28-ton payload. The trucks will be equipped with covers to minimize fugitive dust emissions and will unload utilizing the enclosed, below-grade, rail unloading track hopper which will be arranged to permit truck drive-over. A dust collection system will be provided to collect dust from all of the feeder and conveyor transfer points in the unloading hopper area. Dust suppression with water sprays will be employed at the top of the hopper.

The track hopper will be equipped with four outlets, four manually operated rack and pinion slide gates and four belt feeders. Two belt feeders will discharge coal onto the track hopper feeder collecting belt conveyor and the remaining two feeders onto a second track hopper feeder collecting belt conveyor. Collecting belt conveyors will transport the coal to the stack-out conveyor. The stack-out conveyor is a radial stacker equipped with a telescopic chute and water spray dust suppression. The radial stacker will be used to build a kidney-shaped active coal pile. Mobile equipment (i.e., bulldozers) will be used to build an inactive storage pile and to reclaim coal from the active storage pile. Coal reclaimed by mobile equipment will be pushed into a below-grade hopper and fed by a vibrating feeder onto the IGCC plant transfer conveyor.

Control of particulate emissions from coal handling operations will be achieved by a combination of wet dust suppression, chemical treatment of the coal pile,

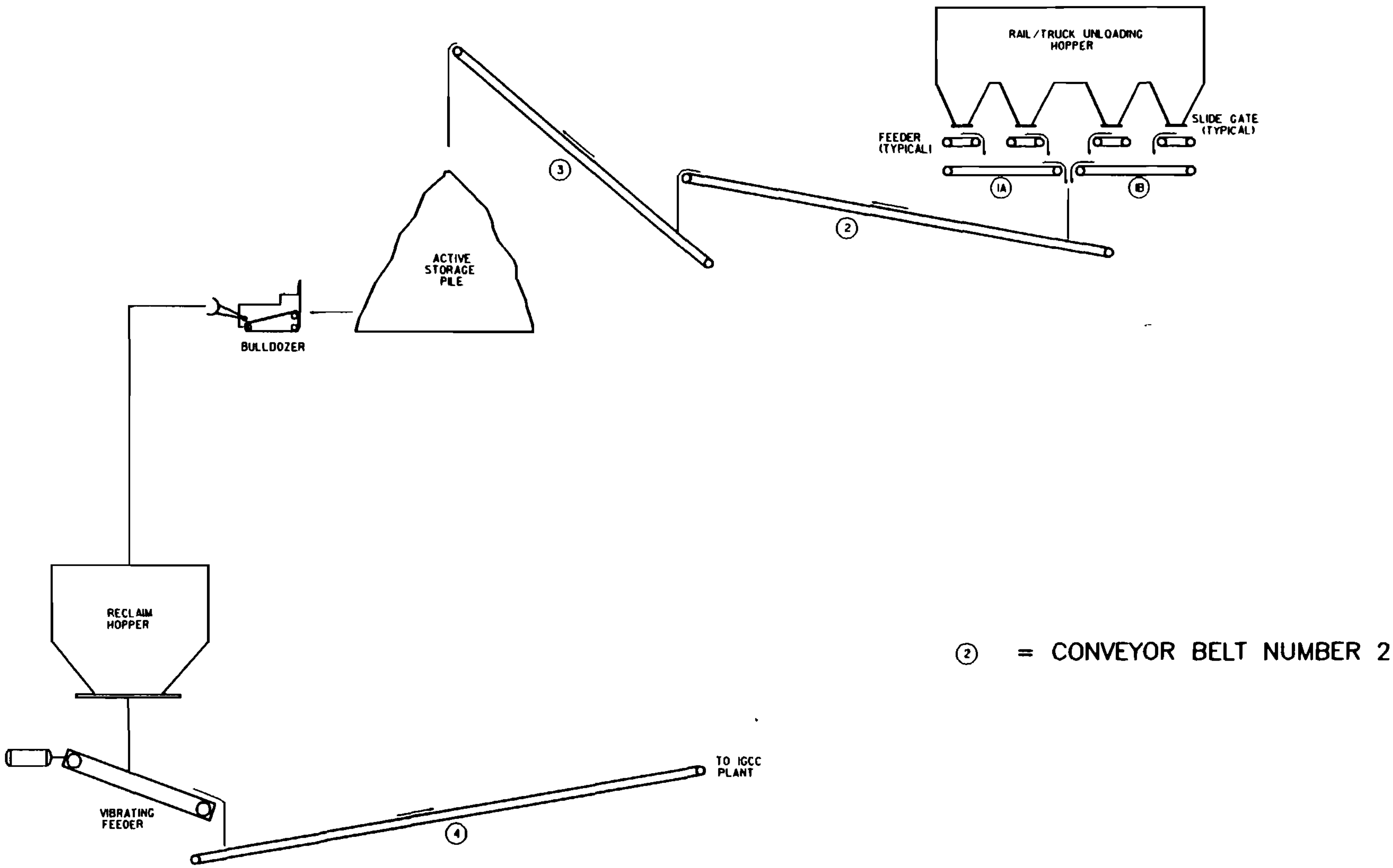

FIGURE 3.3.1-1.

COAL HANDLING SCHEMATIC

Source: UEC, 1992; ECT, 1992.

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equipment enclosures, and dry dust collection systems located at the major dust emissions sources. Wet dust suppression systems employing either foam or water sprays with a wetting agent will be employed at the railcar and truck receiving hopper and at the stacker discharge to the coal pile.

Conveyors and transfer points will be provided with enclosures and water spray systems to contain dust and to minimize emissions to the atmosphere. Coal handling equipment and transfer points will be provided dust-tight enclosures and dry type dust collectors, which will maintain a slight negative pressure within the equipment enclosure to minimize emissions. The dust collection equipment will consist of pulse-jet baghouses, centrifugal exhaust fans, rotary air lock valves, dust return chutes, and control devices. The baghouses will be sized for a maximum air to cloth ratio of 6 to 1 at design air flow and will have a removal efficiency not less than 99.9 percent.

The coal storage pile will be segregated into active and inactive portions. Fugitive dust emissions from the active portion of the pile will be controlled by water sprays and/or the application of chemical dust suppression agents. The inactive portion of the pile will be sealed with a crusting agent to control dust emissions.

The coal storage area will occupy an area of approximately 10 acres, including the coal pile runoff basin and berm surrounding the entire area to prevent stormwater runoff from the area. The aggregate storage capacity of approximately 105,000 tons for both the active and inactive storage piles will be sufficient to supply coal fuel for 45 days of IGCC unit operation at full generating capacity.

The coal pile storage area and the runoff basin will be lined with a synthetic material or other materials with similar low permeability characteristics to prevent leachate and runoff from entering the surficial groundwater system. The coal storage area will also include appropriately designed leachate and stormwater collection systems which will route collected water to the lined coal pile runoff basin. The basin will be capable of containing coal pile runoff resulting from in excess of the 25-year, 24-hour design storm event. The coal pile runoff basin will function to collect coal pile runoff and leachate, to allow sedimentation of solids in the collected waters, and then transfer the runoff at a controlled rate to the wastewater equalization basin associated with the overall IWT system for further treatment. Thus, all runoff water discharges from the coal storage area will be appropriately controlled and treated with no direct discharges to groundwater or surface waters.

3.3.2 NATURAL GAS SUPPLY AND DELIVERY

Natural gas will be used as the primary fuel for the stand-alone CT and CC units planned for the Polk Power Station. Natural gas will be delivered to the site via a pipeline from the existing and future natural gas transmission system in the region. Natural gas will not be stored on the Polk Power Station site. Table 3.3.2-1 presents a typical composition for the natural gas fuel. The CC and stand-alone CT units will use a total of approximately 11 million cubic feet per hour (ft^3/hr) of natural gas fuel if all units were operating at full load and at a worst-case ambient temperature of 20°F.

As discussed in Section 6.2, Tampa Electric Company is currently evaluating the various alternatives to supply natural gas to the Polk Power Station. Therefore, specific interconnection points to the existing or planned future gas transmission system in the site area and, in turn, the pipeline route or alternative routes to the Polk Power Station site have not been determined at this time. Once the proposed pipeline route has been determined, Tampa Electric Company will submit appropriate supplemental application and supporting information to the SCA for the Polk Power Station for agency review and approval of the proposed natural gas pipeline corridor from the transmission system to the site.

Table 3.3.2-1. Typical Natural Gas Composition

Component	Mole Percent (by volume)
Gas Composition	
Hexane+	0.018
Propane	0.190
I-butane	0.010
N-butane	0.007
Pentane	0.002
Nitrogen	0.527
Methane	96.195
CO_2	0.673
Ethane	2.379
Other Characteristics	
Heat content	1,022 Btu/ft^3 with 14.73 psia, dry
Real specific gravity	0.5776
Sulfur content (maximum)	10 gr/100 scf

Note: Btu/ft^3 = British thermal units per cubic foot.
psia = pounds per square inch absolute.
gr/100 scf = grains per 100 standard cubic foot.

Source: Tampa Electric Company, 1992.

3.3.3 FUEL OIL SUPPLY AND DELIVERY, HANDLING, AND STORAGE FACILITIES

3.3.3.1 Fuel Oil Supply and Quality

Initially, No. 2 fuel oil will be used as a primary fuel for the advanced CT unit planned for the Polk Power Station. Fuel oil will be delivered to the site by tanker truck and/or railcar. This will occur during the first year of operation, after which the CT will be converted to the IGCC unit. At this time, Tampa Electric Company anticipates that fuel oil will serve primarily as a backup fuel for the stand-alone CT and CC units and the advanced CT component of the IGCC unit in CC mode after the initial project phase.

Table 3.3.3-1 presents a typical fuel analysis for the low-sulfur No. 2 fuel oil which will be used as backup fuel for the Polk Power Station. The stand-alone CC and CT units will use a total of approximately 77,000 gallons of No. 2 fuel oil per hour if all units were operating at full load and at the worst-case ambient temperature of 20°F. If the CG facilities were unavailable to provide syngas and the CC component of the IGCC unit was fired on the backup fuel oil, this unit would use an additional 13,500 gallons of No. 2 fuel oil per hour at full load and at the worst-case ambient temperature of 20°F.

3.3.3.2 Fuel Oil Delivery, Handling, and Storage Facilities

GATX is currently proposing to construct a new fuel oil pipeline in the site region. The proposed pipeline would parallel Fort Green Road and the CSX Railroad located adjacent to the eastern boundary of the Polk Power Station site. When constructed, fuel oil could be delivered to the site via a pipeline from the proposed GATX pipeline to the onsite fuel oil storage tanks. The corridor for this supply pipeline would be located within the boundaries of the Polk Power Station site and, therefore, would not affect offsite land uses or resources. Tampa Electric Company will submit appropriate supplemental application and supporting information to the SCA for the Polk Power Station for agency review and approval prior to construction of the onsite pipeline to supply fuel oil to the site.

Table 3.3.3-1. Typical No. 2 Fuel Oil Analysis

Parameter	Value
Specific gravity @ 60°F (maximum)	0.876
Viscosity, saybolt (SUS) @ 100°F	
Minimum	40.2
Maximum	32.6
Flash point, °F (minimum)	100
Pour point, °F (minimum)	0
Minimum gross heating value, Btu/gal	
LHV	129,811
HHV	137,600
Water and sediment, percent by volume (maximum)	0.05
Ash, percent by weight (maximum)	0.01
Sulfur, percent by weight (maximum)	0.05
Fuel-bound nitrogen, percent by weight (maximum)	0.015
Trace constituents, ppm (maximum)	
Lead	1.0
Sodium	1.0
Vanadium	0.5

Note: SUS = Saybolt Universal Seconds.
Btu/gal = British thermal units per gallon.
LHV = lower heating value.
HHV = higher heating value.

Source: Tampa Electric Company, 1992.

Whether or not the fuel oil pipeline is constructed, the capability to deliver the backup fuel oil by tanker truck or railcar will be provided on the site.

Fuel oil will ultimately be stored in three aboveground storage tanks on the site at full build-out of the Polk Power Station. The construction of these three tanks will be phased over time to match fuel oil needs as additional generating units are developed on the site. The tanks will be constructed of steel and each tank will have a storage capacity of 3 million gallons of fuel oil. Therefore, after full build-out, the total onsite storage capacity will be 9 million gallons of fuel oil. Each tank will be approximately 128 ft in diameter and 32 ft in height.

The storage tank area will be surrounded by a berm which will be appropriately designed to contain any unexpected spills or failures of the tanks. The area design will also include appropriate systems and safeguards to prevent, control, and recover any potential spills in accordance with federal and state regulatory requirements for aboveground storage tanks. The berms will be constructed of earthen materials primarily excavated from the overburden spoil piles in the mined-out areas of the site. The earthen berms will be covered with sealed asphalt or comparable sealer material to prevent any spilled fuel oil from penetrating or contaminating the berms or groundwater.

Stormwater runoff from the fuel oil storage will be collected and routed to an oil/water separator which will be designed to reduce any potential oil and grease content in the water to a level not exceeding 15 mg/L. The oil/grease and solids sediment will be collected and hauled offsite by a contractor for appropriate disposal. The treated effluent from the oil/water separators will be routed to the cooling reservoir.

A preliminary Spill Prevention, Control, and Countermeasure (SPCC) Plan has been developed for the fuel oil storage and handling systems according to the requirements of 40 CFR 112, including emergency response procedures for controlling and handling any unexpected spills (see Appendix 11.13.1).

3.4 AIR EMISSIONS AND CONTROLS

3.4.1 AIR EMISSION TYPES AND SOURCES

This section describes the types and sources of air pollutants that will be emitted from Polk Power Station. The maximum emission rates for the larger sources are also quantified. Additional details on both the description of emission sources and quantification of emission rates are provided in the PSD permit application, which is included as Appendix 11.1.3 of this SCA.

Air emissions associated with the proposed facility fall into three broad categories: combustion emissions, process emissions, and fugitive emissions. The combustion sources are:

- The advanced CT integral to the IGCC unit;
- The IGCC unit tail gas treating unit thermal oxidizer;
- The IGCC unit H_2SO_4 plant thermal oxidizer;
- The IGCC unit emergency flare;
- A small auxiliary boiler associated with the IGCC unit;
- The four CTs associated with the two CC units; and
- The six stand-alone, simple-cycle CTs.

The primary source of emissions from the IGCC unit is combustion of syngas in the advanced CT (GE 7F). The exhaust gas from the CT will be emitted to the atmosphere via the HRSG stack. Emissions from the HRSG stack are primarily NO_x and SO_2, with lesser quantities of CO, VOC, particulate matter (PM), and other trace constituents present in the fuel. Table 3.4.1-1 presents the estimated maximum hourly emission rates for this source. As shown in the table, emissions of some pollutants may vary with the type of syngas cleanup technology employed. The emission control capabilities of the HGCU system are yet to be fully demonstrated; therefore, some emission estimates are higher compared to estimated emissions from the CGCU system. However, after the completion of the 2-year demonstration period, the lower emission rates from the CGCU system will be achieved. Estimated emissions firing low-sulfur No. 2 distillate fuel oil are also provided in Table 3.4.1-1

Table 3.4.1-1. Maximum Emissions from the IGCC Unit's CT (all values lb/hr)

Pollutant	Syngas: Post-Demonstration*	Syngas: Demonstration†	No. 2 Fuel Oil
Particulate matter**	72	72	27
SO_2	518	518	92
NO_x	223	664	311
CO	98	99	99
VOCs	3	3	32
Lead	0.0035	0.023	0.10
H_2SO_4 mist	55	55	10
Fluorides	0.21	0.21	0.062
Mercury	0.0034	0.025	0.0057
Beryllium	0.0001	0.0001	0.0048
Arsenic	0.0006	0.080	0.31
Cadmium	0.0009	0.020	0.020
Chromium	0.0004	0.0005	0.17

* Maximum emissions after the 2-year demonstration period, based on emissions achievable with CGCU. Utilization of HGCU to be based on ability to achieve maximum post-demonstration emission rates.

† Maximum emissions during the 2-year demonstration period, based on up to 50 percent utilization of HGCU. Maximum post-demonstration emission rates to be achieved thereafter.

** Includes H_2SO_4 mist.

Sources: GE, 1992.
Texaco, 1992.
ECT, 1992.

since: (1) the advanced CT will operate initially (i.e., prior to the integration with the CG facilities) as an oil-fired simple-cycle CT; and (2) after the IGCC conversion, the CT may still operate in CC mode on oil during periods when syngas is not available.

Approximately 96 percent of the sulfur present in the coal will be removed by the CGCU and HGCU systems. The sulfur-laden gas produced in the CGCU and HGCU systems will be treated onsite and converted to a saleable sulfur and/or H_2SO_4 by-products. Small amounts of the sulfur in the tail gas that is not converted in the CGCU system process will be combusted and emitted as SO_2 through the tail gas treating unit thermal oxidizer. Estimated emissions from the thermal oxidizer are presented in Table 3.4.1-2 assuming that 100 percent of the syngas is being treated within the CGCU system.

When the HGCU system is in use, off-gases from this system will be routed to a H_2SO_4 plant. Estimated emissions from the acid plant thermal oxidizer are presented in Table 3.4.1-3. When this system is in use to treat up to approximately 50 percent of the syngas, the use of the CGCU system, and hence the thermal oxidizer emissions, will decrease correspondingly.

The emergency flare will operate only during gasifier startup and shutdown, and during infrequent, unanticipated interruptions of the gasifier's operating cycles. On a routine basis, emissions from the flare will result from the pilot flame, and these emissions will be negligible.

Similarly, the small oil-fired auxiliary boiler will operate only during startup and shutdown of the IGCC unit, or when steam from the IGCC unit's HRSG is unavailable. Estimated maximum emissions from this source are summarized in Table 3.4.1-4.

Table 3.4.1-2. Maximum Tail Gas Treating Unit Thermal Oxidizer Emissions

Pollutant	Emissions (lb/hr)*
Particulate matter	13.1
SO_2	52.0
NO_x	2.6
CO	1.4
VOC	0.8
Lead	0.002
H_2SO_4 mist	0
Fluorides	0.001
Mercury	0.002
Beryllium	0.001
Arsenic	0.001
Cadmium	0.001
Chromium	0.105
H_2S	0.4

*Maximum emissions are for 100 percent CGCU operations; emissions from this source would be less with 50 percent CGCU and 50 percent HGCU.

Source: Texaco, 1992.

Table 3.4.1-3. Maximum Expected Emissions from the H_2SO_4 Plant Thermal Oxidizer

Pollutant	Emissions* (lb/hr)
Particulate matter	2.6
SO_2	10.1
NO_x	1.14
CO	0.61
VOC	0.35
Lead	0.001
H_2SO_4 mist	0
Fluorides	0
Mercury	0.001
Beryllium	0.001
Arsenic	0.001
Cadmium	0.001
Chromium	0.052
H_2S	0.23

*Maximum emissions are for 50 percent CGCU and 50 percent HGCU; this source would have no emissions with 100 percent CGCU.

Source: Texaco, 1992.

Table 3.4.1-4. Auxiliary Boiler Emissions

Pollutant	Emissions (lb/hr)
Particulate matter	3.0
SO_2	2.6
NO_x	7.9
CO	4.3
VOC	2.4
Lead	0.003

Source: Texaco, 1992.

The stand-alone CC units and CTs will emit stack gases resulting from the combustion of natural gas or backup fuel oil. The principal pollutants will be NO_x and SO_2, with lesser quantities of CO, VOC, PM, and other trace pollutants. Table 3.4.1-5 presents the estimated maximum hourly emissions from an individual CT in either CC or simple-cycle mode.

Process and fugitive emissions will result from other facility and process operations associated primarily with the IGCC unit. Fugitive particulate emissions will be generated by material handling and storage, principally coal and slag. The coal handling and slag systems will be designed to effectively control fugitive emissions of PM. For coal handling, the dust control system involves a combination of controls, including rail car and truck unloading in enclosed buildings, enclosure of certain coal conveyors, baghouse particulate control at transfer points, wetting of the coal pile, and wet grinding in the rod mills. Slag will be conveyed wet in conveyors which will greatly minimize or eliminate potential fugitive dust emissions.

Minor, intermittent emissions of gaseous-phase pollutants may be generated within the gasification plant. The potential sources will be process vents, and leaks (fugitive emissions) from equipment such as valves, compressor seals, and flanges. The predominant gases that may be emitted include H_2S and NH_3. A small amount of particulates may also be emitted from vent sources. These emissions will be minimized by good operational and maintenance practices.

Table 3.4.1-5. Maximum Emissions from Individual Stand-Alone CT and CC Units (all values lb/hr)*

Pollutant	Fuel: Natural Gas	Fuel: Fuel Oil
Particulate matter†	11	21
SO_2	36	53
NO_x	35	181
CO	59	71
VOC	10	10
Lead	0	0.059
H_2SO_4 mist	4	6
Fluorides	0	0.036
Mercury	0.012	0.0033
Beryllium	0	0.0028
Arsenic	0	0.18
Cadmium	0	0.012
Chromium	0	0.10

* Emission rates given are for an individual CT in either CC or simple-cycle mode.
† Includes H_2SO_4 mist.

Sources: GE, 1992.
ECT, 1992.

3.4.2 AIR EMISSION CONTROLS

Air emission controls planned for the Polk Power Station are summarized in Tables 3.4.2-1 and 3.4.2-2 for the IGCC facility and stand-alone CTs (CC or simple-cycle mode), respectively. Brief descriptions of the control systems proposed for the Polk Power Station are provided in the following sections. A complete description of the Polk Power Station air emission control systems is included in the PSD permit application contained in Appendix 11.1.3.

3.4.2.1 Particulate Matter and Heavy Metals

PM and trace heavy metals (including lead, mercury, and beryllium) controls planned for the IGCC facility consist of water scrubbing, use of clean fuels and operational practices to achieve efficient combustion. A water scrubber to remove PM from the syngas stream is an integral component of the conventional CGCU process. The scrubbed syngas is cooled prior to entering the acid gas removal system which results in the condensation of trace volatile heavy metals and further reduction in syngas particulate levels. The demonstration HGCU technology employs a high temperature barrier filter to remove 99.5 percent or more of the PM contained in the treated syngas stream.

The IGCC 7F CT will be operated in simple-cycle mode during the first year of operation (prior to installation of the CG facilities) using distillate fuel oil. The primary fuel after conversion to IGCC will be syngas; distillate fuel oil will serve as a secondary fuel source when operating in the CC mode. Syngas and distillate fuel oil are both low in ash and sulfur content resulting in low PM emissions.

Fugitive PM emissions due to the handling of coal in the IGCC facility will be controlled using a comprehensive system of equipment enclosure, fabric filter dust collection, application of water/chemical dust suppression and crusting agents, and the paving of roads within the Polk Power Station site.

Table 3.4.2-1. Summary of Air Emission Controls for the IGCC Facility

Pollutant	Fuel Type: Syngas	Fuel Type: Distillate Fuel Oil
PM and heavy metals	Low ash/sulfur fuel, efficient combustion--all combustion sources	Low ash/sulfur fuel, efficient combustion--all combustion sources
	Equipment enclosure, fabric filter dust collection, water/chemical dust suppression, crusting agents, paved roads--fugitive sources	
CO and VOC	Advanced combustion equipment and efficient combustion--all combustion sources	Advanced combustion equipment and efficient combustion--all combustion sources
SO_2 and H_2SO_4	Acid gas recovery and sulfur recovery/tail gas treating/thermal oxidation--CGCU	Low sulfur ($\leq$0.05 weight percent) fuel--all combustion sources
	Zinc titanate absorption and H_2SO_4 plant/thermal oxidation--HGCU	
	Low sulfur ($\leq$0.07 weight percent) fuel--all combustion sources	
NO_x	Nitrogen injection--CT, low-NO_x burners/combustion practices--all other combustion sources	Wet injection--CT, low-NO_x burners/combustion techniques--all other combustion sources

Sources: GE, 1992.
Texaco, 1992.
ECT, 1992.

Table 3.4.2-2. Summary of Air Emission Controls for Stand-Alone CC and CT Units

Pollutant	Fuel Type: Natural Gas	Fuel Type: Distillate Fuel Oil
PM and heavy metals	Low ash/sulfur fuel, efficient combustion	Low ash/sulfur fuel, efficient combustion
CO and VOC	Advanced combustion equipment and efficient combustion	Advanced combustion equipment and efficient combustion
SO_2 and H_2SO_4	Low sulfur ($\leq$ 10 gr/scf) fuel	Low sulfur ($\leq$ 0.05 weight percent) fuel
NO_x	Dry low-NO_x burners	Water injection

Sources: GE, 1992.
ECT, 1992.

The stand-alone CCs and CTs will be fired primarily with natural gas with distillate fuel oil as a backup fuel source. These fuels are low in sulfur and ash content resulting in low PM emissions.

3.4.2.2 Carbon Monoxide and Volatile Organic Compounds

CO and VOC emissions from the IGCC facility and stand-alone CCs and CTs will be controlled by the use of advanced combustion equipment and operational practices to obtain efficient combustion. Highly efficient combustion will, in turn, result in low CO and VOC emission rates.

3.4.2.3 Sulfur Oxides and Sulfuric Acid Mist

Sulfur oxides and H_2SO_4 mist emission control is integral to the IGCC unit. Using conventional CGCU technology, H_2S and COS present in the syngas leaving the gasifier will be removed using a promoted amine process in the acid gas removal unit. The treated low sulfur syngas stream, containing approximately 0.07 weight percent sulfur compounds, will then be burned in the advanced CT for power production. Sulfur compounds will be stripped from the amine solution and treated by the sulfur recovery/tail gas treating units which will recover more than 99 percent of the inlet sulfur. Any sulfur compounds remaining in the tail gas treating unit exhaust will be converted to SO_2 in the thermal oxidizer. The demonstration HGCU technology will react H_2S present in the syngas stream with zinc titanate sorbent in a moving bed absorber. Regeneration of the absorber will yield a concentrated SO_2 stream which will then be converted to H_2SO_4 in a H_2SO_4 production plant. Sulfur removal efficiency of the HGCU technology will meet or exceed that of conventional CGCU technology.

SO_2 and H_2SO_4 mist emissions from the IGCC combustion sources will be controlled by the use of low-sulfur fuels. The advanced 7F CT, during its initial year of simple-cycle operation, will be fired with low-sulfur distillate fuel oil. Sulfur content of syngas and distillate fuel oil will be 0.07 and 0.05 weight percent, respectively.

SO_2 emissions from the future stand-alone CC and CT units will be controlled by the use of low-sulfur natural gas and distillate fuel oil. Natural gas sulfur content will be less than 10 gr/100 scf. Distillate fuel oil will contain a maximum of 0.05 weight percent sulfur.

3.4.2.4 Nitrogen Oxides

The advanced CT in the IGCC unit will use nitrogen addition to control NO_x emissions during syngas firing. Nitrogen acts as a diluent to lower peak flame temperatures and reduce NO_x formation without the water consumption and treatment/disposal requirements associated with water or steam injection NO_x control methods. Nitrogen used for injection will be provided by the air separation unit used to generate oxygen for the gasification process. Maximum nitrogen diluent will be injected to minimize NO_x exhaust concentrations consistent with safe and stable operation of the CT. Water injection will be employed to control NO_x emissions when backup distillate fuel oil is used and during the first year of the 7F CT simple-cycle operation and when the unit is operated in CC mode. NO_x emissions from the remaining IGCC facility combustion sources will be controlled using low-NO_x burners and/or combustion practices that reduce NO_x formation.

The stand-alone CC and CT units will be equipped with dry low-NO_x burners when fired on natural gas and water injection when fired on backup distillate fuel oil to abate NO_x emissions.

3.4.3 BEST AVAILABLE CONTROL TECHNOLOGY

Best available control technology (BACT) represents an emission limitation that reflects the maximum degree of pollutant reduction achievable, determined on a case-by-case basis, with consideration given to energy, environmental, and economic impacts. BACT emission limitations must be no less stringent than any applicable NSPS (40 CFR 60), National Emission Standard for Hazardous Air Pollutants (NESHAPS) (40 CFR 61), and state emission standards (Chapter 17-2, Part VI, Emission Limiting and Performance Standards, F.A.C.).

A complete BACT evaluation for the Polk Power Station project is contained in the PSD permit application in Appendix 11.1.3. Proposed BACT emission limitations for the IGCC facility and stand-alone CC and CT units are summarized in Tables 3.4.3-1 and 3.4.3-2, respectively. An abbreviated discussion of the BACT review is provided in the following sections.

3.4.3.1 Methodology

The BACT analysis was performed in accordance with the EPA *top-down* method. The first step in the top-down BACT procedure was the identification of all available control technologies. Alternatives considered included process designs and operating practices that reduce the formation of emissions, post-process stack controls that reduce emissions after they are formed, and combinations of these two control categories. Following the identification of available control technologies, the next step in the analysis was to determine which technologies may be technically infeasible. Technical feasibility was evaluated using the criteria contained in Chapter B of the EPA New Source Review (NSR) Workshop Manual (EPA, 1990b). The third step in the top-down BACT process was the ranking of the remaining technically feasible control technologies from high to low in order of control effectiveness. Assessment of energy, environmental, and economic impacts was then performed. The economic analyses of the technologies used procedures found in the Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual (EPA, 1990c). The fifth and final step was the selection of a BACT emission limitation

Table 3.4.3-1. Proposed BACT Limitations for the IGCC Facility

Emission Source	Fuel Type	Pollutant	BACT Emission Limitation lb/hr	lb/MMBtu	lb/MW	ppmvd
CT (simple cycle)	Distillate fuel oil	PM*	27.0	0.014	0.180	NA
CT/HRSG	Syngas (100% CGCU)	PM*	72.0	0.037†	0.296**	NA
	Syngas (50% CGCU/50% HGCU)	PM*	72.0	0.037†	0.296**	NA
Auxiliary boiler	Distillate fuel oil	PM*	3.0	0.061	NA	NA
Tail gas treating unit thermal oxidizer	Distillate fuel oil	PM*	13.1	NA	NA	NA
H_2SO_4 thermal oxidizer	Distillate fuel oil	PM*	2.6	NA	NA	NA
CT/HRSG	Syngas (100% CGCU)	PM††	17.0	0.013†	0.116**	NA
	Syngas (50% CGCU/50% HGCU)	PM††	17.0	0.013†	0.116**	NA
Auxiliary boiler	Distillate fuel oil	PM††	3.0	0.061	NA	NA
Tail gas treating unit thermal oxidizer	Distillate fuel oil	PM††	13.1	NA	NA	NA
H_2SO_4 thermal oxidizer	Distillate fuel oil	PM††	2.6	NA	NA	NA
CT (simple cycle)	Distillate fuel oil	CO	99.0	0.086	1.320	40.0
CT/HRSG	Syngas (100% CGCU)	CO	98.0	0.044†	0.382**	25.0
	Syngas (50% CGCU/50% HGCU)	CO	99.0	0.044†	0.386**	25.0
Auxiliary boiler	Distillate fuel oil	CO	4.3	0.087	NA	108.0
Tail gas treating unit thermal oxidizer	Distillate fuel oil	CO	1.4	NA	NA	29.0

Table 3.4.3-1. Proposed BACT Limitations for the IGCC Facility (Continued, Page 2 of 3)

Emission Source	Fuel Type	Pollutant	BACT Emission Limitation			
			lb/hr	lb/MMBtu	lb/MW	ppmvd
H_2SO_4 thermal oxidizer	Distillate fuel oil	CO	0.61	NA	NA	29.0
CT (simple cycle)	Distillate fuel oil	VOC	32.0	0.028	0.427	20.0
CT/HRSG	Syngas (100% CGCU)	VOC	3.0	0.0013†	0.012**	1.0
	Syngas (50% CGCU/50% HGCU)	VOC	3.0	0.0013†	0.012**	1.0
Auxiliary boiler	Distillate fuel oil	VOC	2.4	0.0485	NA	27.0
Tail gas treating unit thermal oxidizer	Distillate fuel oil	VOC	0.8	NA	NA	37.0
H_2SO_4 thermal oxidizer	Distillate fuel oil	VOC	0.35	NA	NA	29.0
CT (simple cycle)	Distillate fuel oil	SO_2	92.2	0.048	0.615	NA
CT/HRSG	Syngas (100% CGCU)	SO_2	518.0	0.236†	2.073**	NA
	Syngas (50% CGCU/50% HGCU)	SO_2	518.0	0.236†	2.073**	NA
Auxiliary boiler	Distillate fuel oil	SO_2	2.6	0.053	NA	NA
Tail gas treating unit thermal oxidizer	Distillate fuel oil	SO_2	52.0	NA	NA	NA
H_2SO_4 thermal oxidizer	Distillate fuel oil	SO_2	10.1	NA	NA	NA
CT (simple cycle)	Distillate fuel oil	H_2SO_4	9.7	0.005	0.065	NA
CT/HRSG	Syngas (100% CGCU)	H_2SO_4	55.0	0.024†	0.212**	NA
	Syngas (50% CGCU/50% HGCU)	H_2SO_4	55.0	0.024†	0.212**	NA

Table 3.4.3-1. Proposed BACT Limitations for the IGCC Facility (Continued, Page 3 of 3)

Emission Source	Fuel Type	Pollutant	BACT Emission Limitation			
			lb/hr	lb/MMBtu	lb/MW	ppmvd
Auxiliary boiler	Distillate fuel oil	H_2SO_4	0.0	NA	NA	NA
Tail gas treating unit thermal oxidizer	Distillate fuel oil	H_2SO_4	0.0	NA	NA	NA
H_2SO_4 thermal oxidizer	Distillate fuel oil	H_2SO_4	0.0	NA	NA	NA
CT (simple cycle)	Distillate fuel oil	NO_2	311.0	0.163	2.073	NA
CT/HRSG	Syngas (100% CGCU)	NO_2	222.5	0.099†	0.866**	25.0
	Syngas (50% CGCU/50% HGCU)	NO_2	664.0	0.292†	2.564**	81.0
Auxiliary boiler	Distillate fuel oil	NO_2	7.9	0.159	NA	123.0
Tail gas treating unit thermal oxidizer	Distillate fuel oil	NO_2	2.6	NA	NA	42.0
H_2SO_4 thermal oxidizer	Distillate fuel oil	NO_2	1.14	NA	NA	33.0

Note: For distillate fuel oil, emission estimates based on following properties: (1) maximum ash content of 0.01 weight percent, (2) maximum sulfur content of 0.05 weight percent, and (3) maximum fuel-bound nitrogen of 0.015 weight percent [for fuel-bound nitrogen levels greater than 0.015 weight percent, emission limits are adjusted in accordance with the fuel-bound nitrogen allowance contained in 40 CFR 60(GG)].

*Including H_2SO_4 emissions.
†Based on heat input (HHV) to coal gasifier and includes emissions from tail gas treating unit thermal oxidizer.
**Includes emissions from tail gas treating unit thermal oxidizer.
††Excluding H_2SO_4 emissions.

Sources: GE, 1992.
Texaco, 1992.

Table 3.4.3-2. Proposed BACT Limitations for Stand-Alone CC and CT Units

Emission Source	Fuel Type	Pollutant	BACT Emission Limitation lb/hr	lb/MMBtu	lb/MW	ppmvd
CC unit (per unit)	Natural gas	PM*	22.0	0.010	0.100	NA
	Distillate fuel oil	PM*	41.0	0.018	0.186	NA
CTs (per CT)	Natural gas	PM*	11.0	0.010	0.147	NA
	Distillate fuel oil	PM*	20.5	0.018	0.273	NA
CC unit (per unit)	Natural gas	PM†	14.0	0.007	0.064	NA
	Distillate fuel oil	PM†	30.0	0.013	0.136	NA
CTs (per CT)	Natural gas	PM†	7.0	0.007	0.093	NA
	Distillate fuel oil	PM†	15.0	0.013	0.200	NA
CC unit (per unit)	Natural gas	CO	118.0	0.055	0.536	25.0
	Distillate fuel oil	CO	142.0	0.064	0.645	30.0
CTs (per CT)	Natural gas	CO	59.0	0.055	0.787	25.0
	Distillate fuel oil	CO	71.0	0.064	0.945	30.0
CC unit (per unit)	Natural gas	VOC	20.0	0.0093	0.091	7.0
	Distillate fuel oil	VOC	20.0	0.0090	0.091	7.0
CTs (per CT)	Natural gas	VOC	10.0	0.0093	0.133	7.0
	Distillate fuel oil	VOC	10.0	0.0090	0.133	7.0
CC unit (per unit)	Natural gas	SO_2	72.0	0.034	0.327	NA
	Distillate fuel oil	SO_2	107.4	0.047	0.488	NA
CTs (per CT)	Natural gas	SO_2	36.0	0.034	0.480	NA
	Distillate fuel oil	SO_2	53.7	0.047	0.716	NA
CC unit (per unit)	Natural gas	H_2SO_4	8.0	0.0037	0.026	NA
	Distillate fuel oil	H_2SO_4	11.0	0.0049	0.050	NA

Table 3.4.3-2. Proposed BACT Limitations for Stand-Alone CC and CT Units (Continued, Page 2 of 2)

Emission Source	Fuel Type	Pollutant	BACT Emission Limitation			
			lb/hr	lb/MMBtu	lb/MW	ppmvd
CTs (per CT)	Natural gas	H_2SO_4	4.0	0.0037	0.053	NA
	Distillate fuel oil	H_2SO_4	5.5	0.0049	0.073	NA
CC unit (per unit)	Natural gas	NO_2	70.0	0.033	0.318	9.0
	Distillate fuel oil	NO_2	362.0	0.162	1.645	42.0
CTs (per CT)	Natural gas	NO_2	35.0	0.033	0.467	9.0
	Distillate fuel oil	NO_2	181.0	0.162	2.413	42.0

Note: For distillate fuel oil, emission estimates based on following properties: (1) maximum ash content of 0.01 weight percent, (2) maximum sulfur content of 0.05 weight percent, and (3) maximum fuel-bound nitrogen of 0.015 weight percent [for fuel-bound nitrogen levels greater than 0.015 weight percent, emission limits are adjusted in accordance with the fuel-bound nitrogen allowance contained in 40 CFR 60(GG)].

*Including H_2SO_4 emissions.
†Excluding H_2SO_4 emissions.

Source: GE, 1992.

corresponding to the most stringent technically feasible control technology that was not eliminated based on adverse energy, environmental, or economic grounds. Control technology analyses using the five step *top-down* BACT method were prepared for combustion products, products of incomplete combustion, and acid gases, respectively. In the following sections, the BACT analyses are discussed separately for: (a) the IGCC facility, and (b) the stand-alone CC and CT units since these emission sources are two distinct processes with differing available control technologies.

3.4.3.2 Particulate Matter and Trace Heavy Metals

Control technologies available for the IGCC facility (advanced CT and ancillary combustion sources) include use of clean fuels and efficient combustion and conventional post-combustion stack controls such as electrostatic precipitators, fabric filters, and wet scrubbers. A wet scrubber to remove PM from the syngas will be an integral part of the CGCU process. The scrubbed syngas will then be cooled prior to entering the acid gas removal unit which will result in the condensation of trace volatile heavy metals and further reduction in syngas particulate levels. The demonstration HGCU technology will employ a high temperature barrier filter to remove 99.5 percent or more of the PM contained in the syngas stream. The end product of the CG process, for both CGCU and HGCU technologies, will be a treated syngas stream which is low in PM. The low PM content of the treated syngas stream, coupled with high CT excess air rates, will produce an exhaust gas with very low PM concentrations; i.e., 0.010 grains per standard cubic foot (gr/scf) or less. Use of backup low sulfur distillate fuel oil in the advanced CT will also result in low exhaust PM concentrations, 0.0048 gr/scf or less. This low exhaust PM concentration will also occur for the 7F CT during its initial first year, distillate fuel oil-fired, simple-cycle mode operation and when operated in CC mode when syngas is unavailable. Control of exhaust stream PM concentrations of such low magnitude using available post-combustion technologies is not feasible since removal efficiencies would be unreasonably low and costs excessive. Since post-process stack controls for PM are not appropriate for the IGCC facility, the use of wet scrubbing (integral to the IGCC process), good combustion practices and clean fuels is considered to be BACT. The Polk Power Station IGCC project will use the latest CT burner technology to maximize combustion efficiency and minimize PM emission rates. Project fuels will consist of coal-derived syngas and low sulfur distillate fuel oil.

Ancillary equipment associated with the IGCC facility that emit PM include the auxiliary steam boiler, coal handling facilities, H_2SO_4 plant (HGCU technology) thermal oxidizer, and the sulfur recovery unit (CGCU technology) tail gas thermal oxidizer. The auxiliary boiler, H_2SO_4 thermal oxidizer, and sulfur recovery tail gas thermal oxidizer will all use low ash, low-sulfur fuels. Due to low exhaust stream PM concentrations, BACT for PM emissions from these emission sources is considered to be the use of clean fuels and good combustion practices.

Coal handling fugitive PM emissions will be controlled by a combination of wet dust suppression, equipment enclosure, and fabric filter dust collection systems located at the major dust emission points. Trucks and railcars will unload at a receiving hopper equipped with a dust collection system to collect dust from all conveyor transfer points in the dump pit area. Wet dust suppression systems using either foam, or water sprays with a wetting agent, will also be employed at the truck/railcar receiving hopper. Conveyors will be hooded to minimize dust emissions. Enclosures and dust abatement equipment (fabric filters) will be employed to control PM emissions from coal handling equipment and transfer points. A wet suppression system will be used at the stacker discharge to the coal pile. Wind blown PM emissions from the active and inactive coal piles will be controlled by the application of water/chemical dust suppressants and crusting agents, respectively. All roads within the Polk Power Station complex will be paved, except for the infrequently used transmission line service roads. Use of wet suppression, hoods and enclosures, paved roads, and fabric filters is considered to be BACT for PM emissions from coal handling operations.

Exhaust PM concentrations from the stand-alone CC and CT units are inherently low due to the combustion of clean fuels (natural gas and low sulfur distillate fuel oil) and high exhaust gas flow rates. Estimated maximum PM exhaust concentrations (including H_2SO_4 mist) from the individual stand-alone CTs in simple-cycle or CC mode using natural gas and backup distillate fuel oil are 0.0033 and 0.0065 gr/scf, respectively. Due to these low exhaust concentrations, post-process stack controls are not feasible since PM removal efficiencies would be unreasonably low and costs excessive. Use of clean fuels and good combustion practices is considered to be BACT for PM emissions from the stand-alone CC units and CTs.

3.4.3.3 Carbon Monoxide and Volatile Organic Compounds

Available technologies for reducing CO and VOC emissions from the IGCC facility (CT and ancillary combustion sources) include combustion process design and use of post-combustion oxidation catalyst controls. Combustion process controls involve combustion chamber designs and operation practices that improve the oxidation process and minimize incomplete combustion. Due to the high combustion efficiency of most proposed combustion processes, CO and VOC emissions are inherently low.

Noble metal (commonly platinum or palladium) oxidation catalysts can be used to promote oxidation of CO and VOCs to CO_2 and water at temperatures lower than would be necessary for oxidation without a catalyst. The operating temperature range for these oxidation catalysts is between 650 and 1,150°F. However, these oxidation catalysts are susceptible to deactivation due to impurities present in the exhaust gas stream. Arsenic, iron, sodium, phosphorous, and silica all act as catalyst poisons causing a reduction in catalyst activity and pollutant removal efficiencies. Thus, oxidation catalysts are nonselective and will oxidize other compounds in addition to CO and VOCs. The nonselectivity characteristics of oxidation catalysts are important in assessing applicability to exhaust streams containing sulfur compounds. Sulfur compounds that have been oxidized to SO_2 in the combustion process will be further oxidized by the catalyst to sulfur trioxide (SO_3). SO_3 will, in turn, combine with moisture in the gas stream to form H_2SO_4 mist which can lead to corrosion and fouling of boiler tubes in the HRSG, plugging of the catalyst reactor, decrease in CO conversion efficiency of the catalyst, and a visible exhaust plume.

Corrosion of the HRSG boiler tubes decreases heat transfer surface area and thus decreases stream generating capabilities. Sulfur compounds in the exhaust gas stream also decrease CO removal efficiency of the catalyst since the catalyst will selectively absorb sulfur compounds. This thin layer of sulfur residue inhibits the contact between CO and the catalyst decreasing catalyst performance. CO oxidation catalysts treating streams containing sulfur compounds must be washed or heated to high temperatures periodically to eliminate catalyst sulfur residue which increases the downtime of the control system. Increased downtime is unacceptable for the Polk Power Station IGCC facility since the facility will operate as a baseload power plant.

There are no significant energy or environmental impacts associated with the use of good combustor designs and operating practices to minimize CO and VOC emissions. The application of oxidation catalyst technology to a combustion device would result in an increase in backpressure on the device due to pressure drop across the catalyst bed thereby increasing energy consumption. Concerning environmental impacts, the use of oxidation catalysts would, as previously mentioned, result in excessive H_2SO_4 mist emissions if applied to combustion devices fired with fuels containing sulfur. Since the estimated CO and VOC emission rates from the IGCC combustion unit will be inherently low, further reductions through the use of oxidation catalysts will result in insignificant air quality improvements which are well below the defined PSD significant impact levels for CO and negligible reductions in ambient VOC levels. The Polk Power Station site (i.e., Polk County) is classified attainment for all criteria pollutants.

From an air quality perspective, the only benefit of CO oxidation catalysts would be to prevent localized CO *hot spots* since the catalyst does not remove CO but rather simply accelerates the natural atmospheric oxidation of CO to CO_2. Dispersion modeling of CO emissions from the Polk Power Station sources indicate that maximum impacts will be insignificant.

Due to the oxidation of sulfur compounds and excessive formation of H_2SO_4 mist emissions, oxidation catalysts were not considered to be technically feasible for the IGCC combustion units since these units are fired with fuels (syngas and distillate fuel oil) containing appreciable amounts of sulfur. Use of combustion controls and good operating practices to minimize incomplete combustion are proposed as BACT for the IGCC unit and associated combustion sources. Proper combustion system design, efficient operation, and minimization of low load conditions will control CO and VOC emissions to low levels consistent with NO_x emission control requirements. *CO and VOC limits proposed for the IGCC advanced CT when fired with syngas are less than the lowest BACT/Lowest Available Emission Rate (LAER) Information System (BLIS) entries for coal-fired boilers.* Overall, the proposed BACT technologies and emission limits for the IGCC unit and associated facilities are consistent with previous BACT determinations both within Florida and elsewhere in the United States (FDER, 1991; EPA, 1992; San Bernardino County Air Pollution Control District, 1989).

The two available control technologies of combustion process modifications and use of oxidation catalysts would also apply to the stand-alone CC and CT units. The energy and environmental impacts associated with oxidation catalysts as previously described would also be relevant to these units (i.e., negligible improvements in ambient CO and VOC levels, increased H_2SO_4 emissions during distillate fuel oil firing, and an energy penalty due to increased turbine backpressure).

The CTs associated with the stand-alone CC and CT units will use natural gas as the primary fuel with low sulfur distillate fuel oil as a backup fuel source. Maximum distillate oil annual capacity factors for the stand-alone CC units and CTs are 25 and 10 percent, respectively. Maximum natural gas annual capacity factors for the stand-alone CC units and CTs are 100 and 50 percent, respectively. An economic evaluation of an oxidation catalyst system having an 80-percent CO removal efficiency was performed for the future Polk Power Station CTs using OAQPS and project-specific economic cost factors. Base case CO emissions are estimated to be 25 ppmvd resulting in a controlled CO exhaust concentration of 5.0 ppmvd. Base case CO emission levels are representative of the performance of the dry low-NO_x burners planned for the future stand-alone CC units and CTs. The dry low-NO_x burners, which can attain a NO_x exhaust concentration of 9 ppmvd, produce slightly higher CO emissions in comparison to conventional CT burner technology. Cost effectiveness of oxidation catalyst for CO emissions was determined to be $5,158 per ton of CO removed for the CC units. For the simple-cycle CTs, cost effectiveness of CO oxidation catalyst was found to be $5,643 per ton. Based on the high control costs, use of oxidation catalyst technology to control CO and VOC emissions was not considered to be economically feasible. The slightly higher CO emissions which result from the proposed use of dry-low NO_x burners is an acceptable compromise with respect to overall NO_x and CO emission rates.

Use of combustion controls and good operating practices to minimize incomplete combustion are proposed as BACT for the future stand-alone CC and CT units. These control methods are consistent with prior FDER BACT determinations for CO and VOC emissions from CT units which have all been based on the use of good combustion techniques.

3.4.3.4 Sulfur Dioxide and Sulfuric Acid Mist

SO_2, SO_3, and H_2SO_4 mist emissions result from the combustion of fuels containing sulfur. H_2SO_4 emissions result from the reaction of SO_3 and water in the exhaust gas stream. The conversion rate of SO_2 to SO_3 depends on combustion parameters; e.g., temperature and excess oxygen levels, as well as fuel characteristics.

Removal and recovery of sulfur contained in the coal fuel are integral components of the CG process. The proposed IGCC unit and sulfur recovery processes are highly efficient and will result in a low rate of SO_2 emitted per megawatt of electricity produced in comparison to conventional coal-fired power plants. The syngas cleanup processes remove and recover sulfur compounds, primarily H_2S, from the high pressure syngas generated in the gasifier. Removal and recovery of sulfur compounds from the syngas stream will be much more efficient than that achieved removing the same compounds from the post-combustion, highly dilute, low pressure exhaust streams generated by conventional coal combustion in a steam boiler. The proposed IGCC unit sulfur recovery processes result in saleable, concentrated by-product streams, liquid sulfur (CGCU) or H_2SO_4 (HGCU), in contrast to the large quantities of solid waste materials typically generated by conventional wet or dry FGD systems.

In the CGCU system, acid gases (CO_2, H_2S, and COS) present in the syngas will be removed using a promoted amine process in the acid gas removal unit. The promoted amine will act as a weak base to selectively absorb the weak H_2S acid while allowing most of the CO_2 to remain in the syngas. The treated syngas stream, containing approximately 0.07 weight percent sulfur, will flow from the acid gas removal unit through several coolers and knockout drums for water removal and will then be burned in the advanced CT for power production. The rich amine solution containing dissolved acid gases will be routed to the amine stripper where the acid gases are steam stripped from the rich amine solution. The concentrated acid gas overhead stream from the amine stripper will be cooled and routed to the sulfur recovery unit for processing. Lean amine solution from the amine stripper will be cooled and pumped to the amine storage tank for subsequent re-use in the amine absorber. Amine treating is the most widely used and efficient process for removing acid gases from sour gas streams. For the Polk Power Station project, a three-stage catalytic sulfur recovery unit followed by a tail gas treating unit and thermal oxidation will recover over 99 percent of the sulfur entering the sulfur recovery unit/tail gas treating unit system.

The demonstration HGCU system will remove H_2S from the coal gasifier syngas stream at elevated temperatures by reacting the gas stream with zinc titanate sorbent in a moving bed absorber. The zinc titanate sorbent is regenerated by controlled temperature, multi-stage oxidation in a regenerator. The concentrated SO_2 stream from the regenerator will be routed to an H_2SO_4 plant for conversion to H_2SO_4 by-product. The high temperature zinc titanate absorption system has the potential to achieve sulfur removals greater than conventional CGCU technology while improving the overall efficiency of the IGCC facility. At a minimum, sulfur removal efficiency for the HGCU technology will equal that of conventional CGCU.

The proposed sulfur removal and recovery processes (both CGCU and HGCU) which are integral to the IGCC facility will achieve an overall sulfur removal efficiency of 95.6 percent. *This removal efficiency is higher than the highest efficiency listed in BLIS for large, coal-fired power plants and exceeds that required for recently permitted CG and coal-fired boiler facilities in Florida.* Sulfur content of the treated syngas is projected to be less than 0.07 weight percent. Application of FGD systems is not feasible due to the low exhaust SO_2 concentrations. Use of the integral acid gas removal and sulfur recovery processes are proposed as BACT for the IGCC facility. BACT for the ancillary IGCC combustion sources is considered to be the use of low sulfur fuels.

The stand-alone CC and CT units will use natural gas and low sulfur (maximum 0.05 weight percent sulfur) distillate oil as fuels. Natural gas is the primary fuel with distillate oil serving as a backup fuel source. Maximum distillate oil annual capacity factors for the stand-alone CC units and CTs are 25 and 10 percent, respectively. Technologies available to control SO_2 and H_2SO_4 emissions from these units include fuel treatment and post-combustion add-on controls; i.e., FGD systems. While FGD technology would be technically feasible, there have been no applications to CT operations in the United States since low sulfur fuels have been used resulting in low exhaust gas SO_2 concentrations. The sulfur content of the backup distillate oil proposed for the CTs will be more than 40 times lower than the fuels employed in coal-fired boilers using FGD systems. In addition, CTs operate with a significant amount of excess air which generates high exhaust gas flow rates. Since FGD SO_2 removal efficiency decreases with decreasing inlet SO_2 concentrations, application of a FGD system to a CT exhaust stream would result in unreasonably low SO_2 removal efficiencies. Due to low SO_2 exhaust stream concentrations, FGD technology was not considered to be feasible for CTs for the Polk Power Station since removal efficiencies would be unreasonably low and costs would be excessive.

Since post-combustion controls are not applicable, use of low sulfur fuels is considered to represent BACT for SO_2 and H_2SO_4 emissions from the stand-alone CC and CT units. Thes units will use natural gas (containing less than 10 gr/100 scf) and low sulfur distillate oil as fuels.

3.4.3.5 Nitrogen Oxides

NO_x emissions from combustion sources consist of two components; thermal and fuel NO_x. Thermal NO_x results from the oxidation of atmospheric nitrogen under high temperature combustion conditions. The amount of thermal NO_x formed is primarily a function of combustion temperature and residence time, air/fuel ratio and, to a lesser extent, combustion pressure. Fuel NO_x arises from the oxidation of non-elemental nitrogen contained in the fuel. In contrast to thermal NO_x, fuel NO_x formation does not vary appreciably with combustion variables such as temperature or residence time. Presently, there are no combustion process or fuel treatment technologies available to control fuel NO_x emissions.

Available control technologies evaluated for the IGCC combustion sources consist of combustion process modifications and post-combustion exhaust gas treatment systems. Available CT combustion process technologies are standard combustor design and water/steam/diluent injection, advanced combustor design and water/steam/diluent injection, and dry low-NO_x combustors. Combustion process modifications applicable to IGCC combustion sources other than the CT include flue gas recirculation, low excess air, and low-NO_x burners. Post-combustion technologies potentially applicable to all IGCC combustion sources are selective non-catalytic reduction (SNCR), non-selective catalytic reduction (NSCR), and selective catalytic reduction (SCR). Detailed descriptions of these control technologies are provided in the PSD application contained in Appendix 11.1.3 of this SCA.

In theory, technically feasible control technologies for the IGCC CT were determined to be water/steam/diluent injection with either standard or advanced combustor technology and SCR. For the IGCC oxygen-blown process, nitrogen will be provided to serve as a diluent to lower peak flame temperatures and reduce NO_x formation without the water consumption and treatment/disposal requirements associated with water or steam injection. Nitrogen used for injection will be provided by the air separation unit which also produces oxygen for the IGCC gasification process. Steam/water injection technology was not reviewed since it results in the same level of NO_x emissions in comparison to nitrogen injection.

SCR was evaluated although a number of concerns exist regarding the technical feasibility of SCR for CTs fueled with syngas. SCR catalyst deactivation can occur due to chemical poisoning. Principle poisons include arsenic, sulfur, potassium, sodium, and calcium. All of these are present in the flyash generated from coal and oil combustion. Decreased SCR catalyst activity after only a few hundred hours of operation was observed in European tests for certain coals and firing modes. The decrease in catalyst performance was subsequently attributed to arsenic poisoning of the catalyst. Gaseous arsenic trioxide, formed by the oxidation of elemental arsenic in coal, was found to condense on the SCR catalyst preventing the adsorption of NO_x and NH_3.

SCR catalyst will promote the oxidation of flue gas SO_2 to SO_3 which will then combine with water vapor to form H_2SO_4. Accordingly, corrosion of downstream piping and heat transfer equipment (which would operate at temperatures below the H_2SO_4 dew point) would be of concern when using SCR with sulfur-bearing fuels. Also, SO_3 will combine with unreacted NH_3 to form ammonium bisulfate and ammonium sulfate. Ammonium bisulfate is a hygroscopic solid at approximately 380°F and will deposit on equipment surfaces below this temperature as a white solid. Both ammonium bisulfate and ammonium sulfate would be expected to deposit on HRSG heat transfer equipment where temperatures below 380°F will occur. Since ammonium bisulfate is hygroscopic, the material will absorb water forming a sticky substance which can cause fouling of heat transfer equipment. Ammonium bisulfate cannot be easily removed due to its sticky nature; a unit shutdown would be required to clean fouled equipment. Formation of ammonium salts will also result in a significant increase in PM emissions. The technical difficulties associated with SCR and sulfur bearing fuels have been documented for fuels having relatively low sulfur contents; e.g., as low as 50 to 100 parts per million (ppm) (0.005 to 0.01 percent) sulfur. Although the fuels planned for the IGCC advanced CT are low in sulfur content, the sulfur levels are more than sufficient to cause problems with operation of a SCR control system. Problems associated with ammonium salt deposition can be ameliorated to some extent by reducing the NH_3/NO_x molar ratio when firing sulfur-containing fuels. However, all known successful applications of SCR for CTs are on natural gas-fired units. There are presently no applications of SCR to CTs fired with syngas derived from coal.

There are no significant adverse energy or environmental effects due to the use of nitrogen injection and advanced combustor technology. In contrast, application of SCR technology will result in the following adverse impacts:

- Total energy penalty of 7.2 megawatt-hours per year (equivalent to an annual consumption of 23.5 million cubic feet of natural gas) due to increased backpressure on the CT and pumping and vaporization of aqueous NH_3;
- NH_3 emissions due to NH_3 slip; NH_3 emissions are estimated to total 98 tpy (at baseload and 59°F ambient temperature) for a typical SCR design NH_3 slippage rate of 10 ppmvd;
- Ammonium bisulfate and ammonium sulfate particulate emissions due to the reaction of NH_3 with SO_3 present in the exhaust gases; total particulate emissions would increase by approximately 50 percent;
- A public risk due to potential leaks from the storage of large quantities of NH_3--NH_3 has been designated an Extraordinarily Hazardous Substance under the Federal Superfund Amendment and Reauthorization Act (SARA) Title III regulations; and

- Disposal of spent catalyst which may considered hazardous due to heavy metal contamination; vanadium pentoxide is an active component of a typical SCR catalyst and is listed as a hazardous chemical waste under Resource Conservation and Recovery Act (RCRA) Regulations 40 CFR 261.30.

An assessment of economic impacts was performed by comparing control costs between a baseline case of advanced combustion and nitrogen injection and baseline technology with the addition of SCR controls. Baseline technology is expected to achieve NO_x exhaust concentrations of 25 and 42 ppmvd at 15-percent oxygen for syngas and oil-firing, respectively. Due to the problems associated with the application of SCR to exhaust streams containing sulfur, NH_3 addition must be reduced to prevent formation of ammonium salts and subsequent fouling of downstream heat transfer equipment. Based on Japanese experience, SCR technology with reduced NH_3 addition was premised to achieve NO_x concentrations of 12.5 and 21.0 ppmvd at 15-percent oxygen for syngas and oil-firing, respectively, representing a 50-percent NO_x removal efficiency. The cost impact analysis was conducted using OAQPS and project-specific economic factors. Cost effectiveness for the application of SCR technology to the IGCC advanced CT was determined to be $6,272 per ton of NO_x removed. This control cost is greater than those previously found to be reasonable for BACT NO_x determinations. Further, the economic evaluation did not include the increased costs that would also accrue due to downtime required for cleaning of fouled heat transfer equipment.

NO_x emissions during the 2-year HGCU demonstration period are expected to be higher than for CGCU technology. The primary reason for this increase is the presence of NH_3 in the HGCU syngas stream; the NH_3 will be subsequently oxidized to NO_x in the IGCC advanced CT. NH_3 will be removed from the gasifier syngas stream as part of the CGCU process and thus CGCU generates syngas with negligible NH_3 concentrations. One of the goals of the HGCU demonstration project is to determine the NO_x levels that are generated by the process.

Use of nitrogen diluent injection to achieve NO_x exhaust concentrations of 25 ppmvd at 15-percent oxygen for syngas-firing and water injection to achieve 42 ppmvd at 15 percent O_2 for oil-firing is proposed as BACT for the IGCC advanced CT. Nitrogen injection is considered to represent BACT for the following reasons:

- The 25 ppmvd NO_x concentration limit for syngas combustion together with NO_x emissions from the tail gas treating unit thermal oxidizer represents an overall IGCC NO_x emission rate of 0.099 pound per million British thermal unit (lb/MMBtu). *This rate is among the lowest contained in the BLIS database and is well below the most recent BACT determination of 0.17 lb/MMBtu made in Florida and New Jersey for coal-fired power plants.*
- Overall NO_x emissions from the IGCC facility in terms of pounds of NO_x per megawatt *is approximately 50 percent* of the rates recently approved by FDER for the Stanton and Indiantown coal-fired power plants and, with one exception, *is the lowest in the BLIS database.* Comparison of emissions on a pound-per-megawatt basis is felt to be more meaningful than other units such as pound-per-million-Btu since it reflects the emission reduction benefit of process efficiency.
- The 25 ppmvd NO_x concentration limit proposed for syngas combustion is well below the previous BACT concentration of 42 ppmvd assigned to CG projects in Virginia and Florida.
- Nitrogen injection will achieve the same level of NO_x control as water or steam injection without the water consumption and treatment/disposal requirements associated with wet injection.
- Power augmentation due to nitrogen addition results in lower emissions per unit of power produced since the nitrogen augmentation replaces power that would otherwise be generated by fossil fuel combustion. The concomitant emissions associated with fuel combustion are therefore avoided.

- Dry low-NO_x burner technology has not yet been developed for syngas fuels--initial research indicated comparable performance to the standard multi-nozzle combustor.
- Cost-effectiveness of SCR was found to be $6,272 per ton of NO_x removed which exceeds values previously considered to be reasonable for NO_x BACT determinations.
- The application of SCR technology to the treatment of exhaust gases generated by the combustion of sulfur-bearing fuels poses a number of technical concerns. These concerns include catalyst poisoning from arsenic and sulfur compounds and formation of ammonium salts due to the combination of SO_3 and any unreacted NH_3 causing corrosion and reduced efficiency of downstream heat transfer equipment.
- Spent SCR catalyst may require handling and disposal as a hazardous waste due to vanadium pentoxide content. Also, facility workers could be exposed to high levels of vanadium pentoxide particulates during catalyst handling.
- Emissions of NH_3 will occur due to NH_3 slip. SCR vendors typically guarantee a maximum NH_3 slip rate of 10 ppmv. Both NO_x and NH_3 participate in the photochemical ozone cycle--the substitution of 10 ppmv NH_3 (due to slip) for 12.5 ppmv NO_x (the concentration controlled by SCR) during syngas firing, the fuel which will be employed 90 percent of the time in the IGCC CT, is felt to problematical from an air quality perspective. In addition, NH_3 slip can increase significantly during start-ups, upsets/failures of the NH_3 injection system, or due to catalyst degradation. During such instances, NH_3 concentrations of 50 ppmv or greater have been measured which exceeds the odor threshold of approximately 20 ppmv.

Use of low-NO_x burner technology is proposed as BACT for the ancillary IGCC combustion sources. These sources have NO_x emission rates which are only a small fraction (approximately 5 percent) of the total IGCC facility NO_x emissions.

Control technologies to abate NO_x emissions previously described for the IGCC advanced CT are also applicable to the stand-alone CC and CT units with the exception of SCR technology for the simple-cycle units. SCR technology is not considered to be applicable to simple-cycle CTs due to temperature constraints; i.e., the CT exhaust temperature of approximately 1,100°F exceeds the maximum temperature required for successful SCR operation.

Use of dry low-NO_x burner technology will achieve lower NO_x emission rates in comparison to wet injection based on vendor data. The stand-alone CC and CT units are projected to attain NO_x exhaust concentrations of 9 and 42 ppmvd at 15-percent oxygen for gas and oil-firing, respectively. Dry low-NO_x burner technology has not yet been developed for oil-firing, and therefore conventional wet injection will be employed when backup distillate oil is used as the turbine fuel source.

The use of dry low-NO_X burner technology is considered to represent BACT for the future CC and simple-cycle CTs for the following reasons:

- Dry low-NO_x burner technology will achieve NO_x concentrations of 9 and 42 ppmvd for gas and oil-firing, respectively. A NO_x exhaust concentration of 9 ppmvd is generally considered to represent BACT for CTs *equipped with SCR control technology*. The proposed NO_x concentration is also below the current FDER BACT guideline of 15 ppmvd for natural gas-fired CTs using dry low-NO_x burners.
- Dry low-NO_x burner technology will achieve comparable emission rates as SCR for gas-firing without the adverse impacts associated with SCR technology; i.e., NH_3 emissions due to NH_3 slip, potential of ammonium salt particulate formation with subsequent downstream corrosion and reduced efficiency of heat transfer equipment, hazards associated with the storage of NH_3 and disposal of spent catalyst, and energy penalties due to increased turbine backpressure and additional system downtime for catalyst replacement.

- Use of backup distillate fuel oil will be limited to annual capacity factors of 25 and 10 percent, respectively for the combined and simple-cycle CTs.
- Application of SCR to the simple-cycle CTs is not considered to be feasible due to the substantial cost required to reduce CT exhaust temperatures to levels consistent with successful SCR operation, low backup fuel oil capacity factor, and relatively minor reduction in NO_x emissions that would result from applying SCR to CTs equipped with dry low-NO_x burners.

3.4.4 DESIGN DATA FOR CONTROL EQUIPMENT

Control of air emissions for the Polk Power Station project will be accomplished by the use of highly efficient process technologies and clean fuels. These process technologies and fuels will achieve low emission rates without the application of post-combustion control equipment. Process descriptions, emission rates and exhaust gas characteristics, and fuel specifications are provided in Sections 3.1 and 3.3 of this SCA. Tables 3.4.4-1 and 3.4.4-2 provide summaries of exhaust characteristics and pollutant emission rates for the IGCC facility and the stand-alone CT and CC units, respectively.

Table 3.4.4-1. Summary Exhaust Characteristics and Emission Rates for the IGCC Facility

Emission Source	Fuel Type	Pollutant	Emission Rate (lb/hr)	Exhaust Characteristics		
				Temperature (°F)	Velocity (ft/sec)	Flow Rate (acfm)
CT* (simple-cycle)	Distillate fuel oil	PM†	26.0	342	69	772,782
		CO	77.0			
		VOC	10.0			
		SO_2	85.3			
		NO_x	288.0			
CT/HRSG*	Syngas (100% CGCU)	PM†	72.0	265	68	1,156,797
		CO	68.0			
		VOC	2.0			
		SO_2	518.0			
		NO_x	213.0			
CT/HRSG*	Syngas (50% CGCU/50% HGCU)	PM†	72.0	260	69	1,173,809
		CO	87.0			
		VOC	2.0			
		SO_2	518.0			
		NO_x	660.0			
Auxiliary boiler	Distillate fuel oil	PM†	3.0	500	43	18,237
		CO	4.3			
		VOC	2.4			
		SO_2	2.6			
		NO_x	7.9			
TGTU thermal oxidizer	Distillate fuel oil	PM†	13.1	1,400	35	33,399
		CO	1.4			
		VOC	0.8			
		SO_2	52.0			
		NO_x	2.6			

Table 3.4.4-1. Summary Exhaust Characteristics and Emission Rates for the IGCC Facility (Continued, Page 2 of 2)

Emission Source	Fuel Type	Pollutant	Emission Rate (lb/hr)	Exhaust Characteristics Temperature (°F)	Velocity (ft/sec)	Flow Rate (acfm)
H_2SO_4 thermal oxidizer	Distillate fuel oil	PM†	2.6	1,400	30	17,318
		CO	0.6			
		VOC	0.4			
		SO_2	10.1			
		NO_x	1.1			

Note: For distillate fuel oil, emission estimates based on following properties: (1) maximum ash content of 0.01 weight percent, (2) maximum sulfur content of 0.05 weight percent, and (3) maximum fuel-bound nitrogen of 0.015 weight percent [for fuel-bound nitrogen levels greater than 0.015 weight percent, emission limits are adjusted in accordance with the fuel-bound nitrogen allowance contained in 40 CFR 60(GG)].

*Emission rates and exhaust characteristics at 100-percent load and 59°F ambient temperature.
†Includes H_2SO_4.

Sources: GE, 1992.
Texaco, 1992.

Table 3.4.4-2. Summary Exhaust Characteristics and Emission Rates for Stand-Alone CT and CC Units

Emission Source	Fuel Type	Pollutant	Emission Rate (lb/hr)	Exhaust Characteristics: Temperature (°F)	Exhaust Characteristics: Velocity (ft/sec)	Exhaust Characteristics: Flow Rate (acfm)
CC unit* (per unit)	Natural gas	PM†	20.0	253	72	713,361
		CO	108.0			
		VOC	18.0			
		SO_2	66.0			
		NO_x	64.0			
	Distillate fuel oil	PM†	40.0	253	72	713,361
		CO	130.0			
		VOC	18.0			
		SO_2	94.7			
		NO_x	326.0			
CT unit* (per unit)	Natural gas	PM†	10.0	985	94	1,421,280
		CO	54.0			
		VOC	9.0			
		SO_2	33.0			
		NO_x	32.0			
	Distillate fuel oil	PM†	20.0	980	72	1,451,520
		CO	65.0			
		VOC	9.0			
		SO_2	47.4			
		NO_x	163.0			

Note: For distillate fuel oil, emission estimates based on following properties: (1) maximum ash content of 0.01 weight percent, (2) maximum sulfur content of 0.05 weight percent, and (3) maximum fuel-bound nitrogen of 0.015 weight percent [for fuel-bound nitrogen levels greater than 0.015 weight percent, emission limits are adjusted in accordance with the fuel-bound nitrogen allowance contained in 40 CFR 60(GG)].
ft/sec = feet per second.
acfm = actual cubic feet per minute.

*Emission rates and exhaust characteristics at 100 percent load and 59°F ambient temperature.
†Includes H_2SO_4.

Source: GE, 1992.

3.4.5 DESIGN PHILOSOPHY

Air emission controls planned for the Polk Power Station project have been designed to fully comply with all applicable State and Federal regulations. Specific design concepts are summarized as follows:

IGCC Facility

- Use of the most efficient technology for converting coal to electrical power;
- Application of BACT for all affected pollutants and emission sources;
- Use of low sulfur and low ash fuels;
- Use of highly efficient, demonstrated integrated sulfur removal and recovery technology (CGCU);
- Demonstration of HGCU technology to potentially reduce SO_2 emissions to levels below those achieved by conventional CGCU;
- Use of water/nitrogen injection to control CT NO_x emissions;
- Use of efficient combustion to minimize emissions of pollutants associated with incomplete combustion; and
- Use of comprehensive controls to minimize fugitive dust emissions associated with coal handling.

Stand-Alone CT and CC Units

- Application of BACT for all affected pollutants and emission sources;
- Use of low sulfur and low ash fuels;
- Use of state-of-the-art dry low-NO_x burners to minimize NO_x emissions during natural gas-firing;
- Use of water injection to control NO_x emissions during oil-firing;
- Use of low distillate fuel oil capacity factors; and
- Use of efficient combustion to minimize emissions of pollutants associated with incomplete combustion.

The Polk Power Station project will use the most efficient technology available, IGCC, to convert coal to electrical power. On a total power production basis, IGCC air emissions are minimized by using a process technology which produces the most power for each unit of coal consumed. IGCC emissions, on a pound-per-megawatt basis, are generally well below the rates generated by conventional coal-fired power plants.

Air emission control technologies planned for the Polk Power Station project reflect the application of BACT for each affected pollutant and emission source. The proposed BACT limitations are well below applicable State and Federal emission standards. Specific controls include highly efficient sulfur removal and recovery integral to the gasification process; nitrogen/water injection to control NO_x emissions from the IGCC CT during syngas and oil-firing, respectively; dry low-NO_x burners and water injection to minimize NO_x emissions during natural gas and oil-firing, respectively, for the future stand-alone CTs; efficient combustion to minimize emissions of pollutants associated with incomplete combustion; and comprehensive controls to minimize fugitive dust emissions associated with coal handling.

Both the IGCC facility and future stand-alone CTs will use clean fuels to reduce particulate and sulfur emissions. Maximum sulfur content for the syngas and distillate fuel oil will be 0.05 weight percent. Distillate fuel oil will contain no more than 0.01 weight percent ash. Primary fuel for the stand-alone CTs will be natural gas containing less than 10 gr/100 scf.

3.5 PLANT WATER USE

The primary water uses at the proposed Polk Power Station include potable water, plant service water, emergency fire protection water, NO_x injection water, chemical and non-chemical cleaning water, condenser cooling water, and cooling reservoir makeup water. The proposed project processes and systems will be designed to:

- Maximize water reuse and recycling,
- Minimize groundwater withdrawals,
- Minimize water consumption, and
- Optimize the water quality of the offsite surface water and groundwater discharges.

Figure 3.5.0-1 shows the water balance diagram for the plant operation under the annual average conditions based on average plant loads (i.e., expected annual average generating capacities) and average meteorological conditions (i.e., long-term normal rainfall and temperature conditions) after full build-out of the proposed project facilities. As shown in this figure, the largest water use by far will be for circulating condenser cooling purposes for the HRSG/ST generator modules of the IGCC and two CC units. Groundwater withdrawals for cooling reservoir makeup water represent the largest requirement for such withdrawals. The systems involving the largest water consumption and/or loss include evaporation losses from the cooling reservoir and the stand-alone CT and CC units when using water injection for NO_x control, blowdown discharges from the cooling reservoir, and water consumption within the IGCC unit process water handling and concentrating systems. As shown in Figure 3.5.0-1, the IGCC unit process waters will be processed and recycled within the system to the extent possible. Also, other process wastewaters from the overall project facilities will be appropriately treated in the IWT system and reused within the condenser cooling system (i.e., cooling reservoir).

Figure 3.5.0-2 shows the water balance diagram for the maximum daily makeup (i.e., maximum groundwater withdrawal) condition which is based on a worst case condition of 100 percent load factor for all generating units at the site during the

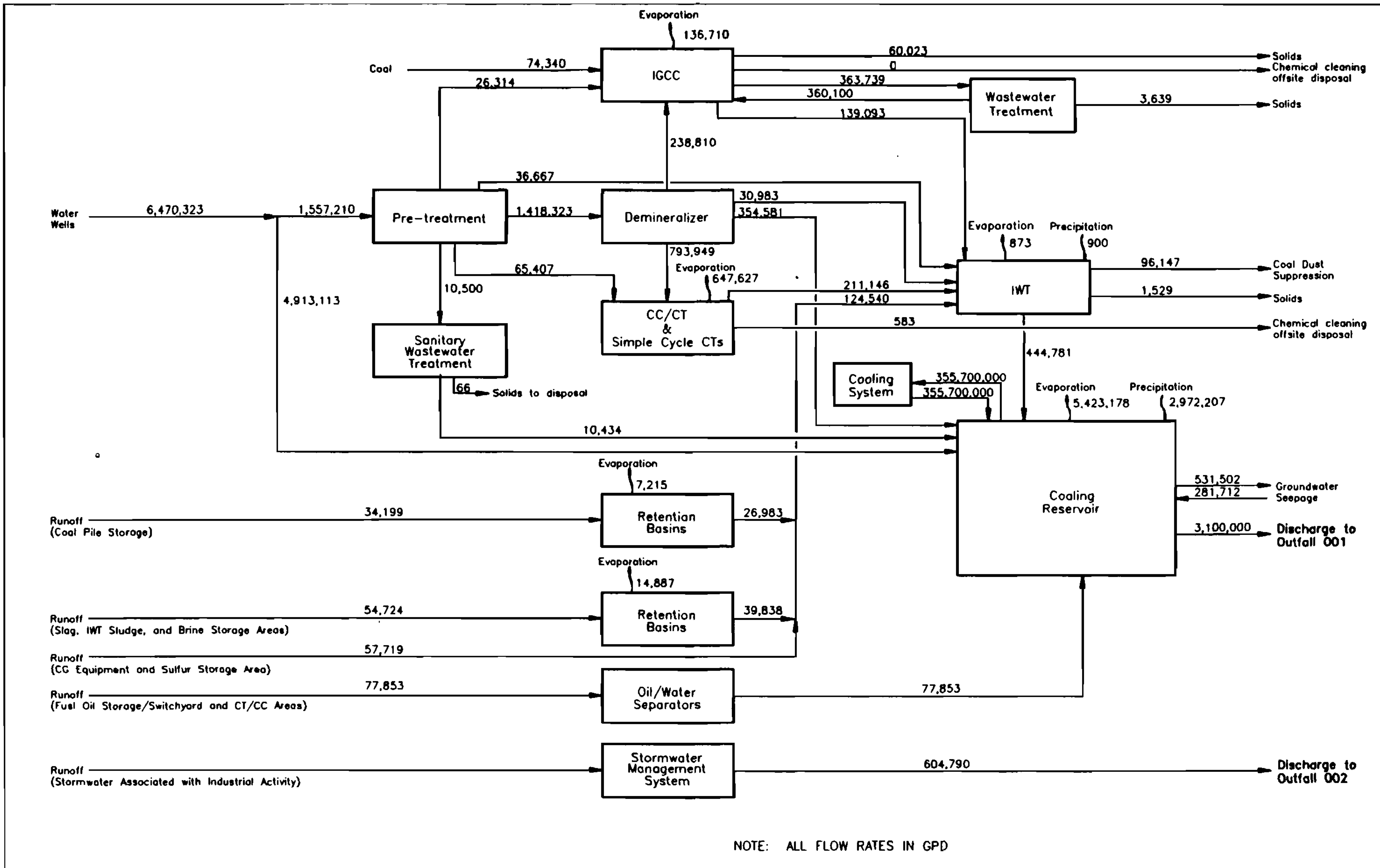

FIGURE 3.5.0-1.

WATER MASS BALANCE, ANNUAL AVERAGE MAKEUP

Source: UE&C, 1992. ECT, 1992.

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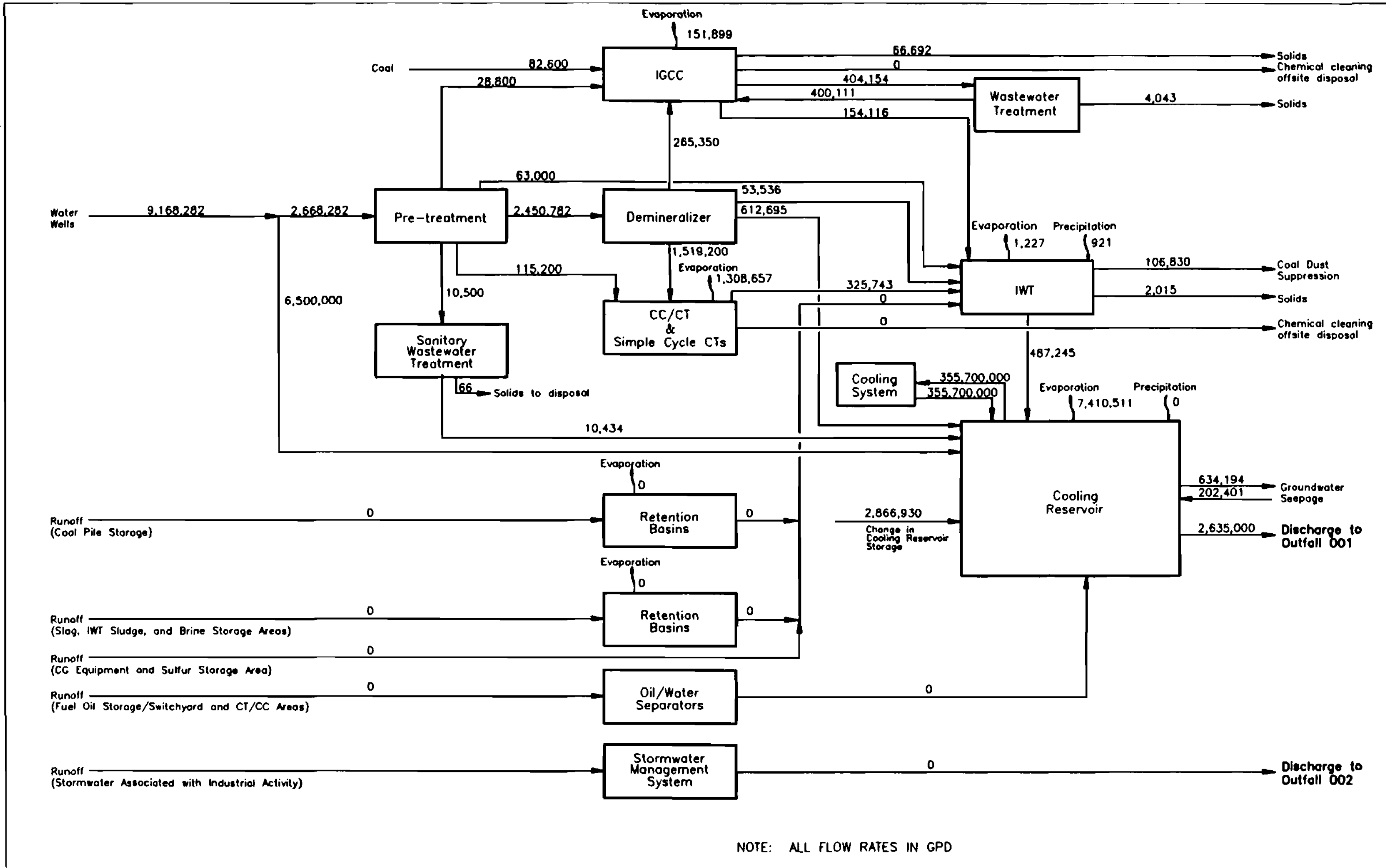

FIGURE 3.5.0-2.

WATER MASS BALANCE, MAXIMUM DAILY MAKEUP

Source: UE&C, 1992. ECT, 1992.

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A TECO ENERGY COMPANY

POLK POWER STATION

driest month of the year (i.e., normally May). Figure 3.5.0-3 presents the water balance for the maximum daily discharge condition (i.e., discharges from the cooling reservoir) which is defined to potentially occur during a 25-year, 24-hour storm event occurring in July, normally the wettest month of the year in the site area. For maximum daily discharge and maximum daily makeup scenarios, there are substantial short-term stresses on the cooling reservoir, causing the water level in the reservoir to rise or fall. The excess water supply and excess water demand are indicated in Figures 3.5.0-2 and 3.5.0-3 as changes in cooling reservoir storage.

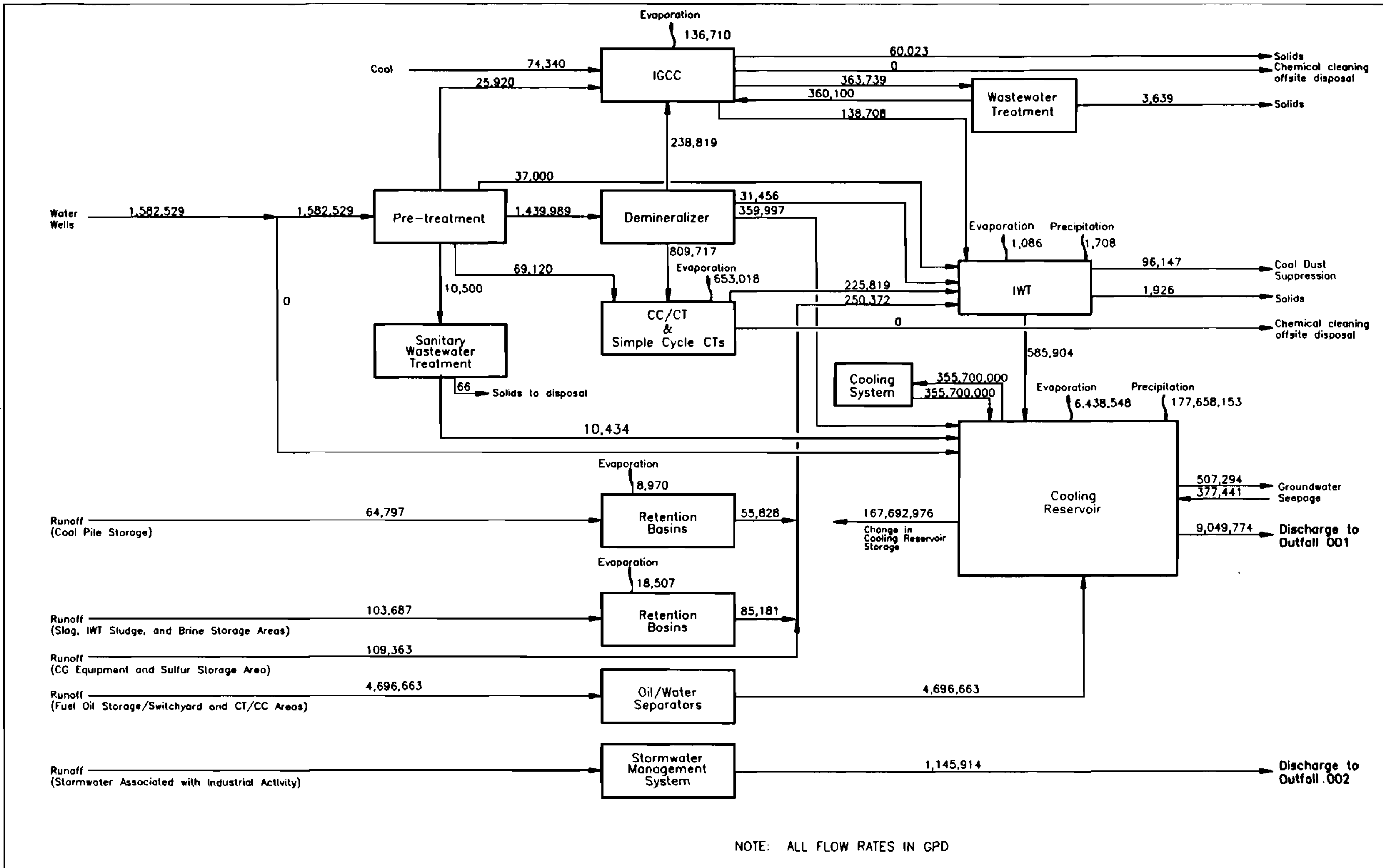

FIGURE 3.5.0-3.

WATER MASS BALANCE, MAXIMUM DAILY DISCHARGE

Sources: UE&C, 1992. ECT, 1992.

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3.5.1 HEAT DISSIPATION SYSTEM

3.5.1.1 System Design

A closed loop cooling system consisting of a cooling water reservoir will be used for heat dissipation/condenser cooling for the three proposed generating ST systems: two nominal net 220-MW CC units and one nominal net 260-MW IGCC unit. Cooling water from the reservoir will also be used for cooling in the air separation unit and other plant auxiliary equipment. The proposed cooling system was designed to meet the following objectives:

- The cooling system will have the capacity to reject 2.47×10^9 Btu per hour of thermal energy on a continuous basis;
- The cooling system will be able to supply cooling water to the condenser with water temperature less than 95.6°F under worst-case conditions (100 percent load factor);
- The turbine back pressure will not exceed 3.5 inches of mercury; and
- The cooling system, compared with alternatives, will have the least environmental impacts, considering surface water hydrology, surface water quality, groundwater hydrology, groundwater quality, water consumption, and ecological impacts.

Based on these design objectives, the proposed optimal configuration for the cooling system was determined to provide the following:

- Flow rate of the recirculating cooling water of approximately 247,000 gpm;
- Maximum temperature rise across the condenser of 20°F;
- Heat-rejection system consisting of a 727-acre (water surface area at 136 ft-NGVD) recirculating cooling reservoir;
- Maximum recycling/reuse of process wastewaters;
- Minimum makeup water from groundwater withdrawals provided to the reservoir to compensate for the net evaporation losses and manage water quality in the reservoir; and
- Minimum blowdown discharges provided for water quality management purposes and to manage stormwater runoff discharges from the site.

Other potential alternatives to this proposed recirculating cooling reservoir considered by Tampa Electric Company included:

- Cooling towers with blowdown discharges, and
- Recirculating cooling reservoir system without blowdown.

The alternatives are discussed in Section 8.2.1.

The layout of the proposed cooling reservoir is shown in Figure 3.2.0-2. The reservoir will be a below-grade basin which will be constructed in areas which are currently water-filled phosphate mine cuts and overburden spoil piles. Materials from these mine cuts will be used to construct low-profile perimeter berms surrounding the reservoir. As shown in the figure, to maximize the heat dissipation efficiency of the cooling reservoir, interior berms or dividers will also be constructed to prevent short circuiting of the warmed water flow and maximize the travel time of water in the reservoir between the discharge and intake structures. The design bottom elevation of the reservoir will be approximately 120 ft-NGVD. The top of the berm will have a width of 25 ft and will be at approximately 145 ft-NGVD in elevation.

The slopes on both sides of the interior and exterior berms are 4:1 (4-ft horizontal to 1-ft vertical). The berms will be grassed to prevent erosion. The size of the reservoir will be approximately 727 acres of water surface when the water elevation is at 136.0 ft-NGVD. The total area of the reservoir system will be approximately 860 acres, including the area of the surrounding berm. A typical cross section of the reservoir is shown in Figure 3.5.1-1.

A cooling water intake structure, which will supply cooling water to the condenser cooling systems of the ST generating systems, will be located in the northern portion of the reservoir. The cooling water will be warmed to approximately 20°F above its intake temperature during the cooling process to condense the ST exhaust steam of the units. This warmed water will be discharged into the reservoir at a location to

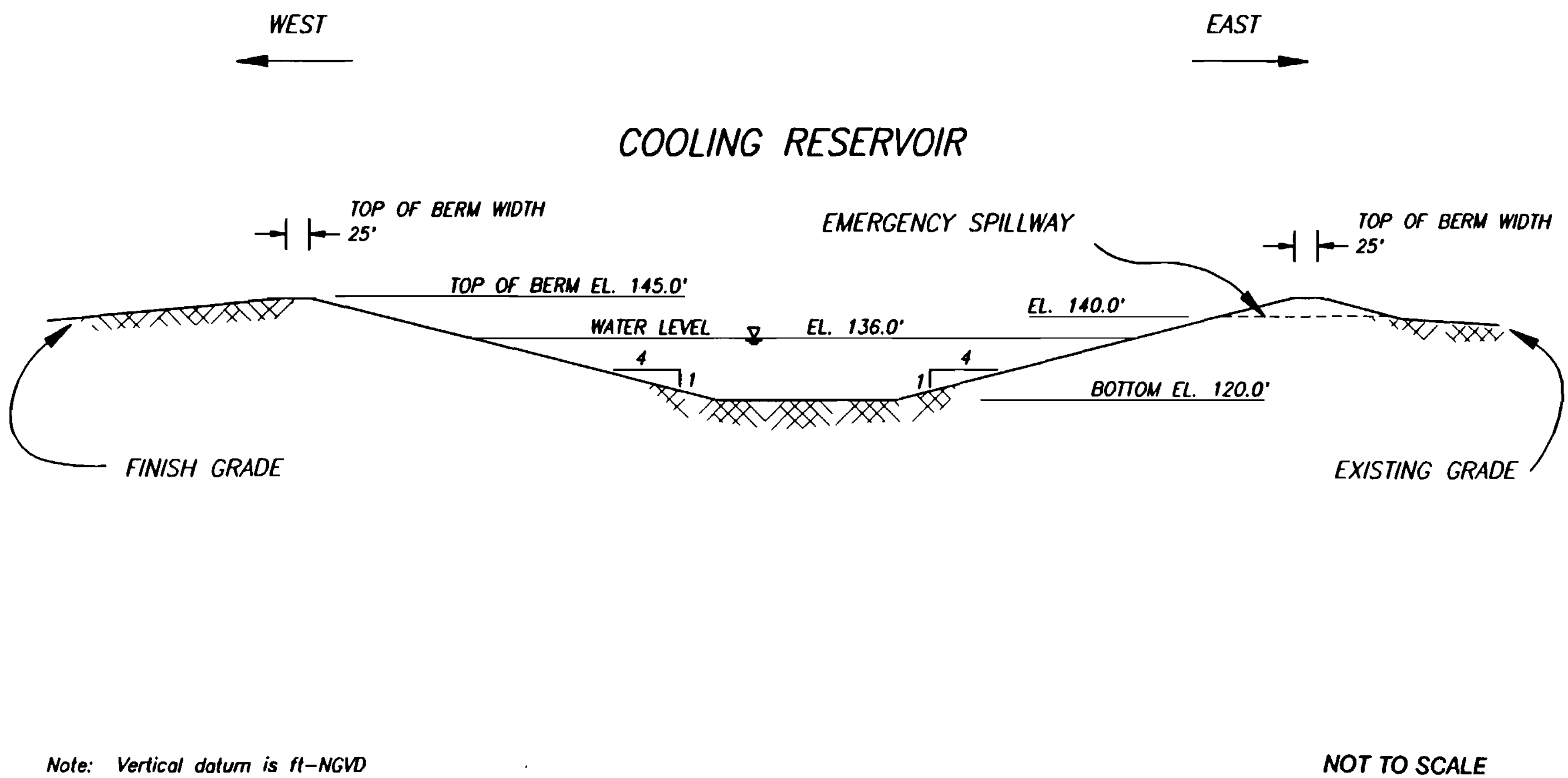

FIGURE 3.5.1-1.

TYPICAL CROSS SECTION OF COOLING RESERVOIR

Source: ECT, 1992.

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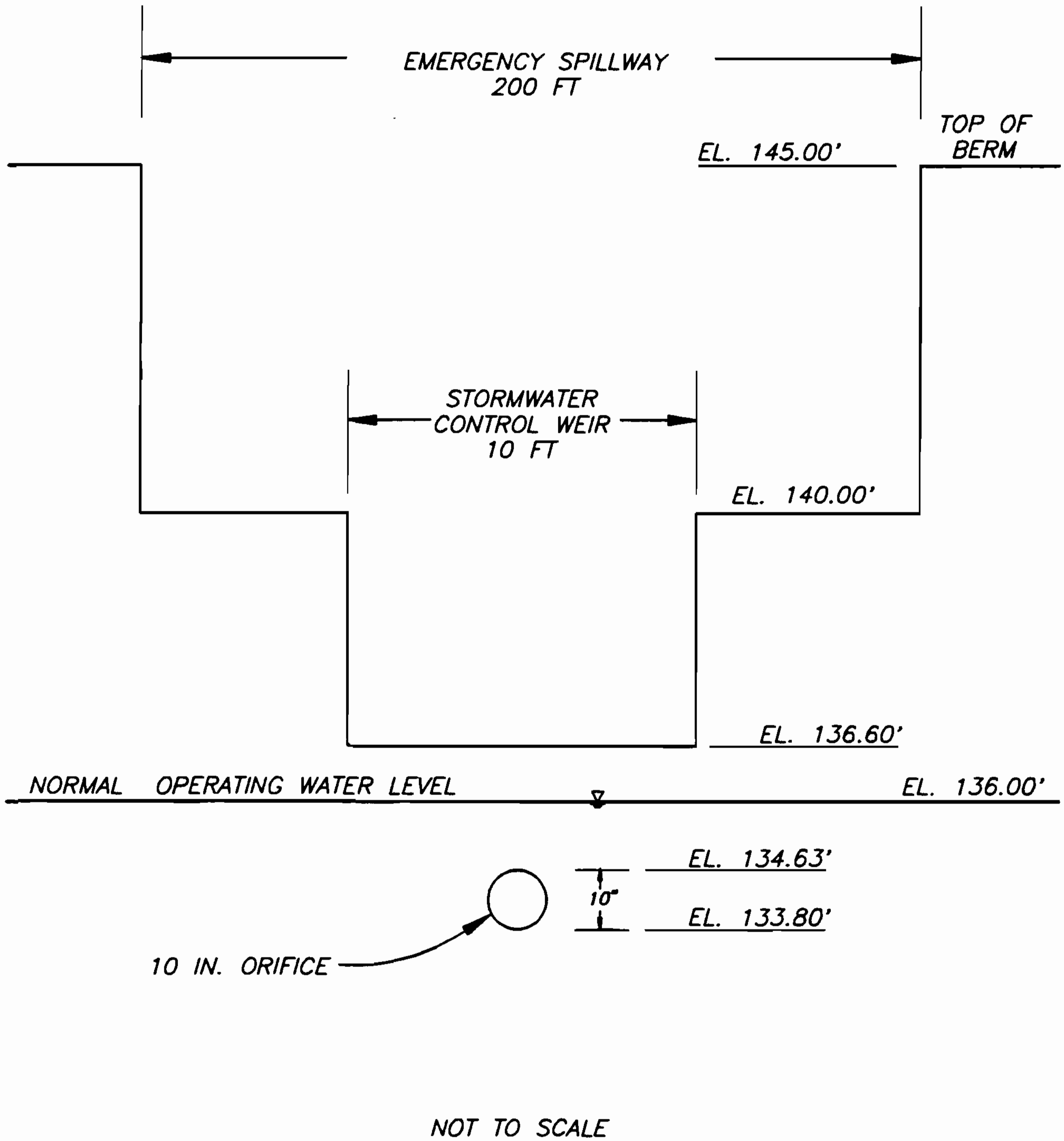
the south of the intake. The discharge flow will meander through the reservoir which is channelized by the network of interior berms for optimal cooling efficiency. By the time the warmed discharge water reaches the intake structure, thermal energy will have been removed from the reservoir water through radiation, evaporation, and heat exchange from the water to the atmosphere. When the water is recirculated to the intake, the water temperature will be sufficiently lowered for reuse for additional condenser cooling purposes.

In order to maintain the water quality in the reservoir in compliance with Florida surface and groundwater standards, an outfall control structure for blowdown discharges from the reservoir to the Little Payne Creek drainage system will be provided. These discharges are needed to prevent trace metals, solids, and other potential constituents from accumulating in the reservoir. To comply with Florida Class III surface water quality standards, a continuous blowdown with an average annual flow of approximately 3.1 MGD from the reservoir will occur.

Hydrologic modeling, water quality protection, and thermal analyses were conducted to assess the potential water quality impacts of the cooling reservoir discharge on the offsite Little Payne Creek hydrological and ecological systems. The results of these analyses are discussed in the following sections and in Chapter 5.0 of this SCA.

In addition to the blowdown discharge control structure, a 10-ft wide rectangular weir will be installed to provide for drainage control during extreme storm events in compliance with applicable FDNR and SWFWMD requirements. A 200-ft wide emergency spillway will also be provided to ensure the berm safety in the event of extreme weather conditions. The operating water level in the reservoir will be controlled at approximately 136.0 ft-NGVD. The water level fluctuation will be about ±0.5 ft. The overflow elevation of the 10-ft wide stormwater management weir will be 136.6 ft-NGVD, and the emergency spillway will be at an elevation of approximately 140.0 ft-NGVD. The conceptual design of the outfall control structure is shown in Figure 3.5.1-2. The design of this structure will allow stormwater



Note: Vertical datum is ft-NGVD

FIGURE 3.5.1-2.

COOLING RESERVOIR OUTFALL STRUCTURE

Source: ECT, 1992.

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overflow of rainfall directly on the reservoir and runoff from the internal berms inside areas of the surrounding berm when a storm event is greater than 7.2 inches. This proposed design to control stormwater runoff discharges will meet the applicable requirements of FDNR and SWFWMD to manage peak and mass flow runoff discharges compared to pre-mining conditions (see Section 3.8).

To ensure that the perimeter berm will not be over-topped under the most extreme weather conditions, wave forecast, wind setup, and wave run-up analyses were conducted for the proposed cooling reservoir. According to the historical weather data, the most severe storm in the region occurred in June 1964, with a highest windspeed of 67 mph recorded at the Tampa Airport. Using this extreme windspeed data and a shallow water wave forecast method developed by Bretschneider and Reid (1953), the greatest wave height will potentially occur at the eastern and western ends of the reservoir due to the large wind fetch along the east-west direction. The predicted significant wave height will be approximately 3.2 ft with a wave period of 2.8 seconds. The calculated wave run-up will be approximately 2.25 ft using the method presented in the Shore Protection Manual (USACE, 1984). The wind setup will be approximately 0.42 ft based on Ippen (1966). Therefore, the height limit of the wash-up will be approximately 5.9 ft above the mean operating water level in the reservoir, or approximately 141.9 ft-NGVD.

Assuming the extreme wind event will coincide with a 100-year, 24-hour rainfall event (slightly less than 11 inches), the wash-up elevation will be approximately 142.8 ft-NGVD, approximately 6.8 ft above normal operating water level in the reservoir. Given the top-of-berm elevation of 145 ft-NGVD, there will still be more than 2.2 ft freeboard on the berm even under the most extreme and highly unlikely event as described previously.

3.5.1.2 **Cooling Reservoir Water Discharges**

Water losses in the cooling water reservoir will occur due to evaporation, groundwater seepage, continuous blowdown, and stormwater discharges during severe rainfall events. A blowdown outfall control structure (i.e., Outfall 001) will be located at the northeast corner of the cooling reservoir and discharged water will drain into the northern portion of the existing reclaimed lake to the east of the reservoir on the site (see Figure 3.2.0-2). Water in the lake drains through a swale along its southern edge and exits the site, flowing into a man-made ditch running along the western side of Fort Green Road. This water is ultimately routed to Little Payne Creek. As shown in Figure 3.5.1-2, the continuous blowdown structure will be a 10-inch orifice (i.e., pipe) with an invert elevation of approximately 133.8 ft-NGVD which will convey approximately 3.1 MGD of discharge water from the reservoir at the operational water level of 136.0 ft-NGVD.

The 10-ft wide overflow weir will not provide for water discharges from the reservoir under normal operating conditions unless a rainfall event of greater than 7.2 inches occurs on the site. An extreme 9-inch storm (25-year, 24-hour event) will create a discharge of approximately 8.2 cfs (5.3 MGD) from the cooling reservoir according to the hydrologic drainage modeling results under the extreme storm event conditions. The hydrologic analysis and modeling results are presented in Section 3.8.4.

In addition to the direct surface discharge through the outfall structure, a net groundwater flow discharge from the reservoir into the surficial aquifer will occur which will assist in managing the water quality within the reservoir. This net outward seepage will occur because the normal operating water level in the reservoir will be generally higher than the surficial aquifer water level.

3.5.1.3 <u>Sources of Cooling Reservoir Water Makeup</u>

As discussed previously, water losses will occur in the cooling water reservoir. Therefore, makeup water will be needed to continuously to replenish the reservoir water in order to maintain an operating water level that is required for cooling efficiency and water quality management purposes. As shown in Figures 3.5.0-1 through 3.5.0-3, the other sources of water supplies to the reservoir will include direct rainfall, runoff from the berm areas, surficial groundwater inflow, treated process water and stormwater runoff from the IWT facilities, and treated sanitary wastewater.

The most significant component of the cooling reservoir makeup water will be groundwater pumped from the Floridan aquifer through the onsite well field. According to the water budget analysis, an annual average makeup of 4.9 MGD (or approximately 5.0 MGD) will be required to maintain required water level and water quality conditions in the reservoir under average plant loads. The average makeup requirement will be approximately 5.3 MGD during plant full load conditions, and the expected maximum makeup requirement under plant full load and dry season conditions will be approximately 6.5 MGD. This maximum makeup rate may occur for up to a 2-month period under assumed worst-case plant operating conditions (i.e., full load and abnormally dry weather conditions). The water level fluctuation in the reservoir will be about 0.2 ft during such dry periods.

The estimated water quality for each component of the cooling reservoir makeup water is shown in Table 3.5.1-1. Based on the flow rates and water quality of these makeup streams and the net groundwater seepage predicted, the long-term water quality (i.e., long-term equilibrium condition) in the reservoir is presented in Table 3.5.1-2. As shown in this table, the water quality in the reservoir and, in turn, the quality of discharges from the reservoir are predicted to meet all applicable Class III surface water quality standards. Further, the reservoir water quality is predicted to meet all applicable groundwater quality standards, except for iron and manganese which are secondary drinking water parameters.

The water from the reservoir will be discharged to the northern portion of the reclaimed lake located to the east of the reservoir. The discharged water will mix with other water flowing through the lake and drain off the site through a swale located along the southern portion of the lake and flow to the Little Payne Creek system. The predicted water quality of the water overflowing offsite from the reclaimed lake is also presented in Table 3.5.1-2. Again, the water quality of

Table 3.5.1-1. Water Quality of Supply Water to Cooling Reservoir (mg/L)

Parameter	IWT	Sanitary Waste Treatment Plant	Membrane Processor	Floridan Aquifer	Surficial Aquifer
Alkalinity	75	225	266		
Aluminum	3	0.02			
Antimony	0.069				
Arsenic	0.006			0	0
Barium	0.0099			0	0
Benzene				0	0
Beryllium	0.00098				
Cadmium	0.0002			0.000333	0.0018
Calcium	59	100	215.1	33.05	
Chlorine	0.2	0.2	0.2		0
Chromium III	0.0003			0	0
Copper	0.021			0	0
Cyanide	0.00003				
Fluoride	0.2		2.5	0.5445	0.6533
Iron	1	0.3		0	10.6
Lead	0.002			0	0.011
Magnesium	9.2	55.2	77.1	15.5	
Manganese	0.25	0.05		0.037	
Chloride	7.7	45	187.4	11.667	11
Mercury	0.00006			0	0
Nickel	0.097				
Nitrate	1.1	25	0.5	0.002	0
Phosphate	2	30	0.35	0.153	
Potassium	1.6	17	14.2	1.730	
Selenium	0.0004			0	
Silver				0	0
Sodium	88.5	64.3	43.5	11.63	8.33
Sulfate	279	140	456	25.6	9
TDS	493	485	1,005	229	118.7
Zinc	0.1			0.02	
Annual average flow rate (gpd)	444,781	10,434	354,581	4,913,113	281,712

Sources: ECT, 1992.
UE&C, 1992.

Table 3.5.1-2. Cooling Reservoir Water Quality Projections (mg/L)

Parameter	Reservoir Blowdown Quality	Offsite Discharge Quality	Surface Water Standard	Ground-water Standard
Alkalinity	35.9	49.9	>20	
Aluminum	0.373	0.238	<1.5	
Antimony	0.009	0.005	<4.3	
Arsenic	0.001	0	<0.05	<0.05
Barium	0.001	0.001		
Benzene	0	0	<0.071	<0.001
Beryllium	0.000122	0.000078	<0.00013	
Cadmium	0.000621	0.000396	<0.001283	<0.01
Calcium	73.96	55.37		
Chlorine	0.000426	0.000272	<0.01	
Chromium III	0	0	<0.235	<0.05
Copper	0.003	0.002	<0.014	<1
Cyanide	0.000004	0.000002	<0.0052	
Fluoride	1.07	1.33	<10	<2
Iron	0.959	0.613	<1	<0.3
Lead	0.001114	0.000712	<0.003885	<0.05
Magnesium	30.16	23.91		
Manganese	0.081	0.052		<0.05
Chloride	36.255	28.58		<250
Mercury	0.000007	0.000005	<0.000012	<0.002000
Nickel	0.012	0.008	<0.18	
Nitrate	0.259	0.166		<10
Phosphate	0.573	0.366		
Potassium	4.01	2.56		
Selenium	0	0	<0.005	<0.01
Silver	0	0.000004	<0.00007	<0.05
Sodium	31.79	28.44		
Sulfate	114.55	90.55		<250
TDS	487.0	388.4	<826	<500
Thallium	0	0	<0.048	
Zinc	0.04	0.025	<0.121	<5

Note: Blowdown = 3.10 MGD.
Average makeup = 4.91 MGD.
Maximum makeup = 6.5 MGD.
Water level = 136 ft-NGVD.
Hardness = 117 mg/L.

Sources: ECT, 1992
UE&C, 1992.

discharges off the Polk Power Station site to the Little Payne Creek system is predicted to meet all applicable surface water quality standards.

3.5.2 DOMESTIC/SANITARY WASTEWATER

Sanitary facilities using potable water will be provided for a projected staffing of 210 administrative, maintenance, and operating personnel after full build-out of the Polk Power Station. Discharges from showers, wash basins, bathrooms, drinking fountains, and other facilities are expected to result in an estimated 10,500 gpd (50 gallons per capita per day) of combined sanitary wastewater flow. The BOD of the sanitary wastewater influent is anticipated to be 160 mg/L, or 14 pounds per day BOD loading to the system. The sludge per pound of BOD ratio is 0.6, or 8.4 pounds per day of sludge.

The proposed sanitary waste treatment system will be an extended aeration type package unit capable of handling at least a daily load of 10,500 gallons. The sanitary wastewater treatment system will include a covered, vented lift station and an activated sludge package unit. The components of the package unit include equalization, biological treatment, clarification, sludge digestion, filtration, and disinfection units. Effluent from the sanitary wastewater treatment system will be discharged to the cooling reservoir for reuse in the heat dissipation system. Periodically, sludge will be removed from the sludge digester by vacuum truck for offsite disposal in an appropriately licensed sanitary landfill. Approximately 1,400 gallons of sewage sludge is expected to be produced each month, based on a maximum of 210 persons at full build-out, and assuming a sludge concentration of 1.5 percent.

The treatment system will be designed to ensure compliance with the following effluent limitations: BOD, 20 mg/L; TSS, 20 mg/L; and pH, between 6 and 8.5. Disinfection will be designed to result in not more than 200 fecal coliform values per 100 mL of effluent sample [Chapter 17-600.440(4), F.A.C.].

Figure 3.5.2-1 presents a flow diagram of the sanitary wastewater treatment system. Wastewater from the sanitary lift station(s) will flow to an activated sludge package treatment unit. Aeration air will be supplied by blowers to provide oxygen and

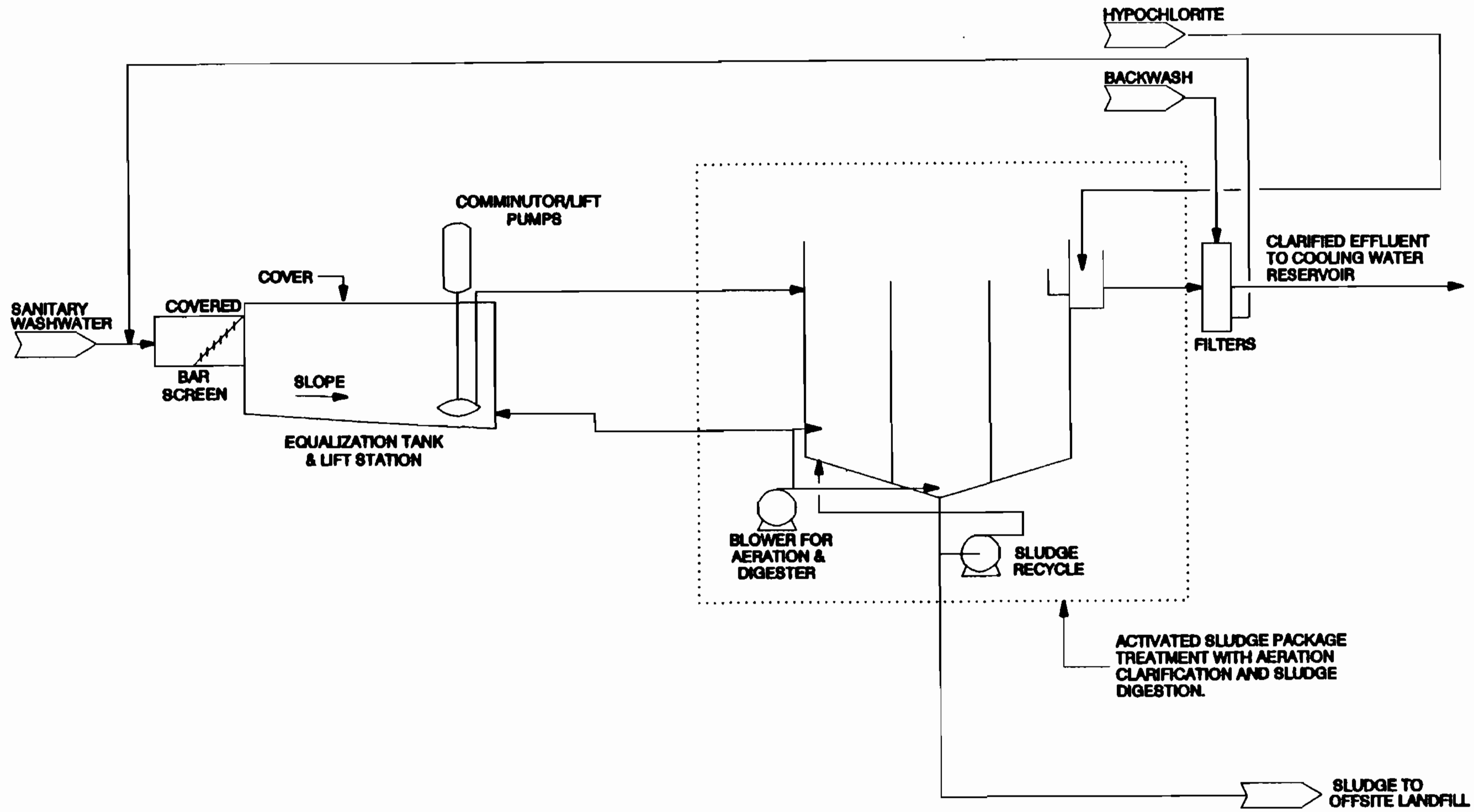

FIGURE 3.5.2-1.

SANITARY WASTEWATER TREATMENT SYSTEM

Sources: Texaco, 1992. UE&C, 1992.

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mixing to the activated sludge for biological metabolism of organic material. Activated sludge will flow by gravity from the aeration basin to the clarifier for solids separation. A portion of the settled solids will be recycled to the aeration basin to sustain the microorganism population. Excess activated sludge will be drawn off and sent to the sludge digester, providing the correct waste-to-recycle ratio.

Effluent from the clarifier will flow by gravity to the chlorine contact chamber for disinfection. Effluent will be given at least 15 minutes contact time in the disinfectant chamber. A residual concentration of 0.5 mg/L total chlorine will be maintained in the effluent prior to discharge to the cooling reservoir.

3.5.3 POTABLE WATER SYSTEMS

Floridan aquifer water will provide the Polk Power Station's process water and potable water needs. The potable water system will provide water for drinking, sanitary facilities, safety showers, and eyewash stations. Potable water needs are estimated to be 10,500 gpd for the 210 administrative, maintenance, and operating personnel at full build-out.

Water will be provided from Floridan aquifer wells, which will also provide service water, fire protection water, and process water needs which will total up to 2.8 MGD (monthly maximum) at full build-out and 100-percent load for all units. Chlorine will be added to the well water to prevent biological growth on the filters. Figure 3.5.3-1 depicts the integrated potable water and process water treatment system. Raw water from the wells will be chlorinated and pumped to the filter skid. Pressure filter units will be used for removal of suspended solids from the total water supply stream. The filters will be backwashed each day with an average of 36,700 gallons of unfiltered well water at full build-out. The filter backwash will be routed to the wastewater equalization basin for treatment in the IWT system.

Following filtration, the water will be routed to a water storage tank. The tank will supply water for the service water, potable water, demineralized water treatment systems, and fire protection water. The tank will be sized to provide 2 hours of reserve storage capacity for fire protection purposes and 8 hours storage for service water and demineralized water treatment system uses. A residual chlorine concentration of 0.1 ppm will be maintained in the storage tank.

Potable water will be pumped to a potable water accumulator to provide potable water distribution to the facility. The accumulator will provide water for safety showers and eyewash stations during power interruptions and to handle system surge requirements. Additional chlorination using sodium hypochlorite will take place in the potable water tank to maintain 0.1 ppm of residual chlorine. From the

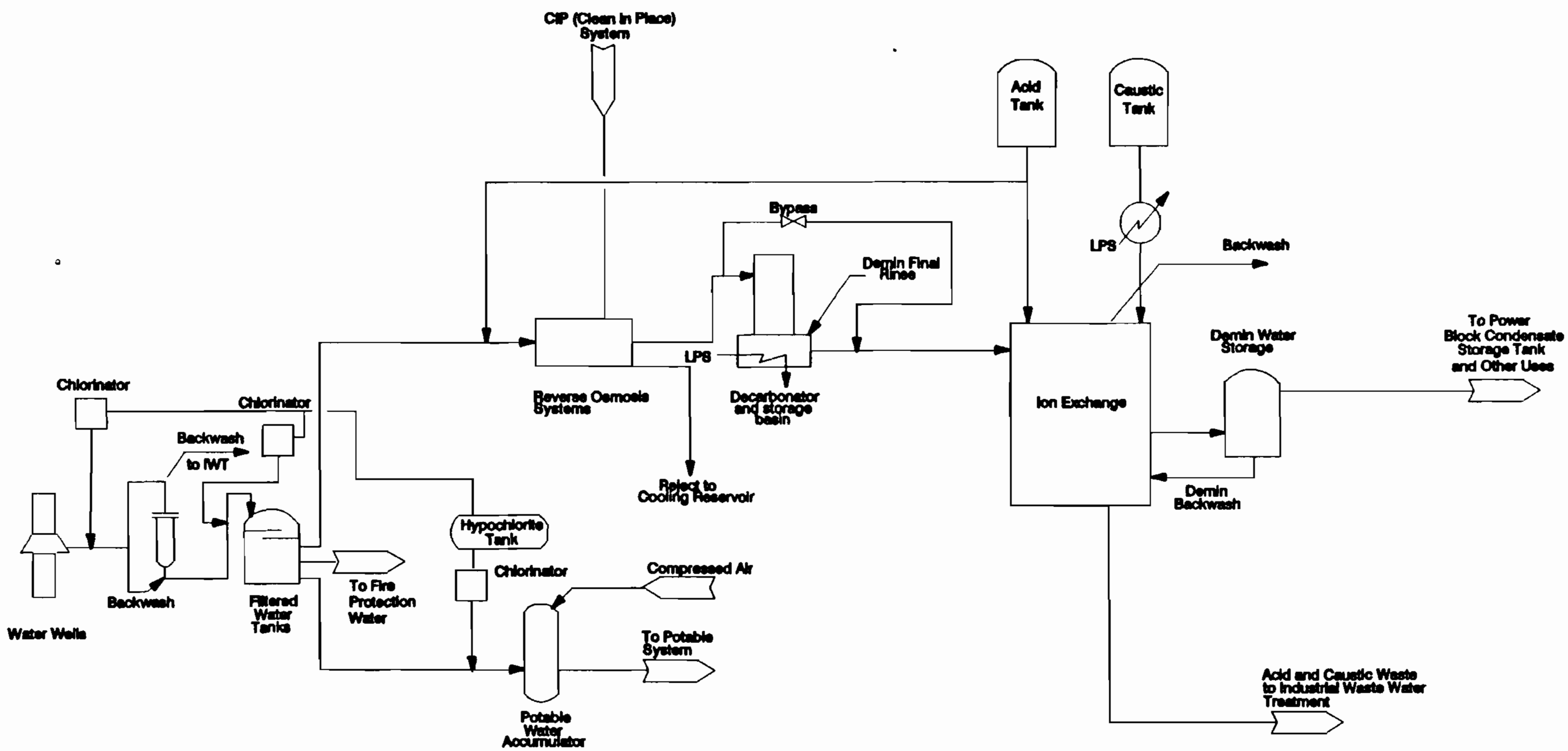

FIGURE 3.5.3-1.

POTABLE WATER AND PROCESS WATER TREATMENT SYSTEM

Sources: Texaco, 1992. UE&C, 1992.

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accumulator, the potable water will be directed to the individual process units and buildings.

The system will be classified as a non-transient, non-community water system and will be operated in accordance with Chapters 17-550 and 17-560, F.A.C., and other relevant standards.

3.5.4 PROCESS WATER SYSTEMS

Process water uses generally fall under one of two categories: service water and demineralized water. Service water will be primarily drawn from the filtered water storage tank or secondarily from the cooling reservoir for additional fire protection needs. Demineralized water will be drawn from the filtered water storage tank and before use, undergo treatment by activated carbon filtration, reverse osmosis (R.O.), decarbonation, and demineralization using mixed bed ion exchangers. Cooling reservoir makeup water will also be drawn from the filtered water storage tank.

Table 3.5.4-1 summarizes the major monthly average water demands for service and demineralized process water and cooling reservoir makeup water. The following sections describe the various process water uses and water treatment system components.

3.5.4.1 Process Water Use

Service Water Uses

The major service water demands will be for non-chemical cleaning of the CT and low volume uses. Fire protection water will represent a major potential use of service water. The daily average service water demand is projected to be approximately 26,000 gpd with the IGCC operation only, and approximately 93,000 gpd at full build-out, excluding fire protection water, under average operating plant loads.

Combustion Turbine Water Washing

CTs can experience a loss of performance during operation as a result of deposits on internal components. The deposit of atmospheric contaminants on compressor parts occurs with the ingestion of air containing contaminants which pass through the inlet air filter. A CT compressor wash will be performed up to 6 times per year to remove these accumulated deposits. The wash water system will consist of a 5,500-gallon water and a 60-gallon detergent tank. These will be the volumes needed for each wash operation. The detergent will be used if hydrocarbons in the inlet air have resulted in oily deposits on the compressor parts. The detergent used for this

Table 3.5.4-1. Process Water Demands

Water Use	Monthly Average Water Demand (gpd)* IGCC Only	Full Buildout	Monthly Maximum Water Demand at Full Buildout (gpd)†
Service Water			
Non-chemical cleaning	400	1,200	7,200
Low volume uses	25,900	90,500	144,000
Demineralized Water			
Advanced CT/CC components of IGCC unit	156,100	156,100	173,500
Gasification makeup	82,700	82,700	91,900
CC units	--	513,300	778,300
Simple cycle CTs	--	280,700	843,200
Water Treatment Units			
Water supply filter backwash	9,000	36,700	66,000
Mixed bed regeneration	7,200	31,000	56,600
R.O. unit	82,000	354,600	647,800
Potable Water Use	6,500	10,500	10,500
Total Process/Potable Water Uses	**369,800**	**1,557,300**	**2,819,000**
Cooling Reservoir Makeup	5,000,000	5,000,000	6,500,000
Total Water Withdrawn	**5,369,800**	**6,557,300**	**9,319,000**

*Assuming average load operating conditions for all units.
†Assuming 100-percent load operating conditions for all units.

Source: UE&C, 1992.

wash will not contain RCRA-listed chemicals, and will be suitable for flushing with rinsewater to the IWT system. Wastewater from CT washings is expected to contain small amounts of dirt, oil, organic debris, and detergent.

Miscellaneous Low Volume Uses

Service water will be provided throughout the facilities for washdown purposes, pump and equipment gland seals, and flushes, as needed. Designated hose stations will be located to conveniently allow equipment and facility washdowns to occur. Drainage from these uses will enter an oil/water separator before entering the IWT system.

Fire Protection Water

The system will be designed for 3,000 gpm flow. Main piping loops will be utilized around the gasification area, fuel oil storage area, fuel unloading areas, and coal storage, at a minimum. The fire protection water loops will extend in phases as the additional CC and CT units are added so that an adequate level of coverage and protection will be provided at all times.

Fire protection water will be drawn from the filtered water tank and also from the cooling reservoir, as needed. From the storage tank, the electric drive fire water pump will deliver water at 1,000 gpm. Figure 3.5.4-1 depicts the overall service and fire water delivery system.

The service water pump will take suction from the same filtered water tank and keep the fire protection water system pressurized. The fire protection water pump will automatically deliver additional flow through the service piping when the service water flow exceeds 100 gpm, or when the service water pressure drops below 95 pounds per square inch gauge (psig). Shutdown of this pump will require action by an operator. The cooling reservoir will provide supplemental fire protection water via two 1,500-gpm diesel driven pumps located at the intake structure. These pumps will have remote start capability and will have separate fuel sources. A pump test

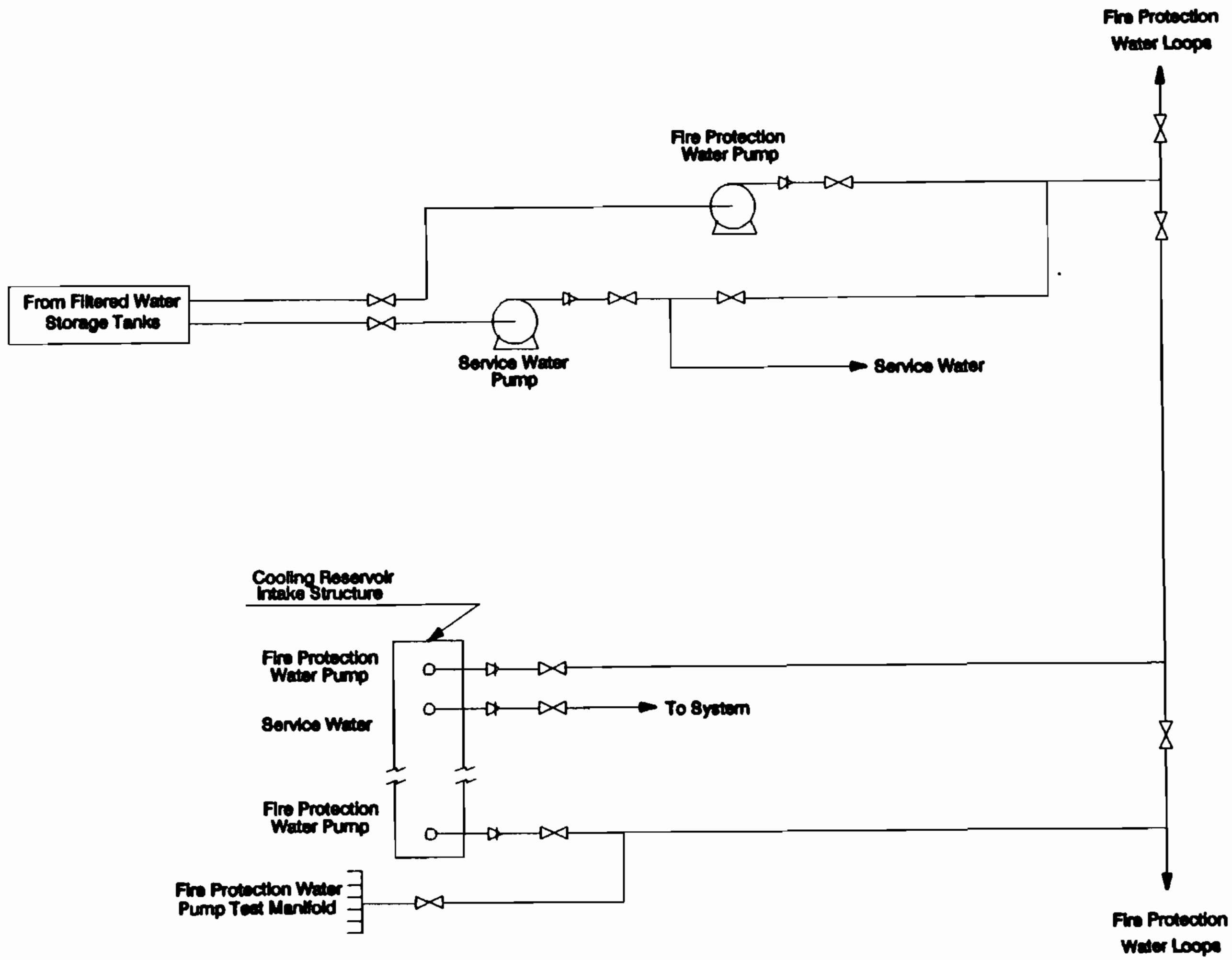

FIGURE 3.5.4-1.

SERVICE AND FIRE PROTECTION WATER DELIVERY SYSTEM

Sources: Texaco, 1992.

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manifold will be located near the intake structure to allow annual testing of the fire protection water pumps.

Demineralized Water Uses

Demineralized water will be used primarily for the following purposes:

- CT NO_x control,
- HRSG boiler makeup,
- Demineralizer regeneration,
- HRSG chemical cleaning, and
- Gasification process water makeup.

The monthly average demineralized water demand is projected to be approximately 0.24 MGD with the IGCC only operation, and 1.03 MGD at full build-out.

Combustion Turbine Nitrogen Oxides Control

During the first year of operation (i.e., prior to being combined with the HRSG, ST, and CG facilities to form the IGCC unit), the advanced GE 7F CT unit will be fired on No. 2 fuel oil. The stand-alone CC and CT units will also use No. 2 fuel oil as a backup fuel. When these units are fired on fuel oil, the primary measure to control NO_x air emissions from these units will be water injection. For this control measure, water will be injected into the primary combustion zone of the CTs to reduce the formation of thermal NO_x by controlling the peak combustion temperature. High purity water will be required to prevent turbine corrosion and deposition of solids on the turbine blades. No wastewater will result from the use of demineralized water for NO_x control since all injected water is evaporated in the process.

Heat Recovery Steam Generator Boiler Makeup

The steam cycle water will be treated to prevent corrosion or scaling in the HRSG components of the IGCC and CC units. The steam cycle water will be treated with an oxygen scavenger for dissolved oxygen control, and with amines or ammonia for pH control. Tri- and di-sodium phosphates will also be fed to the cycle to react with calcium hardness in the HRSGs, to form a nonadherent precipitate. The steam drums on the HRSGs will have intermittent (mud drum) and continuous blowdowns of up to 1 percent of the HRSGs feedwater to control the HRSG water chemistry. Demineralized water will be required to makeup the HRSG water lost to blowdown.

Demineralizer Regeneration

A stream will be taken from the demineralized water tanks twice per day to be used as regenerant dilutant and rinse water. H_2SO_4, sodium hydroxide, rinse water, and backwash streams will be preneutralized in batch fashion prior to treatment in the IWT system in a 60,000-gallon capacity sump for neutralization, and then routed to the IWT system. A portion of the final rinse water may be routed to the decarbonator tanks and used as recycle water.

Heat Recovery Steam Generator Chemical Cleaning

The HRSG components of the IGCC and CC units will be chemically cleaned once at commissioning and then at a probable frequency of once every 5 years, if necessary. The provision of high quality boiler feed water will preclude the need for acid cleaning after startup. The likely chemical cleaning procedure will be an alkaline cleaning followed by passivation and rinse. Each of the cleaning steps will involve 1.5 times the HRSG water volume (filled to top of steam drum). The solutions will be dumped to a chemical cleaning water holding tank for subsequent transport to an offsite permitted disposal facility.

Gasification Process Water Makeup

Gasification process makeup water will be required to replace water lost from various gasification process streams within the CG facilities, such as the water lost to grey water blowdown. Process condensate generated by gas scrubbing, quenching, and cooling will be continuously cleaned and reused. There will be a process contribution to water makeup because the gasifier consumes water-producing hydrogen and CO, and the sulfur recovery unit and thermal oxidizer produce water.

The gasification unit will also send water to the advanced CT unit (in the clean syngas stream).

3.5.4.2 Demineralized Water Treatment System

The proposed demineralizer water treatment system will consist of activated carbon filtration, R.O. for primary demineralization, common atmospheric decarbonation, and ion exchangers to meet the required high water quality requirements. The following paragraphs summarize the major components of the demineralized water treatment system.

Activated Carbon Filtration

Activated carbon filters will be used to dechlorinate the makeup water from the storage tank to the R.O. demineralizers. The backwash water from the carbon filters will be routed to the wastewater equalization basin for treatment in the IWT system.

Reverse Osmosis

The function of R.O. is primary demineralization of the filtered raw water. The R.O. system design parameters will include 75-percent recovery of permeate flow, with 95-percent rejection of solids to the concentrate stream.

Feed pumps will draw water from the filtered water storage tank. The R.O. system will require acid injection and filtering with activated carbon to prevent scaling and to remove residual chlorine. In addition, a clean in-place chemical feed system will be required.

Atmospheric Decarbonation

The function of the atmospheric decarbonator is to remove carbonate from the primary demineralizer effluent. The decarbonator will be sized for a hydraulic loading of 25 gallons per minute per square foot (gpm/ft^2), plus a minimum retention time in the clearwell of 5 minutes. From the decarbonator, the flow will be split to the two mixed bed demineralizers for further demineralization.

Ion Exchange Demineralization

The ion exchange demineralizer will remove dissolved solids to achieve the required demineralized water specific conductivity of 0.1 micromhos per centimeter (μmhos/cm). Ancillaries for the demineralization system will include a common acid storage tank with dedicated injection pumps for R.O. injection and for mixed bed demineralizer regeneration, and caustic storage and injection pumps for mixed bed demineralizer regeneration.

3.5.4.3 Combined Cycle/Combustion Turbine Process Wastewater

Figure 3.5.4-2 shows the overall treatment schematic for wastewater from water treatment, CC, simple cycle CT facilities, and potentially contaminated stormwater from industrial areas. A separate zero wastewater discharge system will be used to handle and recycle process waters from the CG unit. Table 3.5.4-2 provides a summary of the major process wastewater streams. Wastewater from potable and process water treatment, facility operation, and runoff from the coal pile will fall within one of five categories included in the EPA NSPS for steam electric power generating point sources (40 CFR 423.15): low volume wastes, chemical metal cleaning wastes, once-through cooling water, cool tower blowdown, and coal pile runoff. Table 3.5.4-3 lists the effluent guidelines which apply to the five categorized wastewaters. The IWT system is expected to achieve the TSS, oil and grease, metals, and pH effluent guidelines for the respective waste streams. These and other facility wastewaters are described in the following paragraphs.

Low Volume Wastes

The Polk Power Station low volume wastes will mainly consist of equipment and floor drains, laboratory wastes, boiler blowdown, and makeup water treatment system waste (filter backwash, R.O. concentrate, and demineralizer regeneration wastes). These wastewaters may typically contain high concentrations of TSS and TDS. Floor and equipment drainage and laboratory wastewater may contain *de minimis* amounts of various plant chemicals from small leaks or spills [40 CFR 261.3(iv)]. Spill containment provisions (e.g., berms, absorbent materials) will be used to prevent the

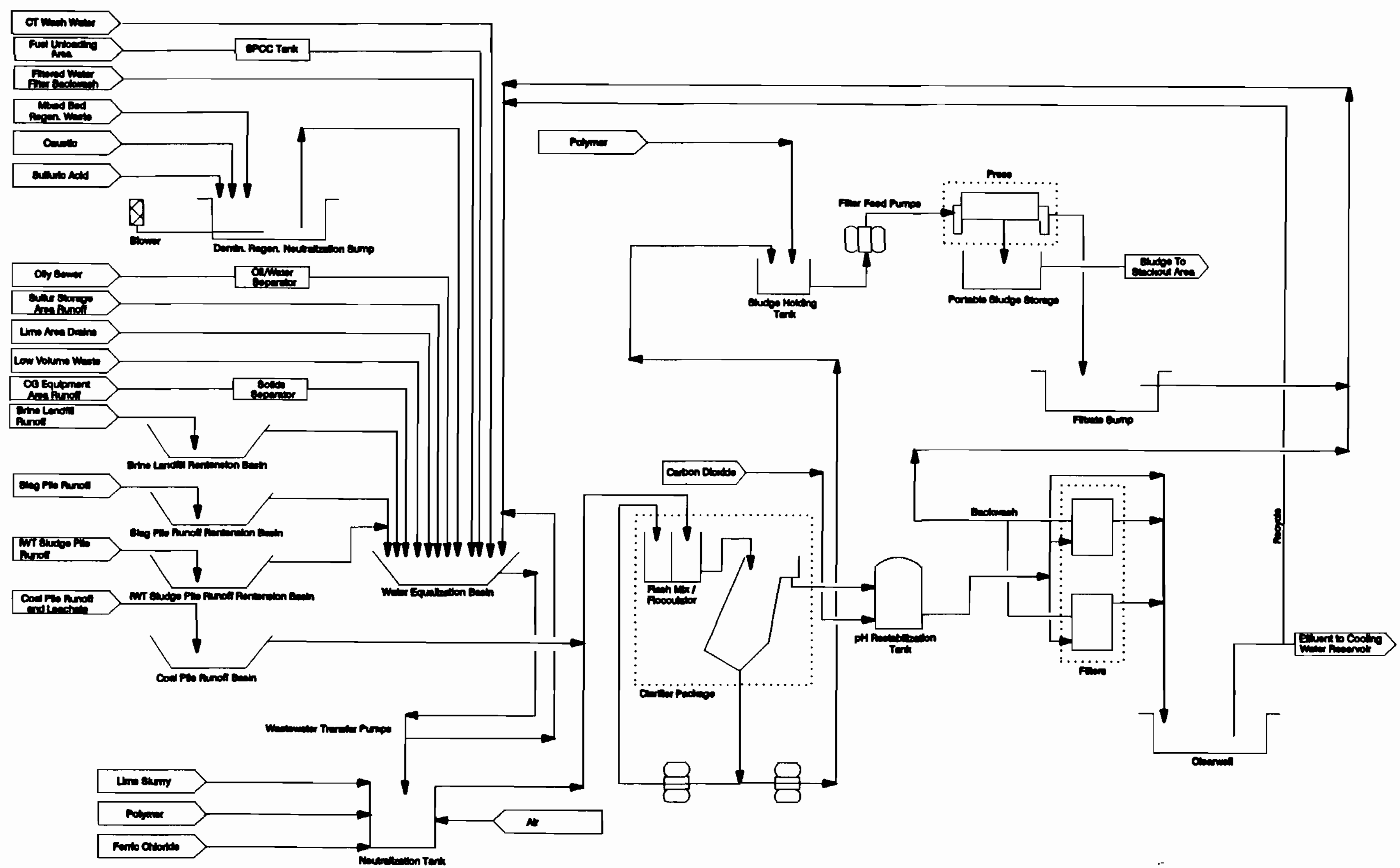

FIGURE 3.5.4-2.

INDUSTRIAL WASTEWATER TREATMENT PROCESS FLOW SCHEMATIC

Sources: Texaco, 1992. UE&C, 1992.

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Table 3.5.4-2. Process Wastewater Stream Flows

Wastewater Stream	Monthly Average Wastewater Flow (gpd)		Discharged To
	IGCC Only	Full Buildout	
Advanced CT/CC unit	112,800	112,800	IWT
CC units	0	145,700	IWT
Simple cycle CT units	0	100	IWT
CG wastewater	363,700	363,700	CG process water handling
Non-chemical cleaning wastewater	400	1,200	IWT
Miscellaneous low volume wastewater	25,900	90,500	IWT
Demineralizer wastewater	7,200	31,000	IWT
R.O. concentrate	82,000	354,600	Cooling reservoir
Potable/process filter backwash	9,000	36,700	IWT
Slag pile runoff	20,300	20,300	Retention basin, IWT
Sludge pile runoff	3,000	3,000	Retention basin, IWT
Coal pile runoff	34,200	34,200	Retention pond, IWT
CG equipment area runoff	48,700	48,700	IWT
Brine storage area runoff	31,400	31,400	IWT
Sulfur storage area runoff	9,000	9,000	IWT
Fuel oil storage/switchyard runoff	54,200	54,200	Oil/water separator, cooling reservoir
CT/CC area runoff	0	23,600	Oil/water separator, cooling reservoir

Source: UE&C, 1992.

Table 3.5.4-3. Effluent Guidelines, NSPS Steam Electric Power Generation

Waste Type	Maximum (mg/L)	30-Day Average (mg/L)
Low Volume Waste		
TSS	100.0	30
Oil and grease	20.0	15
Chemical Metal Cleaning Waste		
TSS	100.0	30
Oil	20.0	15
Copper, total	1.0	1
Iron, total	1.0	1
Once-Through Cooling Water		
Total residual chlorine (discharge to maximum 2 hours per day)	0.2	
Cooling Tower Blowdown		
Free available total residual chlorine	0.5	0.2
Chromium, total	0.2	0.2
Zinc, total	1.0	1.0
Priority pollutants	No detectable amounts	
Coal Pile Runoff		
TSS	<50	
pH	6.0 to 9.0	

Source: EPA NSPS, 40 CFR 423.15.

inappropriate release of chemicals to the wastewater system. HRSG blowdown may include boiler treatment chemicals in extremely small quantities, and will also contain some trace metals such as copper and iron which are picked up from heat exchanger surfaces.

Low volume wastewaters will be routed to the wastewater equalization basin for treatment in the IWT system. One exception is the concentrate from the R.O. unit, of relatively higher quality, which will be discharged directly to the cooling reservoir. An R.O. concentrate monitoring station will provide a final effluent monitoring point and lift station prior to discharging the wastewater. The effluent piping will include a recycle line to the wastewater equalization basin in the event that the treated wastewater is out of compliance. Some low volume wastewaters will require the following types of pretreatment prior to entering the equalization basin:

- Neutralized Waste Streams--High TDS wastewater from demineralization regeneration and rinse water from the anion and cation beds of the demineralization trains will have high or low pH, depending on whether it results from the regeneration of the anion or cation beds. These waste streams will collectively enter a neutralization tank for instantaneous pH adjustment in a neutralization unit by acid or caustic solution. The pH will be adjusted to between 6 to 9 before leaving the neutralization unit, to reduce the loading to the IWT system. An automatic feed system will regulate the addition of acid or caustic until the 6 to 9 pH is reached, then the wastewater will enter the equalization basin.
- Oil/Water Separator--Any oily waste streams generated from minor leaks or spills in the CC/CT, fuel oil storage, and switchyard areas will be processed in area oil/water separators before entering the cooling reservoir. An oil/water separator will also be used to remove oil and grease and suspended solids from equipment and floor drains prior to discharging to the wastewater equalization basin. The oil/water separators will be designed to reduce the oil and grease content of the wastewater to a level not exceeding 15 mg/L. The oil will be separated off and collected in

drums or waste oil tanks for offsite disposal. Sludge from the bottom of the separators will be periodically disposed offsite by a licensed contractor at either a hazardous waste or industrial waste facility, depending on the results of toxicity characteristic leaching procedure (TCLP) analyses.

Metal Cleaning Wastes

Non-chemical and chemical metal cleaning wastes will be generated at the Polk Power Station. As discussed in Section 3.5.4.1., non-chemical cleaning wastes associated with CT and compressor washing contains dirt, organic matter, oil, and non-hazardous detergent. This wastewater will be generated up to six times per year and will be routed to the equalization basin for subsequent treatment. Chemical metal cleaning wastes, also discussed in Section 3.5.4.1, will be conducted at plant startup and infrequently thereafter. Pollutants in the metal cleaning wastes may include variable pH, high TSS, and trace metals such as copper and iron, depending on the boiler tube composition. Spent chemicals and metal cleaning wastes will be taken offsite by a licensed contractor for disposal at approved licensed disposal facility.

Condenser Cooling Water

Cooling of the facilities main condensers and miscellaneous components will be achieved by recirculating, non-contact cooling loops. Recirculating water for this application will be withdrawn and subsequently discharged to the onsite cooling reservoir. Gaseous chlorine will be used as a biocide for cooling system protection.

Coal Pile/Slag Storage Area Runoff

Precipitation results in the generation of surface runoff and leachate from open, lined coal storage areas. Coal pile runoff will not exceed 50 mg/L TSS, 1 mg/L iron and 0.5 mg/L copper. These wastewaters from the coal pile will be initially collected in a retention basin to allow settling of solids. After settlement, the basin overflow will be pumped to the wastewater equalization basin within the IWTP. Compaction and grading of the coal will be performed to minimize air and water contact with coal, which in turn, is expected to minimize oxidation and solubilization of the coal constituents.

In addition to the coal pile drainage, the IWT system will receive drainage from the lined, CG slag stackout area, and the industrial wastewater treatment sludge storage area. Runoff from these two areas will enter basins designed to collect stormwater in excess of the 25-year, 24-hour storm event.

3.5.4.4 Process Wastewater and Stormwater Runoff Treatment System

The proposed IWT system includes a waste collection system consisting of four wastewater retention basins and an equalization basin followed by a dynamic physical/chemical treatment system and a wastewater holding tank for chemical cleaning waste.

Wastewater Equalization Basins

The four wastewater holding basins/tanks are as follows:

- Coal Pile Runoff Retention Basin--The function of this basin will be to contain runoff from the coal pile for transfer to the IWT system wastewater equalization basin. This basin will be lined with a synthetic material or other materials with similar low-permeability characteristics and provide containment in excess of the 25-year, 24-hour storm volume.
- Slag Pile Runoff Retention Basin--The function of this basin will be to contain runoff from the slag pile for transfer to the wastewater equalization basin. This basin will be lined with a synthetic material or other low-permeability materials and provide containment in excess of the 25-year, 24-hour storm volume.
- IWT Sludge Pile Runoff Retention Basin--The function of this basin will be to contain runoff from the sludge pile for transfer to the wastewater equalization basin for treatment in the IWT system. This basin will incorporate a synthetic liner and provide containment in excess of the 25-year, 24-hour storm volume.

- Brine Runoff Retention Basin--The function of this basin will be to contain runoff from the active brine pile for transfer to the IWT system. Any leachate collected from within the active brine storage area will be routed to the inlet of the brine concentrator unit. The design of this basin will incorporate a synthetic liner. Containment in excess of the 25-year, 24-hour storm volume will be provided by this basin design.
- Wastewater Equalization Basin--The function of this basin will be to provide containment and equalization of all industrial wastewater requiring treatment. The design of this basin will incorporate a synthetic liner and provide containment of 24 hours of wastewater at the design service rate of the IWT system.
- Chemical Cleaning Wastewater Holding Tank--The function of the chemical cleaning wastewater holding tank will be to provide collection and temporary storage of chemical cleaning wastewater generated by the periodic cleaning of the HRSG boilers. The tank will include drain overflow and local and remote level indication. The chemical cleaning waste will be stored onsite in a dedicated cleaning waste tank prior to being hauled offsite by a boiler cleaning contractor for appropriate treatment and disposal.

Industrial Wastewater Treatment System

The IWT system will consist of five principal unit operations as described below. The system will be designed to treat wastewater on a continuous basis.

Wastewater Neutralization/Oxidation Tank

Wastewater from the waste equalization basin will be directed to the neutralization tank to achieve oxidation of ferrous iron in conjunction with waste neutralization. The pH will be adjusted to the range of 8.5 to 9.0 through the addition of hydrated lime slurry. At this neutralized pH, the ferric iron will precipitate as a hydroxide which ensures compliance with iron limits while providing nucleation sites for the co-precipitation of other trace metals. The lime slurry feed rate will be based on pH feedback control from the neutralization tank effluent. Lime slurry will be recirculated continuously from the lime slurry storage tank and withdrawn from the recirculation loop for injection into the neutralization tank. The injection rate will be controlled by an in-line pinch valve modulated by pH feedback control. A blower will deliver aeration air through a sparger located at the bottom of the tank.

Clarifier

Overflow from the neutralization tank will cascade by gravity to a clarifier for solids removal. The clarifier will include a flash mix and flocculator tank for chemical conditioning prior to clarification. The clarifier will have a design rise rate of 0.35 to 0.5 gpm/ft^2, at the maximum service rate depending on the type of clarifier selected. Effluent from the clarifier will flow by gravity to the chemical restabilization tank for final pH adjustment. Solids collected in the clarifier will be continuously pumped out and treated in the sludge handling system. Ferric chloride will be used as coagulant in conjunction with a polyelectrolyte additive for flocculation in the clarifier package.

Chemical Restabilization Tank

The function of the chemical restabilization tank will be to readjust the pH of the IWT system wastewater effluent prior to polishing filtration and discharge. The pH will be adjusted to the range of 6.0 to 9.0 to meet effluent standards for discharge to the cooling reservoir. Treated wastewater will flow by gravity from the IWT system clarifier to the pH restabilization tank. The neutralizing chemical will be gaseous CO_2 regulated by a pH feedback signal control loop.

Polishing Filters

The function of the polishing filters will be to further reduce the TSS levels in the IWT system effluent into the 5- to 10-mg/L range to ensure compliance with total iron and TSS discharge limits. The polishing filters will be continuous backwash gravity filters. The filters will receive stabilized effluent at a pH of 6.0 to 9.0 from the pH restabilization tank, and discharge from the filter to the clearwell sump for monitoring prior to discharge to the cooling reservoir. The effluent piping design will include a recycle line to the wastewater equalization basin in the event that the treated wastewater is out of compliance. Backwash will flow to the wastewater equalization basin for subsequent treatment in the IWT system.

Sludge Handling System

Sludge handling will consist of sludge storage and dewatering. A sludge holding tank will receive sludge from the clarifier on a continuous basis. The sludge tank will have an active design capacity to store sludge from the IWT system for an average 3-day period. Sludge will be pumped from the sludge holding tank to the filter press for dewatering. The press capacity will be selected to allow dewatering of sludge on a one-shift-per-day, 5-days-per-week basis. The filter cake will be temporarily stored onsite prior to offsite disposal by a licensed contractor. Filtrate from the filter press will be routed to a filtrate sump for transfer to the wastewater equalization basin and subsequent treatment in the IWT system.

3.5.4.5 Coal Gasification Process Water

The slag flushed from the gasifier to the slag sump tank will be dewatered and conveyed to the slag storage area. The water removed from the slag will contain fine particles of slag and is referred to as black water. The syngas scrubber will also generate black water, which contains all the entrained solids which were not removed by the radiant syngas cooler sump in the gasifier.

Hot gas and slag in the gasifier will flow downward into the radiant syngas cooler. Slag will solidify in a water sump at the bottom of the pressurized radiant cooler. The solids which have accumulated in the water sump will be water flushed to the slag sump tank.

Black water from both of these sources will be directed to a vacuum flash drum and gravity settler, which together remove nearly all of the suspended solids in the black water feed. The overflow from the gravity settler is referred to as grey water and will be directed to the grey water tank. The water in the grey water tank will contain approximately 200 ppm of fine slag solids. Most of the grey water will be reused in the gasification plant for syngas scrubbing or slag flushing; however, some of the grey water will be discharged and processed to maintain the correct solids balance within the recycling system. The solids stream (approximately 20-percent solids) leaving the settler will be routed to a plate/frame fines filter, where the slag filter cake will be removed and sent to the temporary slag storage area and sold for offsite uses with the coarser slag by-products. The filtrate from the gravity settler, also considered grey water, will be routed to the grey water treatment system.

3.5.4.6 Coal Gasification Grey Water Processing and Brine Concentration

Grey water from the filtrate tank and grey water tank will be preheated and subsequently fed to the grey water evaporator. Caustic soda will be added to the grey water system to control pH. The grey water will flow in series through the first and second evaporator stages where low pressure steam will be used to evaporate most of the water. Plant steam will be used as the heating medium in the first evaporator stage, and the overhead vapor from the first evaporator will be used as the heating medium in the second evaporator stage.

Concentrated grey water from the second stage of the grey water evaporator will be pumped to the brine storage tank. Figure 3.5.4-3 shows a schematic of the grey water evaporation system. Brine from the tank will be heated in a crystallizer slurry heater, and then pumped to the grey water solids crystallizer. Figure 3.5.4-4 presents a schematic of the solids crystallization system. Some gypsum may be used as an additive in the crystallization procedure. Vapor from the crystallizer will be condensed and recycled as coal slurry water. The liquid and crystal mixture will be separated in a centrifuge or other means of solids separation. The crystals will be sent to the onsite brine solids storage area. The liquid will be recycled back to the crystallizer for further processing.

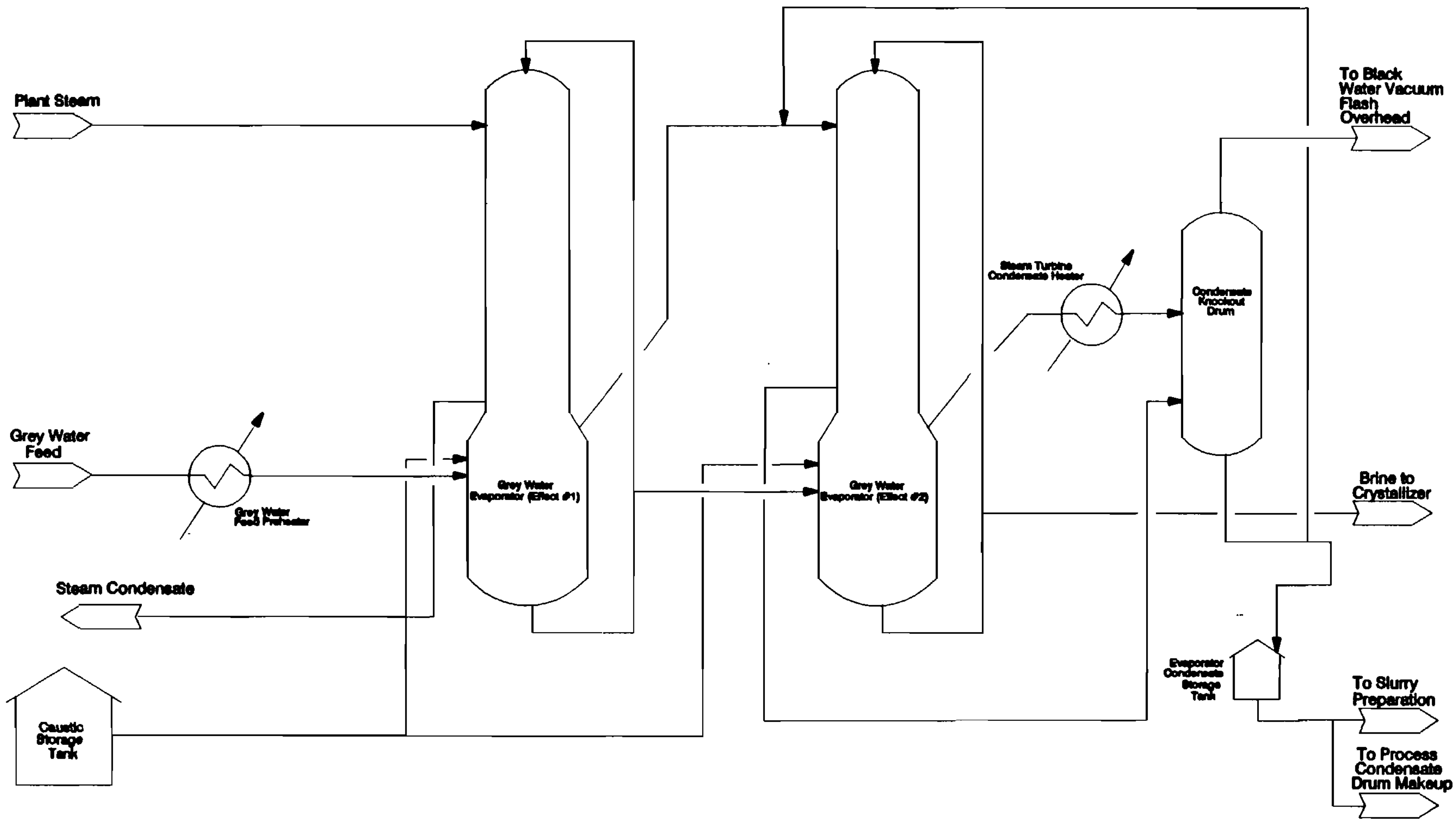

FIGURE 3.5.4-3.

GREY WATER EVAPORATION SYSTEM SCHEMATIC

Source: Texaco, 1992.

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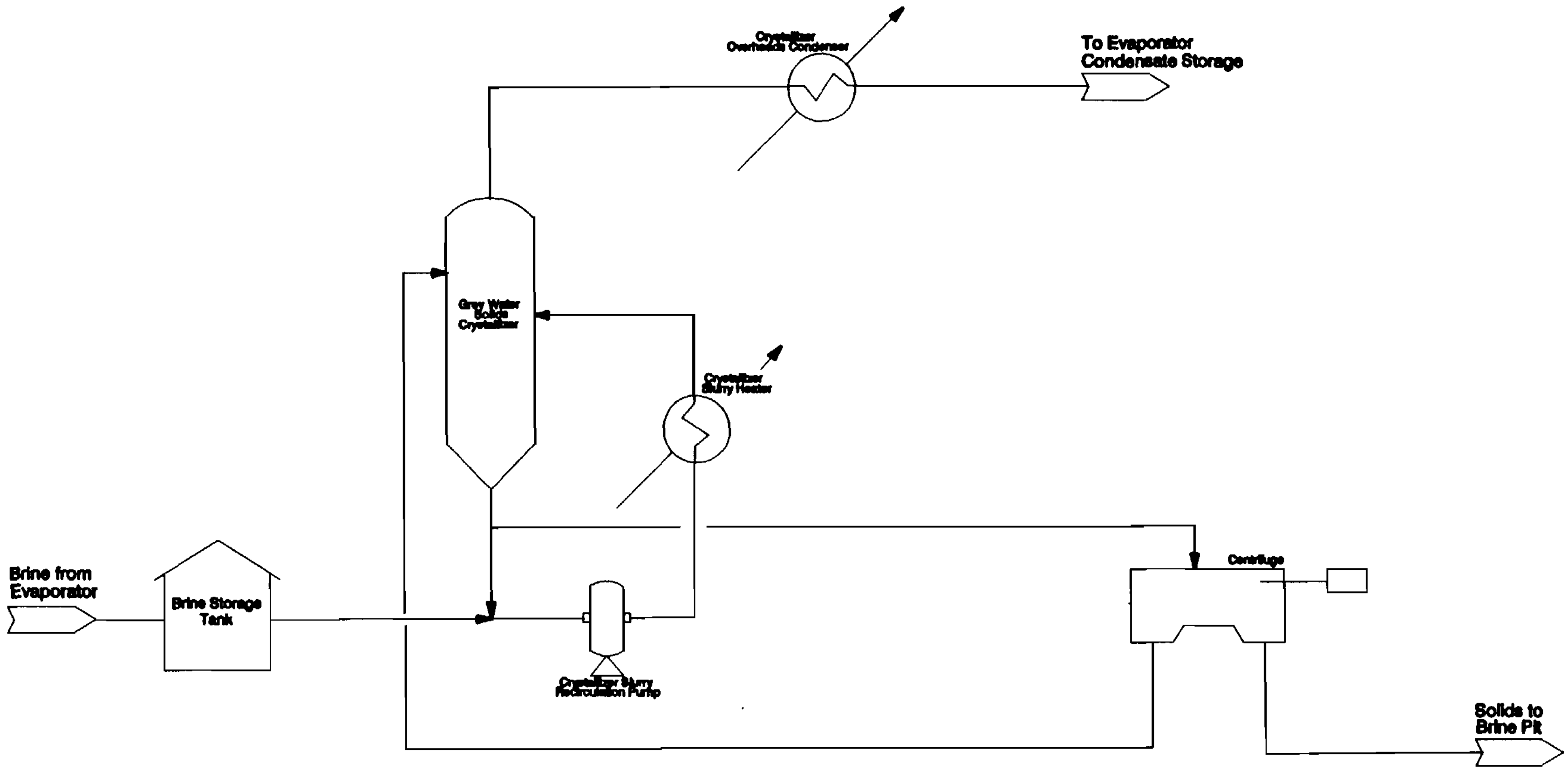

FIGURE 3.5.4-4.

SOLIDS CRYSTALLIZATION SYSTEM SCHEMATIC

Source: Texaco, 1992.

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POLK POWER STATION

The resulting brine will primarily consist of salt, with some small amounts of gypsum and formate. Together, these compounds are expected to constitute 99 percent of the brine. The remaining 1 percent of the brine will be trace elements contained in the coal feed ash as described in Section 3.7.1.

The brine will be stored in a secure, onsite solids storage area with a leachate and runoff collection system, synthetic liner, and other provisions to prevent the release of brine constituents to the environment.

3.6 CHEMICAL AND BIOCIDE WASTES

3.6.1 CHEMICAL STORAGE AND HANDLING

Several chemicals will be used as process additives and typically will not result in the generation of solid or hazardous wastes, unless an accidental spill occurs.

Spill prevention measures will be implemented to prevent the unauthorized release of hazardous chemicals to the environment for the Polk Power Station operations. For example, storage tank systems will meet all applicable aboveground and underground storage tank rules specified in Chapters 17-762 and 17-761, F.A.C., as well as applicable EPA and other regulations and design standards for tanks. H_2SO_4 storage facilities will comply with rules governing mineral acids specified in Chapter 17-767, F.A.C.; fuel oil storage will comply with oil spill contingency requirements outlined in 40 CFR 112. The use and management of containers (e.g., drums, pails) storing chemicals or hazardous wastes will be in accordance with relevant FDOT, RCRA, and state requirements. Spill absorbent, neutralizing agents, and personal protective equipment will be provided for responding to spills occurring in the workplace. Tampa Electric Company will also conduct appropriate hazardous material handling and health and safety training programs for appropriate employees at the Polk Power Station.

3.6.2 CHEMICAL USAGE

The following paragraphs describe the chemicals which may be used on the Polk Power Station site. During the operational life of the facilities, certain substitutes for these chemicals which provide similar characteristics and functions may be used.

3.6.2.1 Ammonia

Coal will be withdrawn from the coal storage bin and fed to the grinding mill. Ammonia may be added to the mill for pH adjustment, if necessary. Slurry pH will be maintained between 6 and 8 to minimize corrosion in the carbon steel equipment.

3.6.2.2 Ammonium Hydroxide

Ammonium hydroxide (aqueous ammonia) will be used for boiler feedwater pH control and coal slurry preparation. A bulk storage tank, of approximately 6,000-gallon capacity, will be used for onsite aqueous ammonia storage.

3.6.2.3 Sodium Hypochlorite

Sodium hypochlorite is an oxidizing biocide which will be used for potable water sterilization and treated sanitary wastewater disinfection. It is anticipated that approximately 150 gallons of 15-percent commercial solution will be stored onsite. The sodium hypochlorite will be received in drums.

3.6.2.4 Hydrazine

Hydrazine will be used as a boiler feedwater oxygen scavenger for dissolved oxygen control. It is anticipated that 200 gallons of 35-percent commercial solution will be stored onsite in drums. Hydrazine used in the boiler is expected to be decomposed prior to discharge to the IWT system.

3.6.2.5 Sodium Hydroxide

Sodium hydroxide will be used as a regenerant for the makeup demineralizer and for the neutralization of regenerated water backwash. Caustic will also be used in the brine concentration area for pH control. A 50-percent solution bulk storage tank, approximately 8,000-gallon capacity, will supply the two solution tanks. Each solution tank will be sized for two regenerations with concentrated chemical.

3.6.2.6 Sulfuric Acid

H_2SO_4 will be used as a regenerant for the makeup demineralizer, neutralization of the regenerated wastewater, and pH adjustment of the R.O. feedwater. A bulk storage tank, approximately 8,000-gallon capacity, will supply three solution tanks. The regenerant solution tanks will be sized for two regenerations, and the R.O. feed tank will hold enough acid for 24 hours of maximum continuous usage. Operation of the H_2SO_4 plant for treatment of off-gas from the HGCU system may produce as much as 45,000 tons of H_2SO_4 annually. An aboveground storage tank of approximately 150,000-gallon capacity will be used for onsite storage prior to sale.

3.6.2.7 Ferric Chloride

Ferric chloride will be used as coagulant for wastewater treatment prior to discharge or reuse. A bulk storage tank, approximately 4,000-gallon capacity, will be provided for storage of 25- to 45-percent ferric chloride solution.

3.6.2.8 Sodium Phosphates

Di- and trisodium phosphate will be fed to the boiler stream cycle water to react with calcium hardness to prevent scaling. These chemicals will be stored in drums.

3.6.2.9 Combustion Turbine Water Washing Detergent

Contaminants that pass through the air inlet filters, such as condensed hydrocarbon fumes, will be removed from the compressor by washing with a water-detergent solution (less than 5 percent detergent), followed by a water rinse. The detergent will be stored in drums or pails.

3.6.2.10 Polyelectrolytes (Polymers)

Polyelectrolytes may be used for wastewater treatment. The application could involve commercially available liquid solution of about 35-percent concentration.

The exact concentration to be used will depend on treatability testing results. It is estimated that approximately 10 gallons of polymer will be used per day.

3.6.2.11 Lime

Hydrated lime will be used for wastewater neutralization. The lime storage system will include a 1,500-cubic-foot (ft^3) (26-ton) silo with approximately 50 days of storage capacity. A 750-gallon slurry feed tank will be used to hold a 10-percent lime slurry solution.

3.6.2.12 Chlorine

Liquid or gaseous chlorine will be used for makeup water and condenser cooling water treatment. The chlorine will be received and stored in 1-ton cylinders. Sodium hypochlorite may be alternatively used for chlorination of process makeup water.

3.6.2.13 No. 2 Fuel Oil

No. 2 fuel oil will be stored onsite in three aboveground steel tanks, each with a capacity of approximately 3 million gallons. The tanks will be surrounded by an earthen berm covered with sealed asphalt or comparable sealing material to contain any unanticipated spills or tank failures, in accordance with federal and state spill contingency requirements and the requirements of Chapter 17-762, F.A.C. Fuel oil will be delivered to the site by truck, railcar, or pipeline.

3.6.2.14 Heat Recovery Steam Generator Chemical Metal Cleaning Solutions

The HRSG and condensate/feedwater piping will be chemically cleaned during plant construction and startup and may be cleaned periodically during the life of the plant, but on an infrequent basis. The solutions to be used for acid and alkaline cleaning of the HRSG and piping will be dependent on the HRSG manufacturer selected. The most likely method of cleaning condensate/feedwater piping includes alkaline cleaning, acid cleaning, and passivation. Typical chemicals associated with each step will be as follows:

- Alkaline cleaning--Disodium phosphate, trisodium phosphate, and anti-foaming and wetting agents;
- Acid cleaning--Hydroxyacetic acid, formic acid, and anti-foaming and wetting agents; and
- Passivation--Hydrazine, ammonia, and anti-foaming and wetting agents.

The probable HRSG cleaning methods include alkaline cleaning, acid cleaning and passivation, or ammoniated citric acid cleaning. The most probable chemicals associated with each alkaline/acid/passivation step are as follows:

- Alkaline cleaning--Disodium phosphate, trisodium phosphate, and anti-foaming and wetting agents;
- Acid cleaning--Inhibited hydrochloric acid, anti-foaming agent, and citric acid rinse; and
- Passivation--Sodium carbonate and sodium nitrate.

Chemicals associated with ammoniated citric acid cleaning include 50-percent liquid citric acid, ammonia, sodium nitrate, ammonium bicarbonate, ammonium bifluoride, hydrochloric acid, and sodium sulfite.

These chemical solutions will be brought onsite, and spent chemicals and post-rinse waters will be collected and transported offsite for appropriate treatment and disposal.

3.6.2.15 Sulfur Recovery and Tail Gas Treating Materials

Several materials will be used to convert H_2S and SO_2 in the acid gases from the syngas cleanup systems to liquid molten sulfur, or to H_2SO_4. These materials have the potential to be considered hazardous wastes, although most of these spent materials will be reclaimed. These materials are discussed in Section 3.7.2.

Some raw materials will become part of a wastewater stream requiring treatment in the IWT system. The wastewater streams and methods of treatment are discussed in Sections 3.5.4.3 through 3.5.4.6. Other raw materials resulting in a solid or potential hazardous waste will be disposed of or reclaimed offsite. The handling of these wastes or by-products is discussed in Section 3.7.

3.7 SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS

3.7.1 SOLID WASTES AND BY-PRODUCTS

Non-hazardous solid wastes and by-products generated by the Polk Power Station project include the following:

- Sanitary wastewater treatment sludge,
- Industrial wastewater treatment sludge,
- CG wastewater treatment brine,
- Sulfur,
- Slag,
- Waste oils,
- Water treatment media,
- HGCU system wastes, and
- General solid wastes.

3.7.1.1 Sanitary Wastewater Treatment Sludge

Sludge from the sewage treatment package plant will be periodically transported offsite for disposal. Approximately 1,400 gallons of sludge per month will be generated based on an estimated 210 operating personnel at full build-out. The sludge will be transported offsite to a permitted facility for disposal.

3.7.1.2 Industrial Wastewater Treatment Sludge

Metal hydroxide sludge and total suspended solids from the IWT system will be generated at the rate of approximately 100 cubic feet per day (ft^3/day) at 30-percent solids. The filter cake is expected to be non-hazardous, containing primarily calcium carbonates, metal hydroxides, and inert solids.

The sludge handling system will consist of a sludge holding tank and a filter press. The sludge tank will be sized for 3 days active storage of solids from the clarifier. Sludge will be pumped from the sludge holding tank to the filter press for dewatering. Filter cake will be stored in the sludge disposal area. Stormwater from the sludge disposal area will be collected in an adjacent drainage basin and routed to the IWT system for treatment. The disposal area will be designed with a synthetic liner/leachate collection system in accordance with Chapter 17-701, F.A.C.

3.7.1.3 Coal Gasification Wastewater Treatment Brine

Concentrated brine solids will be discharged from the brine concentrator at an approximate rate of 26.5 ft^3/hr. The brine will be predominantly water and sodium chloride. Some gypsum may be used as an additive in the crystallization procedure. There may also be some formate content. These three compounds are expected to represent 99 percent of the total brine makeup. The remaining 1 percent consists of trace elements present in the feed coal ash, such as aluminum, barium, cobalt, copper, vanadium, and zinc.

The brine will be stored in a secure, onsite disposal area. The disposal area will consist of six 540-ft square cells with leachate and runoff collection systems and impermeable liner in accordance with Chapter 17-701, F.A.C. The brine will be mixed with up to an equal amount of sand or other stabilizing medium. The mix will then be stacked approximately 4 to 6 ft high and covered with a temporary cover. The disposal area will be designed to operate with one cell accepting waste at any one time. The majority of rainfall will be isolated from the brine by the temporary cover and runoff from the active brine area will be sent to the IWT system. Any leachate collected from within the active brine storage area will be routed back to the inlet of the brine concentrator unit. As the cell reaches storage capacity, it will be covered with a clay cap and the impermeable cover will be moved to the next cell. Runoff from the capped brine storage cells will be routed to the stormwater retention basin.

3.7.1.4 Sulfur By-Product

Elemental sulfur by-product from the CGCU system is expected to be of marketable-grade quality, with low ash levels and trace elements content. Approximately 90 tpd of sulfur is expected to be generated from the sulfur recovery units if 100 percent of the syngas for the IGCC unit is being treated in the CGCU system. Operation of the

H_2SO_4 plant for treatment of approximately 50 percent of the syngas for the IGCC unit in the HGCU system would result in significantly lower rates of sulfur produced. The sulfur will be stored in a molten state in a sulfur day tank, located within a concrete pit. The sulfur day tank will be provided with a sulfur pump to transfer the sulfur to either the truck loading rack or to the railcar loading rack for transport for offsite uses.

3.7.1.5 Slag By-Product

Slag formed in the gasifier will consist of coal ash, unconverted carbon, and trace elements contained in the coal. This material will be generated at a maximum rate of 210 stpd, dry weight. The slag will contain approximately 25-percent moisture and have a density of 90 pounds per cubic foot (lb/ft^3). The silt content of less than 200 mesh slag material is 1 to 8 percent.

Fine slag will consist of filter cake material produced by the syngas scrubbing system. This slag will be generated at the maximum rate of 60 stpd dry and will be approximately 50-percent moisture with a bulk density of approximately 70 lb/ft^3. The fine slag will have 80- to 90-percent silt content for the less than 200 mesh material.

Slag will be composed of glassy particles which are the remnants of completely burned coal particles or slurry droplets. Slag particles that have contacted the wall of the gasifier chamber will be typically of non-spherical, irregular shape, representing the drippings from the gasifier chamber exit throat. Slag particles that have traversed the gasifier chamber without wall contact will generally be spherical in shape. The glassy slag particles will be collected in the bottom of the radiant syngas cooler (see Figure 3.1.1-4).

Slag is a solid waste which is not considered hazardous under federal regulations 40 CFR 261.4(6)4 or 261.4(6)7vi. Local requirements such as the California leachability testing have been always passed by slag generated in the Texaco gasification system. Tables 3.7.1-1 and 3.7.1-2 summarize the State of California and

Table 3.7.1-1. State of California Waste Leaching Testing Results for Gasifier Slag (mg/L)

Parameter	Leachate Concentration	California Limit
Antimony	ND	15
Arsenic	ND	5.0
Barium	25	100
Beryllium	ND	0.75
Cadmium	ND	100
Chromium	1.6	560
Chromium (+6)	ND	5.0
Cobalt	0.14	80
Copper	0.25	25
Fluoride	3.8	180
Lead	0.36	5.0
Mercury	ND	0.2
Molybdenum	ND	350
Nickel (total)	ND	20
Selenium	ND	1.0
Silver	ND	5.0
Thallium	ND	7.0
Vanadium	1	24
Zinc	ND	250
LC-50 (96-hour)	>500	--

Note: ND = not detected.

Source: Cool Water Coal Gasification Program, 1984.

Table 3.7.1-2. RCRA Waste Testing Results for Gasifier Slag (mg/L)

RCRA Parameter	Leachate Concentration	RCRA Limit
Arsenic	ND	5.0
Barium	0.32	100.0
Cadmium	ND	1.0
Chromium (total)	ND	5.0
Lead	ND	5.0
Mercury	ND	0.2
Selenium	ND	1.0
Silver	ND	5.0

Note: Ignitability is negative.
Corrosivity is negative.
Reactivity is negative.
ND = not detected.

Source: Cool Water Coal Gasification Program, 1984.

EPA extraction procedure toxicity leaching test results for gasifier slag produced from the Texaco Cool Water Coal Gasification Program. The slag contains the trace elements found in the feed coal in non-leachable form. Table 3.7.1-3 provides a summary of the trace element balance in the slag, fine slag, sulfur, and brine, using the modified Illinois No. 6 coal. These trace element estimates are based on actual Texaco gasifier operating data and account for contribution of some trace elements by the wear of gasifier refractory materials.

The slag by-product is salable as an abrasive, roofing material, industrial filler, aggregate for concrete, or road base material. Onsite storage will be provided for temporary storage in the event the slag cannot be immediately sold. Tampa Electric Company will actively market this by-product and has been successful in securing markets for this type of product at its other power plants. The temporary storage area will be designed with a liner and stormwater collection system in accordance with Chapter 17-701, F.A.C. The area will be sloped to allow water to drain into an adjacent stormwater collection basin, for subsequent treatment in the IWT system. The basin will be sized to retain the runoff in excess of the 25-year, 24-hour storm event.

3.7.1.6 Waste Oils

Waste oils will be periodically generated from lubricating oil leakage and replacement from turbines, pumps, fans, bearings, compressors and other plant-related operating machinery and vehicles. Less than 50 pounds per day (lb/day) of waste oil is expected to result from small leaks or other *de minimis* plant sources. These oils will be captured in the plant oil/water separators, and later skimmed out and placed in drums for pickup by an oil recycling contractor. Waste oils generated from oil changes and equipment maintenance will vary according to the level of plant maintenance. The waste oil will be placed in designated 55-gallon drums to prevent the mixing of oil with listed hazardous solvents. Waste oil collected in the drums will be periodically picked up by an oil recycler or disposed of as appropriate in an approved

Table 3.7.1-3. Trace Element Analysis in Slag, Fine Slag, Sulfur, and Brine

Element	Feed Coal (percent)	Slag (lb/hr)	Fine Slag (lb/hr)	Sulfur (lb/hr)	Brine (lb/hr)
Aluminum	1.13	2,116	65.4	0	0.001
Antimony	0.00040	0.54	0.23	0	0.005
Arsenic	0.0013	1.73	0.59	0	0.093
Barium	0.0084	14.9	1.14	0.002	0.228
Beryllium	0.00047	0.80	0.11	0	0
Boron	0.014	9.1	10.9	0.05	7.195
Cadmium	0.00019	0.16	0.21	0.001	0.005
Calcium	0.36	686	6.48	0	6.851
Chromium	0.0028	11.7	0.5	0	0.016
Cobalt	0.00093	1.71	0.07	0	0.004
Copper	0.0026	3.76	1.25	0.008	0.01
Iron	1.03	1,672	310	0	1.395
Lead	0.00047	0.24	0.66	0	0.004
Magnesium	0.075	140	4.11	0.06	0.71
Manganese	0.0045	8.31	0.22	0.002	0.076
Mercury	0.000028	0.005	0.048	0	0
Molybdenum	0.0010	0.36	1.57	0	0.029
Nickel	0.0014	2.11	0.43	0.003	0.015
Potassium	0.16	303	6.92	0	2.03
Selenium	0.00080	1.31	0.23	0	0.009
Silicon	2.85	5,276	243	0.245	5.641
Silver	0.000004	0	0.01	0.004	0
Sodium	0.076	107	35.5	0.55	5.252
Strontium	0.028	43.9	9.42	0.002	0.403
Thallium	0.00025	0	0.48	0	0
Tin	0.00080	0.96	0.57	0	0.017
Titanium	0.13	233	12.9	0	0.32
Vanadium	0.0052	9.03	1.02	0.007	0.012
Zinc	0.0054	5.63	4.78	0.007	0.043

Note: Coal feed rate at 193,489 lb/hr.

Source: Texaco, 1992.

disposal facility. Waste oil which meets the specifications listed in 40 CFR 266.40 may be burned as fuel in the boiler.

3.7.1.7 Water Treatment Media

Water treatment media such as ion exchange resin, filter media (e.g., sand, anthracite) and R.O. cartridge filters will periodically require replacement. Such replacements are not expected to occur more than once every 3 to 5 years. These wastes will be disposed of at an offsite permitted landfill.

3.7.1.8 Hot Gas Cleanup System Wastes

The HGCU system is expected to generate sorbent fines from the regenerator, salt from the barrier filter, and solids from the cyclone unit. An approximate amount of these materials is as follows:

- Salt, 125 pounds per hour (lb/hr);
- Sorbent fines (zinc oxide and titanium dioxide), 25 lb/hr; and
- Cyclone solids (zinc sulfide, titanium dioxide, carbon), 25 lb/hr.

It is anticipated that the salt from the barrier filter will be disposed in the brine storage area. The sorbent fines are expected to be reclaimed offsite. The non-hazardous cyclone solids will be disposed of offsite in a permitted landfill.

3.7.1.9 General Wastes

General wastes will include miscellaneous plant trash and organic material collected from the cooling water reservoir intake screens. The non-hazardous plant trash will be disposed of at an offsite sanitary landfill. Small quantities of predominately organic matter collected at the intake will be returned to the reservoir, and inorganic matter will be disposed of as trash.

3.7.2 POTENTIALLY HAZARDOUS WASTES AND BY-PRODUCTS

Material and by-products with *potentially* hazardous properties to be generated by the Polk Power Station project include the following:

- Worn gasifier refractory,
- Refractory backup brick,
- Spent sulfur recovery unit catalysts,
- Spent tail gas treatment catalysts,
- Rich acid gas removal solvent,
- Acid gas removal solvent filters,
- De-activated carbon filter media,
- H_2SO_4 by-product, and
- Miscellaneous wastes.

3.7.2.1 Worn Gasifier Refractory

Gasifier refractory hot face is the innermost layer of brick in the gasifier. Following extensive use, the brick face will become impregnated with slag and must be replaced. The typical composition of the worn refractory material will contain various trace metals which are a potential concern; however, previous extraction procedure toxicity testing of this material has indicated that the refractory is non-hazardous. A typical analysis of worn refractory is provided in Appendix 11.13.3.

Total weight of the refractory hot face is approximately 48 tons. The hot face will generally be replaced over a 2-year cycle. Startup conditions may force one early refractory repair or replacement after the first year of IGCC unit operation. It is expected that hot face refractory will be sold back to the manufacturer for reclamation. Because of its intrinsic value, waste refractory is not expected to be disposed in offsite landfill facilities.

3.7.2.2 Refractory Backup Brick

Backup brick, the brick layers located behind the gasifier hot face, consist primarily of aluminum, silica, and iron oxide minerals. The sulfur recovery unit facilities will also have refractory lined vessels of the same composition as that of the gasifier backup brick. Under normal operating conditions, an estimated 27 tons of this material will be returned to the vendor for reclamation or disposed of offsite every 5 years.

3.7.2.3 Spent Sulfur Recovery Unit Catalysts

The sulfur recovery unit will convert the H_2S gas in the CGCU system to liquid molten sulfur. Three catalytic reactors will be used in conjunction with a thermal reactor to achieve sulfur recovery. A typical analysis of the sulfur recovery unit catalyst is provided in Appendix 11.13.3.

Total catalyst in the three reactors will amount to approximately 45 tons. The catalyst will require replacement every 3 to 5 years. It is unlikely that all three beds will require a simultaneous replacement. It is expected that the spent catalyst will be returned to the vendor for reclamation.

3.7.2.4 Spent Tail Gas Treating Catalysts

The tail gas treating unit will be designed to recover the H_2S and SO_2 from the tail gas in the CGCU system for recycle back to the sulfur recovery unit. The tail gas treating unit catalysts will primarily consist of nickel or cobalt-molybdenum. A typical analysis of these catalysts is provided in Appendix 11.13.3. Total reactor charge of catalysts will be approximately 25 tons.

Typically these catalysts will be replaced every 3 to 5 years. Plant upsets could result in a more frequent changes. The catalysts will typically be sold to metals reclaimers or taken back by the catalyst vendor. If these options are not available, the material will be disposed of in a permitted offsite landfill.

3.7.2.5 Rich Acid Gas Removal Solvent

Amines from the acid gas removal or tail gas treating units, with an inventory of as much as 80,000 gallons, will be returned to the manufacturer for reclamation when replacement is required. Therefore, no waste amine solvent requiring offsite or onsite disposal will be produced.

3.7.2.6 Acid Gas Removal Solvent Filters

The acid gas removal solvent filters will be periodically changed based on differential pressure build-up. The filtrate will consist primarily of corrosion products and a small amount of degraded amine solvent.

This material will collect immediately after any event that allows air into the acid gas removal system (e.g., major plant outages). During routine operations, approximately 70 pounds per week of wastes will be generated as a result of filter replacement. The waste filters will be characterized for hazardous constituents, and accordingly disposed of at an offsite RCRA hazardous or sanitary waste disposal facility.

3.7.2.7 De-Activated Carbon Filter Media

De-activated carbon filter media will need to be periodically replaced. The waste filter media will either be disposed offsite in an approved facility or sent back to vendor for reactivation.

3.7.2.8 Sulfuric Acid By-Product

Treatment of the off-gas from the HGCU system will involve the production of liquid H_2SO_4 in an onsite skid-mounted plant. The H_2SO_4 is a by-product which will be sold for offsite commercial uses. Operation of the acid plant may produce up to 45,000 tons of H_2SO_4 annually. The H_2SO_4 will be temporarily stored onsite in an aboveground tank or in specially designed rail cars prior to offsite shipment. The storage facilities will comply with applicable rules for mineral acids (Chapter 17-767, F.A.C.).

3.7.2.9 Miscellaneous Wastes

The operation and maintenance of the Polk Power Station facilities will require the use of solvents, degreasers, paints, and other materials which result in hazardous wastes. The amount of hazardous wastes will be minimized through the use of appropriate product substitution and waste segregation techniques. The routine hazardous waste generation rate is expected to be a small quantity [i.e., between 100 to 1,000 kilograms (kg) per calendar month]. However, during periods of shutdown or high maintenance the facility may generate large quantities (i.e., greater than 1,000 kg per month) of hazardous wastes.

These wastes will be managed onsite and shipped offsite to a permitted waste disposal or recycle facility in accordance with local, state, and federal hazardous waste requirements. Some locations where hazardous wastes will be stored are expected to be fixed (e.g., maintenance shop, paint shop), while other locations may vary according to the need (e.g., pump requiring degreasing and repair). Satellite storage areas will be selected near the most common hazardous waste generation points which will be used to store up to 55 gallons of hazardous wastes in a designated drum. When the drum is full, the waste will be transferred to the hazardous waste storage facility and shipped to a permitted RCRA facility within 90 days. The hazardous waste storage facility will be located near a site roadway to provide easy access to both offsite waste transporters and emergency response personnel. The facility will be equipped with fire extinguisher, spill absorbent material, and spill containment features to ensure that the environment is adequately protected from a chemical release. A preliminary RCRA contingency plan for the facility is included in Appendix 11.13.2.

3.8 ONSITE DRAINAGE SYSTEM

Similar to the pre-mining drainage conditions, the surface runoff from the project site will be drained into three watersheds: South Prong Alafia River, Payne Creek, and Little Payne Creek. As discussed in Section 2.3.4, currently the proposed project site has been significantly altered by the phosphate mining activities. To alleviate the existing mining impacts and to minimize the potential hydrologic impact due to the proposed project, the Polk Power Station onsite drainage plan is designed to achieve the following objectives:

1. Comply with FDNR's reclamation regulations (Chapter 16C-16, F.A.C.);
2. Comply with SWFWMD's surface water regulations (Chapter 40D-4, F.A.C.);
3. Comply with FDER's stormwater management regulations (Chapter 17-25, F.A.C.);
4. Comply with EPA regulations for stormwater discharges associated with industrial activities (40 CFR 122.26); and
5. Comply with state and Federal regulations for surface water and groundwater standards.

The onsite master drainage plan is designed to detain at least the first inch of stormwater runoff resulting from the 25-year, 24-hour storm event from areas on the plant site associated with industrial activity for appropriate water quality treatment. The drainage system will also provide sufficient storage and detention capacity for water quantity control so that the post-reclamation peak runoff rate will not exceed the pre-mining peak discharge for a design storm event (25-year, 24-hour event) in each of the three watersheds. The detention/storage capacity will be provided by the proposed stormwater detention basins and reclaimed wetland areas.

Although the onsite drainage patterns and watersheds have been significantly altered by mining activities, the proposed project development will restore the drainage basin boundaries and onsite basin acreages to approximately (i.e., within 2 percent) pre-mining conditions. The proposed post-reclamation/development drainage basin boundaries are shown in Figure 3.8.0-1 and Figure 3.8.0-2 for the portions of the site to the west and east of SR 37, respectively. The pre-mining and post-reclamation watershed areas are compared in Table 3.8.0-1. The onsite drainage patterns for the onsite watersheds (i.e., South Prong Alafia River, Payne Creek, and Little Payne Creek) are described in the following sections.

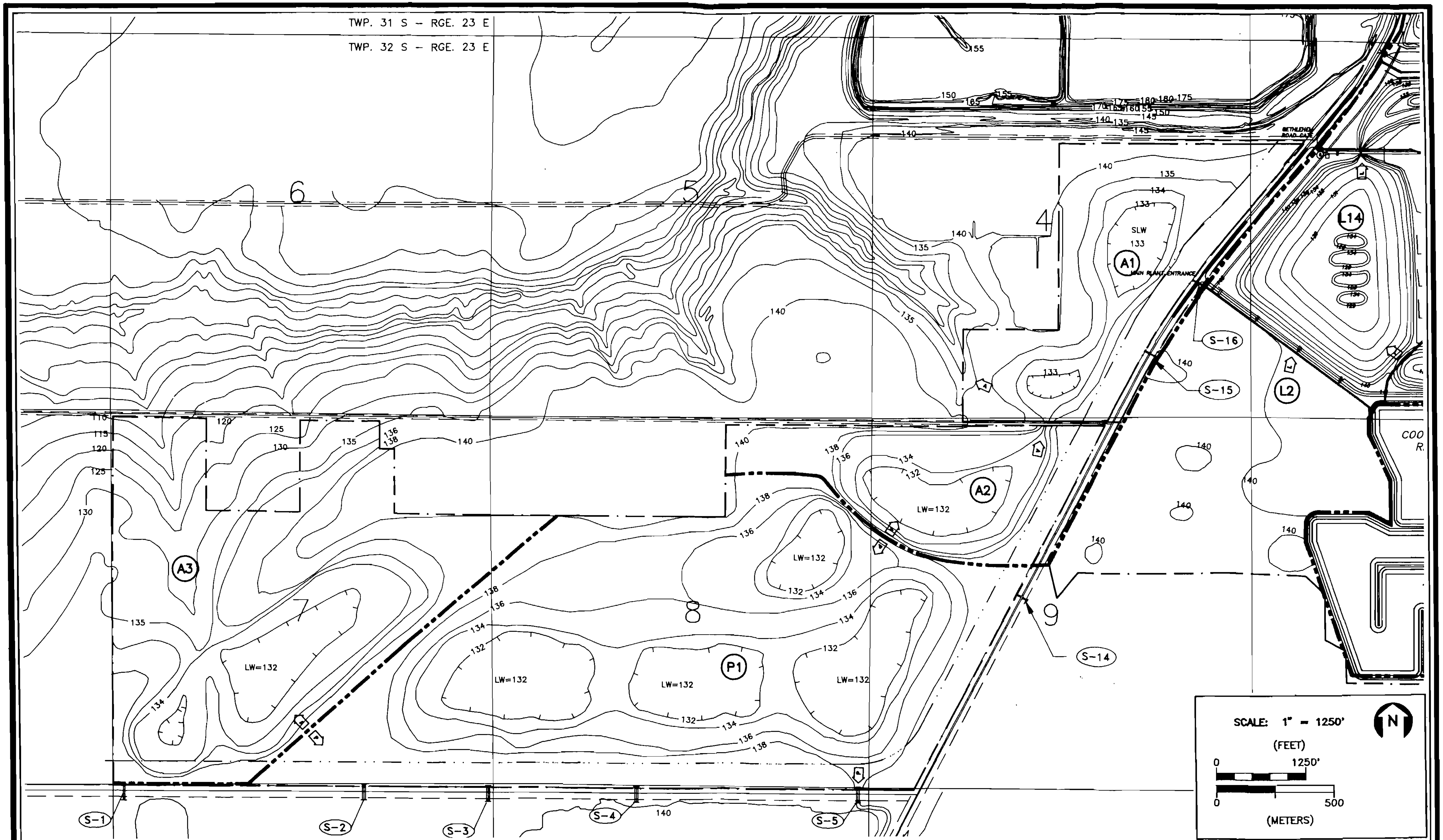

FIGURE 3.8.0-1.

POST-RECLAMATION/DEVELOPMENT DRAINAGE BASINS AND TOPOGRAPHY: WESTERN SITE TRACT

Source: ECT, 1992.

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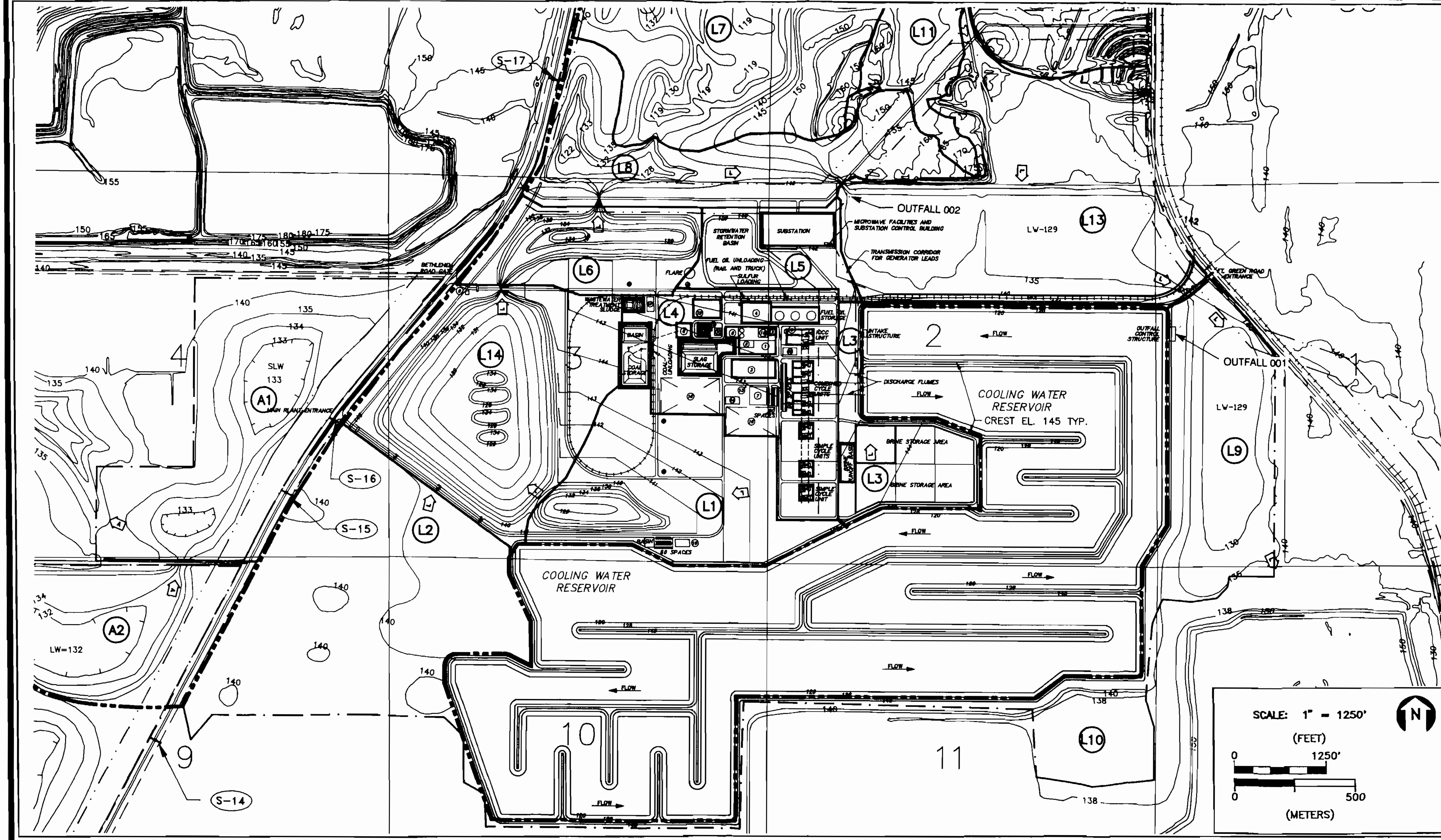

FIGURE 3.8.0-2.

POST-RECLAMATION/DEVELOPMENT DRAINAGE BASINS AND TOPOGRAPHY: EASTERN SITE TRACT

Source: ECT, 1992.

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Table 3.8.0-1. Pre-Mining and Post-Reclamation Drainage Areas

Watershed	Drainage Basin Size (acres) Pre-Mining	Post-Reclamation	Percent Change
South Prong Alafia River	816	801	-1.8
Payne Creek	716	710	-0.8
Little Payne Creek	2,816	2,837	0.7
TOTAL	**4,348**	**4,348**	

Source: ECT, 1992.

3.8.1 SOUTH PRONG ALAFIA RIVER BASIN

As shown in Table 3.8.0-1 and Figure 3.8.0-1, the drainage basin boundary of South Prong Alafia River watershed within the project site will be restored to approximately its pre-mining location. The total drainage area after reclamation will be 801 acres compared to the pre-mining drainage area of 816 acres. According to FDNR's mined land reclamation requirements, this mined area west of SR 37 will be regraded and planted with vegetation to enhance wildlife habitats. Also, to comply with these requirements, the onsite reclamation plan for this tract will create approximately 216 acres of forested and non-forested wetland areas. The western site tract will not include any power plant facilities. The runoff from the reclaimed upland forest and pasture will not be associated with industrial activity and will sheet flow into two separate wetland areas (east and west) prior to offsite discharge as depicted in Figure 3.8.0-1. The wetlands will have a large surface area to significantly suppress the peak discharge and allow for the settling and filtering of suspended material and removal of nutrients by plant uptake prior to offsite discharge.

The stormwater runoff from the wetlands in the eastern area in the South Prong Alafia River watershed will be routed to a tributary of the river via a vegetated swale. The stormwater runoff from the western wetland areas will also be discharged into a small tributary of the South Prong Alafia River in the extreme northwestern corner of the site through a fixed hydraulic structure to maintain the proper hydroperiod for the wetland.

3.8.2 PAYNE CREEK BASIN

The drainage basin boundary of the Payne Creek watershed within the project site will also be restored to approximately its pre-mining position (see Table 3.8.0-1 and Figure 3.8.0-1). The total drainage area after reclamation will be 710 acres compared to the pre-mining drainage area of 716 acres. Similar to the South Prong Alafia River, the presently mined areas will be reclaimed to 242 acres of wetlands and upland forests. The runoff from the reclaimed upland forest will sheet flow into the wetlands prior to offsite discharge. The substantial wetland areas will have flood control functions and provide for water quality treatment. Any runoff discharges from the wetlands will drain southward across SR 674 through culverts similar to pre-mining conditions. This discharge of stormwater not associated with industrial activity will be routed to Payne Creek which runs along the western side of SR 37. The post-reclamation topography and drainage plan for the Payne Creek basin is shown in Figure 3.8.0-1.

3.8.3 LITTLE PAYNE CREEK BASIN

The drainage basin boundary of the Little Payne Creek watershed within the project site will be restored to approximately its pre-mining position. As shown in Table 3.8.0-1, the total drainage area after reclamation will be 2,837 acres, compared to a pre-mining drainage area of 2,816 acres. The power blocks and associated facilities, including the cooling reservoir, for the Polk Power Station will be located within the Little Payne Creek basin. Other mined-out areas in this basin will also be reclaimed to upland and wetland areas. Figure 3.8.0-2 presents the post-reclamation topography and drainage plan for the Little Payne Creek basin.

The cooling water reservoir will receive direct rainfall and runoff from its 835-acre area, including 727 acres of water surface area and 108 acres of interior berms and the inside slope of the exterior berm. The configuration and operation of the cooling reservoir are described in detail in Section 3.5.1.

Stormwater runoff associated with industrial activities from the CG process area and sulfur storage area will be collected and routed to the IWT system. Runoff associated with industrial activity from CT/CC units, fuel oil storage area, and substation will be treated in an oil/water separator and then discharged into the cooling reservoir.

The runoff from coal pile, slag storage, active brine storage, and IWT sludge storage areas will be collected in retention basins to allow settling of the suspended solids and then routed to the IWT system for further treatment. A small portion of the treated water from the IWT system will be used for dust suppression in the coal handling system, and the remainder will be discharged into the cooling water reservoir for reuse in the cooling system.

The total drainage area associated with industrial activities which ultimately discharges to the cooling reservoir is approximately 65 acres. In addition to recirculating cooling water and the IWT effluent, the cooling water reservoir receives other process waters described in Section 3.5. Blowdown from the cooling reservoir will be discharged to a reclaimed lake along the eastern edge of the cooling reservoir via a control structure (Outfall 001).

Two detention basins will be constructed to collect stormwater runoff from other plant site areas not described previously. The detention basins will provide water quantity and water quality treatment as required by SWFWMD. A 0.2-acre detention basin located south of the power block and adjacent to the northern berm of the cooling reservoir will receive runoff from the administration building, parking lot, and a small area in the immediate vicinity of the building. The total subbasin area is about 3 acres, and the detention basin will detain in excess of 1 inch of runoff from the area. The discharge from this detention basin will be drained via a control structure into a reclaimed wetland located east of SR 37 and west of the cooling reservoir (see Figure 3.8.0-2).

A 26-acre detention basin will be constructed to the north of the power block. This basin will receive stormwater runoff from a 172-acre upland facility area. This detention basin will detain in excess of 1 inch of runoff prior to discharging into a second wetland area lying to the west of the basin and northwest of the main plant facilities (see Figure 3.8.0-2).

The runoff from the detention basins and other site areas to the west of the power block plant site and east of SR 37 will also be drained into a wetland area to the west of the large detention basin. The discharge from this wetland will be routed north and then eastward via swales and Outfall 002 into the old mine-cut lake which also receives runoff from the northern portion of the project site. The total drainage area which discharges to the old mine-cut lake is approximately 1,994 acres.

The discharge from the old mine-cut lake will be drained southward into an existing reclaimed lake located along the eastern edge of the proposed cooling water reservoir. The blowdown from the reservoir will also be routed into this existing reclaimed lake. The blowdown and stormwater runoff discharges from the reclaimed lake will be routed offsite through a swale and drain into Little Payne Creek system which currently consists of a man-made ditch running along the west side of Fort Green Road near the project site.

3.8.4 HYDROLOGIC ANALYSIS

The onsite drainage plan has been designed to minimize the potential hydrologic impacts of the Polk Power Station project by restoring drainage basin boundaries to pre-mining conditions. However, the proposed project will alter certain land use patterns on the project site by the inclusion of the proposed reclaimed wetlands, plant facilities, and the cooling reservoir. Therefore, a hydrologic analysis of drainage patterns and stormwater flows within each of the onsite watersheds (Payne Creek, Little Payne Creek, and South Prong Alafia River) was conducted. The results of this analysis were used in establishing the proposed hydrologically balanced drainage plan.

In accordance with the drainage and stormwater management requirements of FDNR and SWFWMD, the potential hydrologic impacts of the proposed project can be assessed according to two evaluation criteria:

1. The project will not increase the peak runoff from the design storm (i.e., 25-year, 24-hour) compared with the pre-mining peak runoff to ensure that the proposed project will not worsen the potential for downstream flooding; and
2. The project will not increase the total mass flow and will not reduce the mass flow by more than 15 percent. These criteria will ensure that the project will cause no excessive diversion, addition, or consumption of the surface runoff.

A hydrologic model, HEC-1, developed by Hydraulic Engineering Center (USACE, 1990) was used to conduct the hydrologic analysis. The SCS runoff hydrograph method was selected to perform the surface runoff calculations. A storm event of a 25-year return period and 24-hour duration with SCS Type II distribution was used for the design storm for the hydrologic analysis. According to SWFWMD's surface water permit manual, the 25-year, 24-hour storm depth near the project area is approximately 9 inches.

For the analysis, each watershed was divided into a number of sub-basins according to the topography, land use, and other watershed characteristics. A weighted curve number for each sub-basin was computed based on its soil type and land use cover. The Payne Creek watershed, due to its small size on the site and uniform hydrologic characteristics, had only one basin for both pre-mining and post-reclamation conditions. South Prong Alafia River was divided into three sub-basins for pre-mining and four sub-basins for post-reclamation conditions. Alternately, Little Payne Creek watershed, which will consist of reclaimed upland and wetland systems, the plant facilities, and areas not disturbed by the project after site development, was divided into ten sub-basins for pre-mining and 16 sub-basins for post-reclamation conditions. The watershed post-reclamation/development and sub-basin boundaries for Little Payne Creek are shown on Figure 3.8.0-2.

The computed total mass flows for the design storm in the three watersheds are provided in Table 3.8.4-1 for pre-mining and post-reclamation conditions. The results indicate that the proposed project will decrease the mass flow in South Prong Alafia River by 5.6 percent. Mass flows in Payne Creek and Little Payne Creek will be reduced by 13.2 and 11.9 percent, respectively.

To assess potential flooding impacts, the hydrographs for each watershed under post-reclamation condition were compared with pre-mining hydrographs. Figure 3.8.4-1 shows the hydrograph comparison for the South Prong Alafia River watershed. Figures 3.8.4-2 and 3.8.4-3 illustrate the hydrographs for Payne Creek and Little Payne Creek, respectively. The results indicate that the proposed project will significantly reduce the peak runoff largely because of the extensive onsite wetland areas and water management facilities. The drainage plan for the proposed project will also allow runoff to be slowly released out of the detention areas, therefore reducing the probability of extreme dry conditions in the receiving streams. Table 3.8.4-2 summarizes the peak discharges for each watershed. The HEC-1 model inputs and outputs are presented in Appendix 11.8.9.

Table 3.8.4-1. Mass Flow Analysis

Sub-Watershed	Drainage Area (acres) Pre-Mining	Drainage Area (acres) Post-Reclamation	Mass Flow (ac-ft) Pre-Mining	Mass Flow (ac-ft) Post-Reclamation	Ratio (%)
South Prong Alafia River	816	801	411	388	94.4
Little Payne Creek	2,816	2,837	1,441	1,269	88.1
Payne Creek	716	710	380	330	86.8
TOTAL	**4,348**	**4,348**	**2,232**	**1,987**	

Note: Storm event = 25-year, 24-hour.
Rainfall depth = 9 inches.

Source: ECT, 1992.

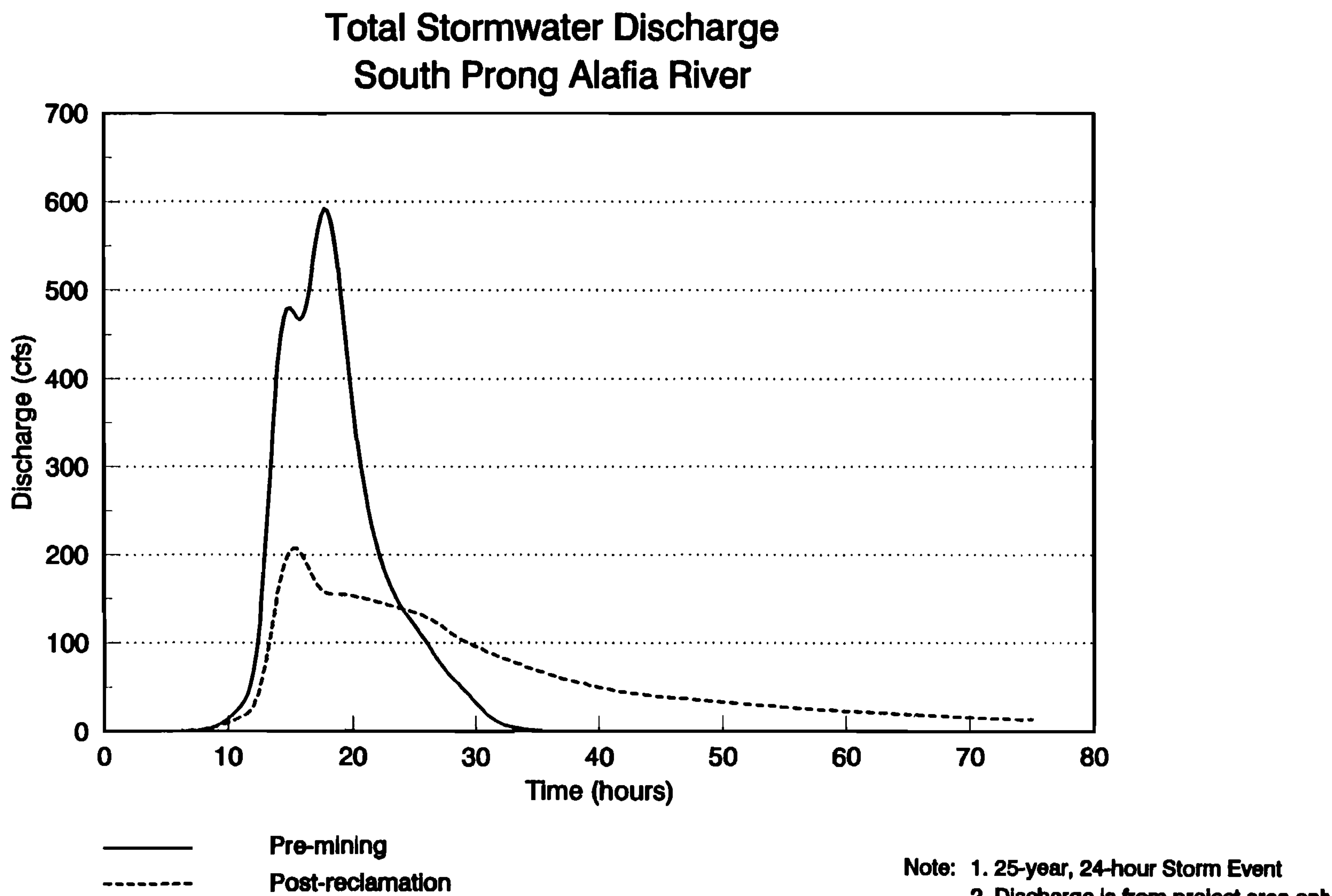

FIGURE 3.8.4-1.
PRE-MINING AND POST-RECLAMATION RUNOFF HYDROGRAPH FOR SOUTH PRONG ALAFIA RIVER BASIN (25 YEAR, 24 HOUR STORM)
Source: ECT, 1992.

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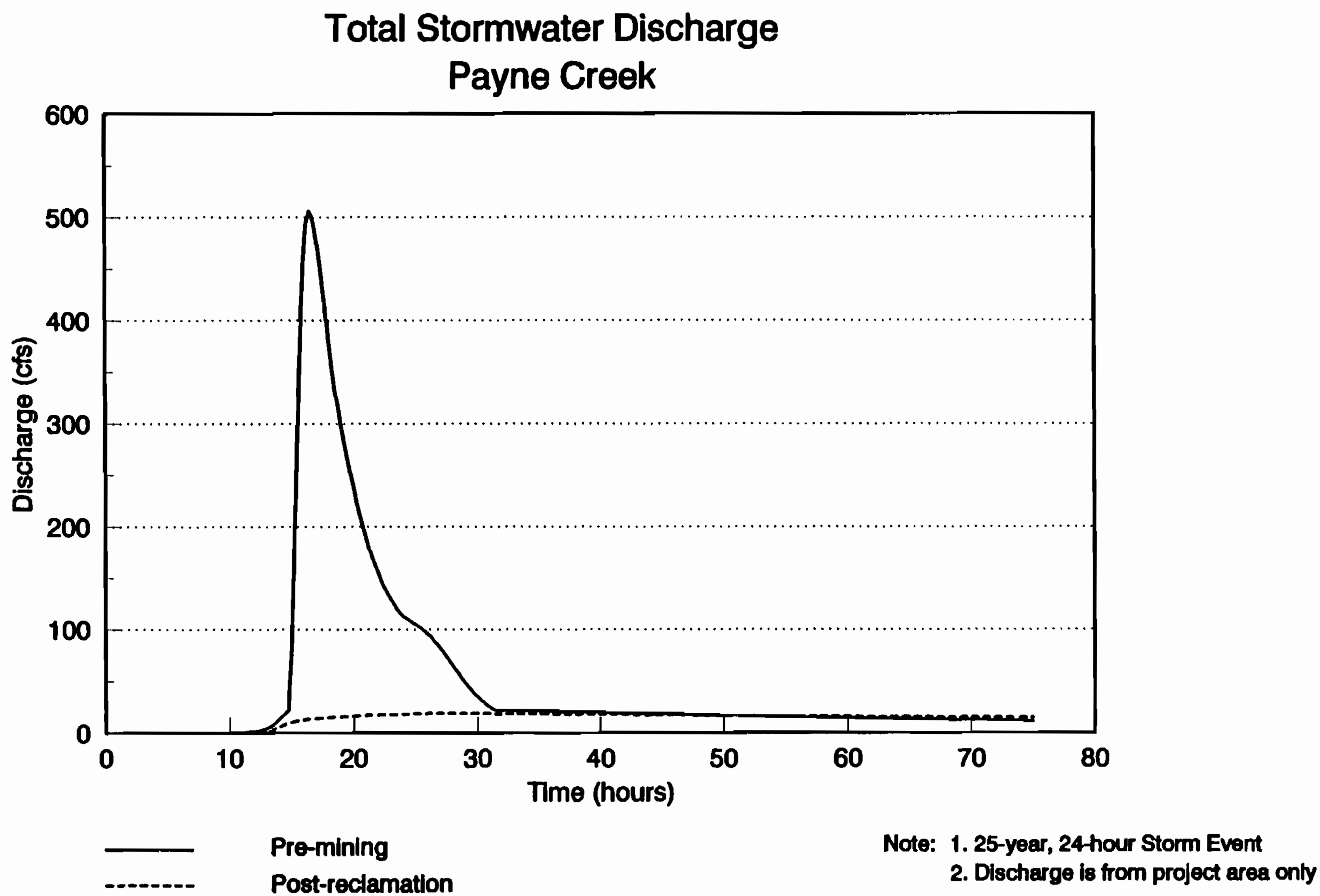

FIGURE 3.8.4-2.
PRE-MINING AND POST-RECLAMATION RUNOFF HYDROGRAPH FOR PAYNE CREEK BASIN (25 YEAR, 24 HOUR STORM)
Source: ECT, 1992.

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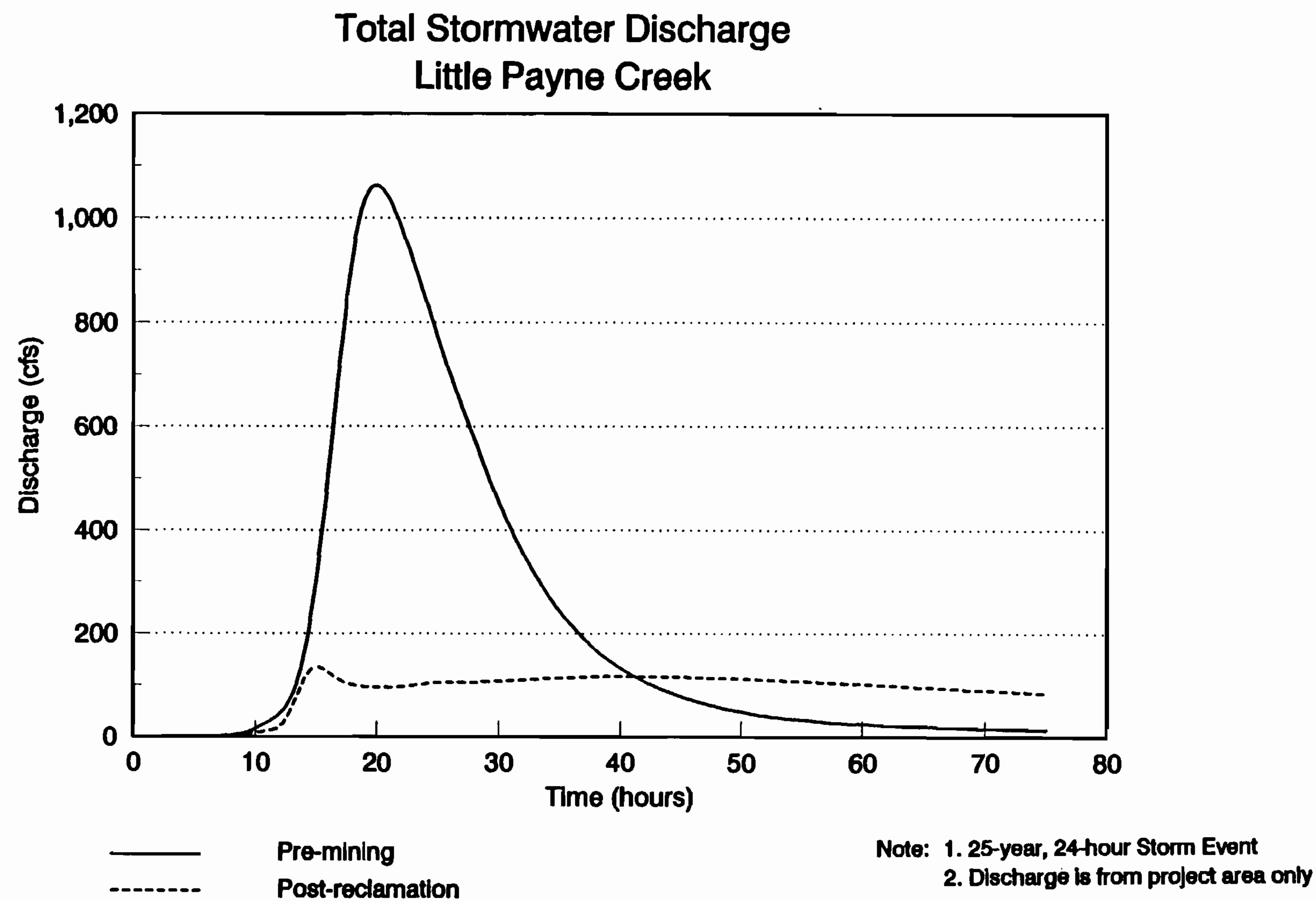

FIGURE 3.8.4-3.
PRE-MINING AND POST RECLAMATION RUNOFF HYDROGRAPH FOR LITTLE PAYNE CREEK BASIN (25 YEAR, 24 HOUR STORM)
Source: ECT, 1992.

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Table 3.8.4-2. Summary of Pre-Mining and Post-Reclamation Peak Runoff

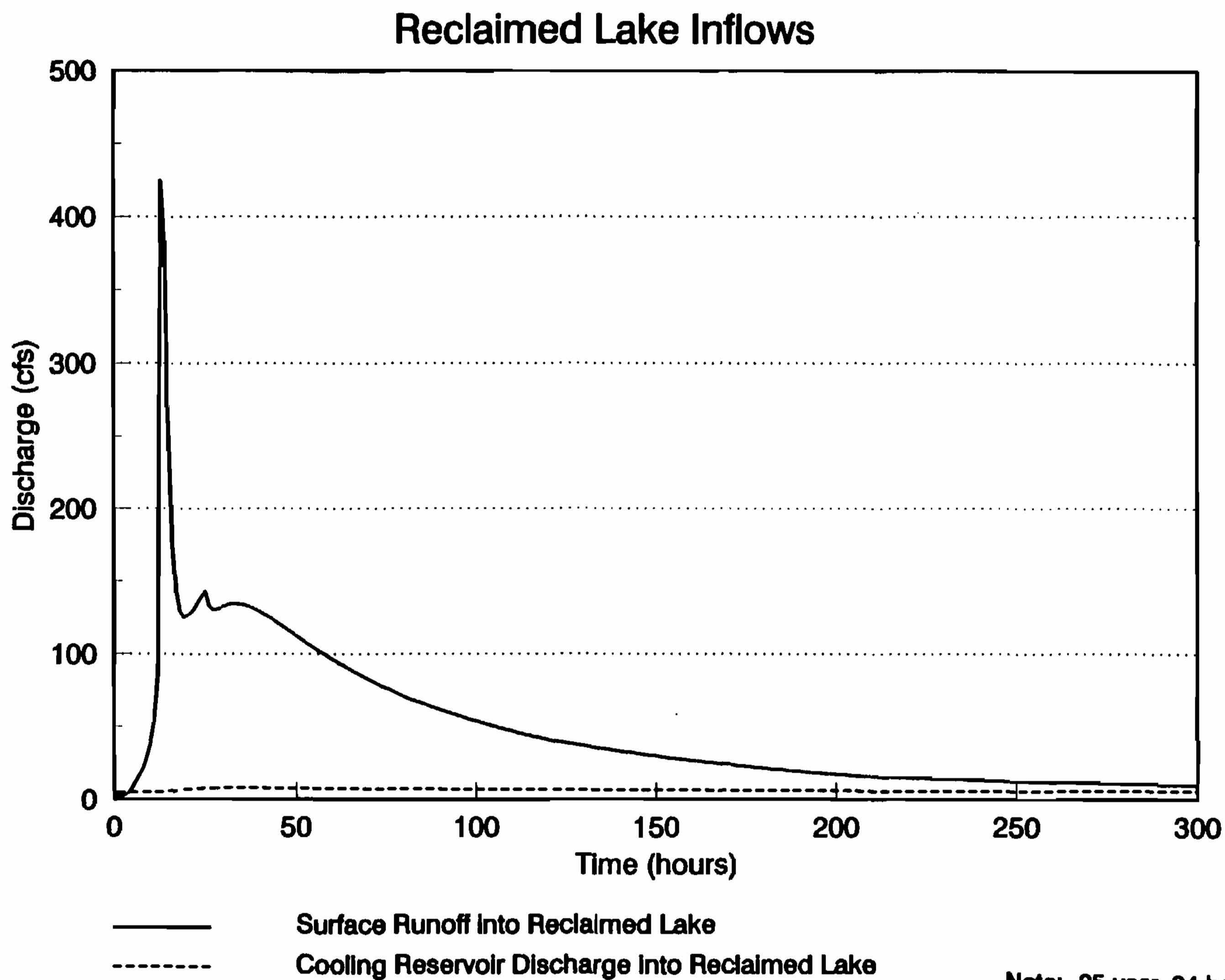
Watershed	Drainage (acres) Pre-Mining	Drainage (acres) Post-Reclamation	Peak Runoff (cfs) Pre-Mining	Peak Runoff (cfs) Post-Reclamation
South Prong Alafia River	816	801	541	208
Little Payne Creek	2,816	2,837	1,063	135
Payne Creek	716	710	506	19

Source: ECT, 1992.

As discussed in Section 3.5.1.2, the cooling reservoir will have an approximately 3.1-MGD discharge into the reclaimed lake under normal conditions. With a 9-inch rainfall (i.e., 25-year, 24-hour storm event), however, additional stormwater will be released from the reservoir through a 10-ft overflow weir. To assess the potential water quality and quantity impacts due to the increased blowdown from the overflow weir, the hydrograph of the reservoir discharge is compared with the surface runoff into the reclaimed lake, as shown in Figure 3.8.4-4. The solid line represents the surface runoff into the reclaimed lake, including runoff from a 277-acre offsite drainage area. Figure 3.8.4-4 indicated that the maximum surface runoff is about 465 cfs while the maximum cooling reservoir discharge under 25-year, 24-hour storm is about 8.2 cfs; therefore, the surface runoff into the reclaimed lake will provide significant mixing to the reservoir discharge even though the blowdown will increase with a 9-inch storm.

The mixing ratio between the surface runoff and the cooling reservoir discharge is shown in Figure 3.8.4-5. The analysis shows that the maximum mix ratio of the surface runoff is approximately 82:1 during the design storm, and the mix ratio will decrease when the surface runoff into the reclaimed lake has receded. The mixing ratio at 300 hours (12.5 days) after the storm is approximately 8.1:1. On an annual average basis, the base flow into the reclaimed lake is approximately 2.7 cfs and will have a mix ratio of 0.6:1 to be mixed with 3.1 MGD blowdown.

To assess the possibility of flooding at the proposed facilities, a 100-year, 24-hour storm (approximately 11 inches) was used to simulate the hydrograph and to predict the water levels of the water bodies in the project area. The results indicate that the highest water level will occur at the 0.2-acre and 26-acre retention basins. Both basins will have a water level of 138.8 ft-NGVD at the peak stage, and the maximum stage in the wetland areas to the east of SR 37 is approximately 137.9 ft-NGVD. The maximum stages in the old mine-cut is approximately 137.9 ft-NGVD.



Note: 25-year, 24-hour Storm Event

FIGURE 3.8.4-4.
COMPARISON BETWEEN COOLING RESERVOIR DISCHARGE AND SURFACE RUNOFF INTO THE RECLAIMED LAKE
Source: ECT, 1992.

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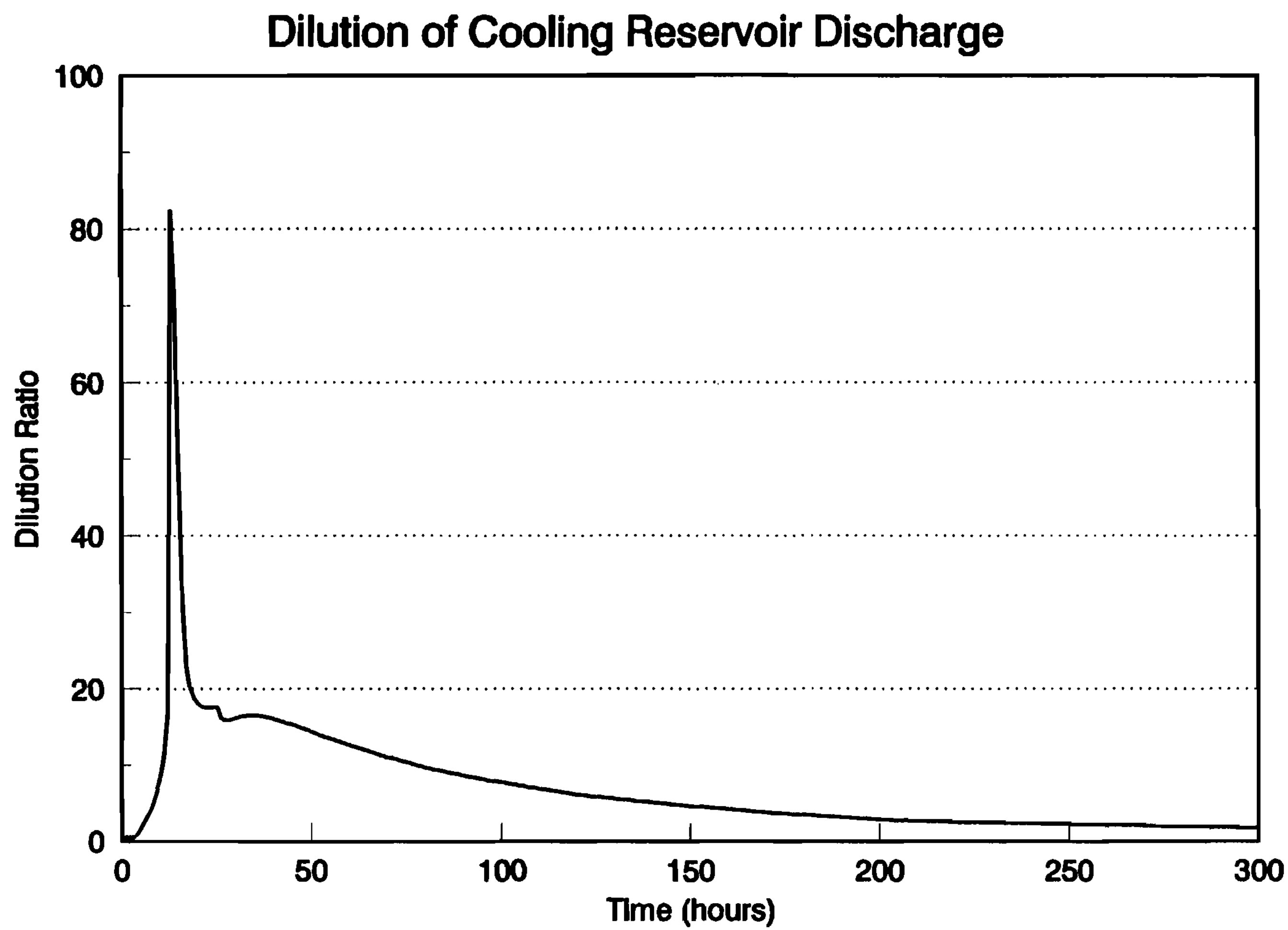

Dilution Ratio = Surface Runoff into Reclaimed Lake / Cooling Reservoir Discharge

Note: 25-year, 24-hour Storm Event

FIGURE 3.8.4-5.
DILUTION RATIO BETWEEN SURFACE RUNOFF AND COOLING RESERVOIR DISCHARGE
Source: ECT, 1992.

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The plant facility areas will be graded to be above 140 ft-NGVD; therefore, the facilities will not be flooded with a 100-year storm.

The HEC-model inputs and outputs are presented in Appendix 11.8.9 and in the Conceptual Reclamation Plan submitted separately to FDNR.

The results of the hydrologic analysis indicate that the post-reclamation peak discharge will be significantly lower than the pre-mining peak discharges; therefore, the proposed project will not cause additional downstream flooding under the 25-year, 24-hour storm event. However, the continuous 3.1 MGD blowdown will increase baseflow in the Little Payne Creek system during dry periods.

According to Table 2.3.4-1, the pre-mining drainage areas of the Little Payne Creek at Fort Green Road and at Route 665 near Bowling Green are 6,567 acres and 24,693 acres, respectively. Based on an annual average flow of 0.8 CSM for Little Payne Creek basin, the average pre-mining discharge at Fort Green Road and 8.2 cfs and 30.9 cfs, respectively.

Similarly, the post-reclamation drainage areas of the Little Payne Creek at Fort Green Road and at Route 665, excluding the cooling reservoir, are 5,646 acres and 23,793 acres, respectively, and the annual average flows at these two locations including the 3.1-MGD cooling reservoir blowdown are 11.9 cfs and 34.5 cfs, respectively. The results indicate that the proposed project will increase the average flow of Little Payne Creek by 3.7 cfs. This increased flow will raise the water level of Little Payne Creek at Fort Green Road approximately 0.2 ft. The water level increase will be diminished further downstream. The increase of water depth at the USGS gauging station near Bowling Green will be approximately 1.4 percent, or less than 1 inch.

3.8.5 STORMWATER MANAGEMENT DURING CONSTRUCTION

As described in Section 4.2., stormwater runoff from the site during construction activities will normally be retained in the onsite mine cuts and cooling water reservoir area under normal rainfall conditions. However, offsite stormwater discharges may occur during construction under higher rainfall conditions or storm events. Best management practices will be implemented to prevent soil erosion and to remove any sediments from any potential offsite runoff discharges. The sediment control and stormwater management practices to be used during construction are discussed in detail in Section 4.2.

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 3.2.0-1, existing roads to the site include Fort Green Road to the east of the power block area, SR 37 to the west of the power block, and CR 630 located along the north site boundary. An existing CSX railroad is located along Fort Green Road to the east.

During initial construction activities, Tampa Electric Company will construct appropriate geometric improvements at the intersections of the two entrance roads from SR 37 and the Fort Green Road entrance road to accommodate the projected construction and operational workforces, while not adversely affecting the operations (i.e., LOS) of the existing roadways. These improvements are shown in Figures 4.1.2-1 and 4.1.2-2 for the main plant and Bethlehem Road entrances, respectively. The detailed transportation analysis for the Polk Power Station demonstrated that the projected construction-related traffic will not lower other existing roadway links and intersections in the project area to unacceptable LOS levels (see Appendix 11.6).

The planned roads will be constructed in accordance with applicable FDOT and Polk County requirements. A rail spur will also be constructed on the site from the CSX Railroad to allow the movement of materials onto the site by rail. Materials will be unloaded and moved around the site using cranes, trucks, and forklifts. Some of the heavier items, such as the CTs, generators, and transformers, will require rail delivery and special rigging for onsite handling. Pollution control measures for the laydown areas will include runoff collection in temporary drainage basins and ditches and water spraying for dust control. Water collected in ditches and basins will be routed to onsite water storage subareas.

Storage of materials will be conducted in a manner which will not create an environmental or safety hazard. Bags, containers, bundles, etc., stored in tiers will be stacked, interlocked, and limited in height so that they are stable and secure against sliding or collapse. Storage areas will be kept free from an accumulation of materials that constitute hazards from fire, explosion, or spills. Suitable fire extinguishing equipment will be kept near flammables in a state of readiness for instant use.

3.9.2 OPERATIONAL MATERIALS

The handling and storage of fuels and other operational chemicals are discussed in Sections 3.3 and 3.6, respectively. Handling and storage of solid and hazardous wastes and gasification by-products (i.e., slag, sulfur, and H_2SO_4) are discussed in Section 3.7. These operational materials, wastes, and by-products will be handled and stored in a manner which complies with applicable environmental regulations and prevents the release of untreated chemical constituents to the site soil, surface water, and groundwater resources.

REFERENCES

Bretschneider, C.L., and Reid, R.O. 1953. Change in Wave Height Due to Bottom Friction, Percolation, and Refraction. 34th Annual Meeting of American Geophysical Union.

Florida Department of Environmental Regulation (FDER). 1991. Permit Files for Selected Facilities. Tallahassee, FL.

Ippen, A.T. 1966. Editor. Estuary and Coastline Hydrodynamics. McGraw-Hill.

San Bernardino County Air Pollution Control District (SBCAPCD). 1989. Permit File for Cool Water Coal Gasification Plant. Victorville, CA.

U.S. Army Corps of Engineers (USACE). 1984. Shore Protection Manual. Coastal Engineering Research Center, Waterway Experiment Station. Corps of Engineers, Vicksburg, MS.

U.S. Army Corps of Engineers (USACE). 1991. HEC-1 Flood Hydrograph Package, User's Manual, Hydrologic Engineering Center. Davis, CA.

U.S. Environmental Protection Agency (EPA). 1990. New Source Review Workshop Manual. Prevention of Significant Deterioration and Nonattainment Area Permitting. Office of Air Quality, Planning and Standards, Research Triangle Park, NC.

U.S. Environmental Protection Agency (EPA). 1990. Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual. Fourth Edition. EPA 450/3-90-006. Research Triangle Park, NC.

U.S. Environmental Protection Agency (EPA). 1992. BACT/LAER Information System (BLIS). Research Triangle Park, NC.

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4.0 EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

4.1 LAND IMPACT

As discussed in Section 2.3.5, more than 94 percent of the 4,348-acre Polk Power Station site has been or will be disturbed by phosphate mining activities prior to Tampa Electric Company's use of the site for the proposed project. Also, more than 3,330 acres (i.e., more than 76 percent) of the site which have been recently or will be mined or disturbed would be subject to further disturbance by reclamation activities required under FDNR regulations even without the proposed Polk Power Station project. These required reclamation activities would essentially involve earthmoving and dewatering activities similar to those needed for the proposed project. Therefore, the general site preparation and construction activities for the Polk Power Station will have minimal impacts on land resources on and in the vicinity of the site.

4.1.1 GENERAL CONSTRUCTION IMPACTS

The general site preparation and construction activities associated with the overall development of the project site include the following:

- Clearing, grubbing, corridor preparation, and construction of the three access roads and rail spur to the main power plant facilities area;
- Construction of temporary berms within the cooling reservoir area to provide separate subareas for onsite storage of water from dewatering and stormwater runoff from other subareas under construction;
- Sequential dewatering of reservoir and reclaimed wetland subareas by pumping to other subareas and excavation and surrounding and internal berm construction activities in dewatered subareas of the reservoir;
- Construction of temporary stormwater runoff storage basins and drainage ditches to collect and route runoff to onsite water storage subareas within the cooling reservoir area or, as needed, to offsite drainage basins during grading, excavation, and construction activities;

- Clearing, grubbing, and cutting of main plant site area and filling the area with materials excavated from cooling reservoir area;
- Stabilizing, grading, and contouring main plant facilities area for construction of facilities foundations, interior roadways, and parking lots;
- Construction of areas for coal unloading, permanent stormwater retention basins, by-product, fuel storage, water and wastewater treatment, and brine and wastewater treatment sludge storage;
- Performing groundwork, as necessary, for construction of facility footings and foundations and underground electrical, water, and other utility piping systems;
- Development of substation and onsite and offsite transmission line rights-of-way; and
- Earthmoving, grading, and contouring for reclaimed wetland and upland areas and re-establishing drainage systems to pre-mining conditions.

These site preparation and construction activities are not expected to require the use of explosives. Materials for filling and preparing areas for development will be provided from other onsite areas except for some finishing foundation and bed support materials such as limerock, crushed rock ballast, and other materials which will be provided from regional, contracted sources.

4.1.1.1 Main Power Plant Facilities and Cooling Reservoir Areas

The main power plant facilities, excluding the cooling reservoir, will be primarily constructed on lands which have not been mined for phosphate, but have, for the most part, been disturbed by associated mining activities such as dragline walk corridors, vehicle access roads, and material storage areas. As shown in Figure 3.2.0-2, the area developed for the main power plant facilities will be approximately 150 acres or 3 percent of entire Polk Power Station site. The proposed facilities within this area include the power block areas; the coal and fuel oil delivery and storage areas; the CG facilities and associated coal preparation and process water handling and brine storage areas; the by-product temporary storage and handling areas; the water supply and wastewater treatment and temporary sludge storage areas; parking lot areas, administration, and general services and maintenance buildings; and construction laydown and temporary parking areas. These areas include all facilities for the full build-out (i.e., approximately 1,150 MW) of the Polk Power Station site in the 1994 through 2010 timeframe (see Table 3.1.0-1).

The cooling reservoir will be constructed on lands which have been primarily mined for phosphate. The entire reservoir facility will include approximately 860 acres of land, including the surrounding earthen berms. The proposed reclaimed wetland and upland areas to the west and north of the main plant facilities site will also be developed in mined-out areas. Development activities for the cooling reservoir and reclaimed wetlands and uplands in these mined out areas will require dewatering of the specific subareas under construction. Also, soil materials will be excavated from the dewatered subareas of the reservoir and used to fill the main plant site area and reclaimed wetland areas.

All dewatering water from these general site preparation activities will be collected, managed, and contained within the site boundaries by sequentially pumping or routing water to and from subareas within the site as the construction activities proceed. Therefore, no offsite land or surface water body impacts are expected from the proposed construction activities except for potential discharges of stormwater runoff. These stormwater runoff discharges will be detained within the storage subareas allowing for sediment settling in accordance with the applicable requirements of Chapter 40D-4, F.A.C. No adverse impacts are expected from these stormwater discharges.

The initial site preparation activities for the main plant site and cooling reservoir areas will involve establishing preliminary site access and clearing, grubbing, and initial earthwork activities in the plant site, access road, and rail spur areas. Temporary berms will be constructed within the mined-out reservoir area to establish three subareas for the sequential dewatering, water storage, and construction of the cooling reservoir. Temporary stormwater runoff basins and drainage ditches will be developed, as needed, to route runoff to the onsite water storage subareas. The initial site preparation efforts also include grading and contouring activities to re-establish drainage patterns on the portion of the site to the east of SR 37 to the Little Payne Creek system which is similar to pre-mining conditions. Any potential stormwater runoff discharges from the site during the construction activities will be routed through these re-established drainage systems.

During normal rainfall conditions, stormwater runoff from areas under construction will generally be contained within the dewatering storage subareas on the site. Some runoff may need to be discharged from these storage subareas to the Little Payne Creek system. The stormwater runoff will be initially detained within the storage subareas or constructed detention basins to allow for sediment settling and will be discharged through overflow swale(s) with appropriate controls and measures (e.g., straw bales and silt fences) to minimize transport of sediments offsite. Therefore, any stormwater runoff discharges are not expected to adversely impact offsite water bodies.

As construction activities proceed in the dewatered subareas of the cooling reservoir, soil materials will be excavated and used to fill the main plant site area and adjacent reclaimed wetland areas. Existing elevations on the plant site area range between 135 and 140 ft-NGVD. This area will be cut, filled, stabilized, and graded to final elevations ranging from 140 to 145 ft-NGVD. Figures 3.8.0-1 and 3.8.0-2 present the finish grade contours and post-reclamation drainage basins on the plant site and cooling reservoir areas to the east of SR 37 and on the remainder of the site to the west of SR 37. After these initial site preparation activities are completed, construction activities will proceed for the coal unloading facility (i.e., dump pit hopper), the rail spur and loop, the entrance roads, rough grades for interior roads, and the permanent stormwater management basins and structures. The remaining construction activities on the plant site area will involve specific groundwork needed for the foundations of the power block, CG, and associated facilities and structures;

the coal, fuel, and by-product storage areas; the brine and wastewater treatment sludge storage areas; the permanent parking lots; the administration and maintenance buildings; and the substation. These activities will also include the construction and installation of underground electrical, water, and other utility piping systems, including the recirculating water pipelines to and from the reservoir. After final grading, areas of the plant site which do not involve additional construction activities will be grassed to prevent erosion.

The cooling reservoir and reclaimed wetland systems adjacent to the plant site will be constructed on mined-out lands. Currently, these lands consist primarily of spoil pile rows with elevations generally ranging from approximately 155 to 160 ft-NGVD and up to 170 to 180 ft-NGVD and water-filled mine cuts with bottom elevations ranging from approximately 100 to 120 ft-NGVD and water surfaces ranging from approximately 125 to 135 ft-NGVD. In addition to the excavation of materials for filling the plant site, site preparation activities for the cooling reservoir will include the construction of a surrounding earthen berm and a series of internal earthen berms. The internal berms will be used to maximize the residence time of the recirculating water within the reservoir by specifically directing the discharged water throughout the reservoir area prior to its intake and reuse. After final contouring, both the surrounding and internal berms will have top elevations of approximately 145 ft-NGVD, while the bottom of the reservoir will have a maximum elevation of approximately 120 ft-NGVD. The berms will have gentle interior and exterior slopes (i.e., 4:1 horizontal to vertical) and therefore will be structurally stable. During plant operations, the average elevation of water within the reservoir will be maintained at approximately 136 ft-NGVD.

4.1.1.2 Wildlife Habitat/Corridor Area

More than 89 percent (1,345 acres) of the 1,511-acre portion of the Polk Power Station site to the west of SR 37 has been mined or will be mined and disturbed prior to Tampa Electric Company's use of this property tract for the proposed project. Currently, Agrico has ongoing mining operations on this tract which are expected to be completed in 1994. For the Polk Power Station, this portion of the site will be reclaimed to an integrated system of forested and non-forested wetlands and uplands which will develop as a wildlife habitat/corridor area. The proposed reclamation activities will occur on those portions of the tract which have been disturbed by mining. Therefore, the proposed activities will have no adverse land impacts and will have positive impacts by reclaiming mined-out lands to a significant environmental resource area in southwest Polk County.

Since no power plant facilities or structures will be located on this site tract, the proposed site preparation activities will be similar to those used for reclamation of mined phosphate lands in central Florida. These activities generally involve the sequential dewatering of mined-out subareas by pumping water to other mined-out subareas and cutting, filling, and grading earthwork activities in the dewatered subareas. Similar to the main plant site and cooling reservoir area, the dewatering water and stormwater runoff from the subareas under preparation will generally be collected and maintained within the site boundaries. Some runoff may be discharged offsite after initial detention and through appropriate control measures to prevent sediment transport. This runoff would be routed to either the Payne Creek or South Prong Alafia River systems similar to pre-mining conditions on this tract. The site preparation/reclamation activities will not adversely impact offsite lands or surface water bodies. Also, after final contouring, the subareas will be seeded and planted to control potential erosion. The proposed post-reclamation vegetation plans for this tract were presented in Figure 3.2.0-1 and discussed in Section 3.2.

4.1.1.3 <u>Other General Activities</u>

Construction waste materials will be appropriately collected, managed, and disposed in accordance with applicable rules and regulations. Combustible construction wastes (e.g., wood, paper, etc.) will be burned onsite in accordance with applicable state and local requirements. General waste materials (i.e., garbage) will be collected in appropriate waste collection containers and periodically transported offsite for disposal at an approved facility. Other construction wastes (e.g., metal, wire, piping, etc.) will be stockpiled for salvage, to the extent possible, and then also removed from the site for disposal at an approved facility.

Waste oil from construction vehicles and equipment will be collected in appropriate containers and transported offsite for recycling or disposal at an approved, permitted facility.

During site preparation and construction, the construction labor force will use portable chemical toilets. These facilities will be provided and serviced by a licensed contractor and all sanitary sewage from these facilities will be transported offsite by the contractor for appropriate disposal.

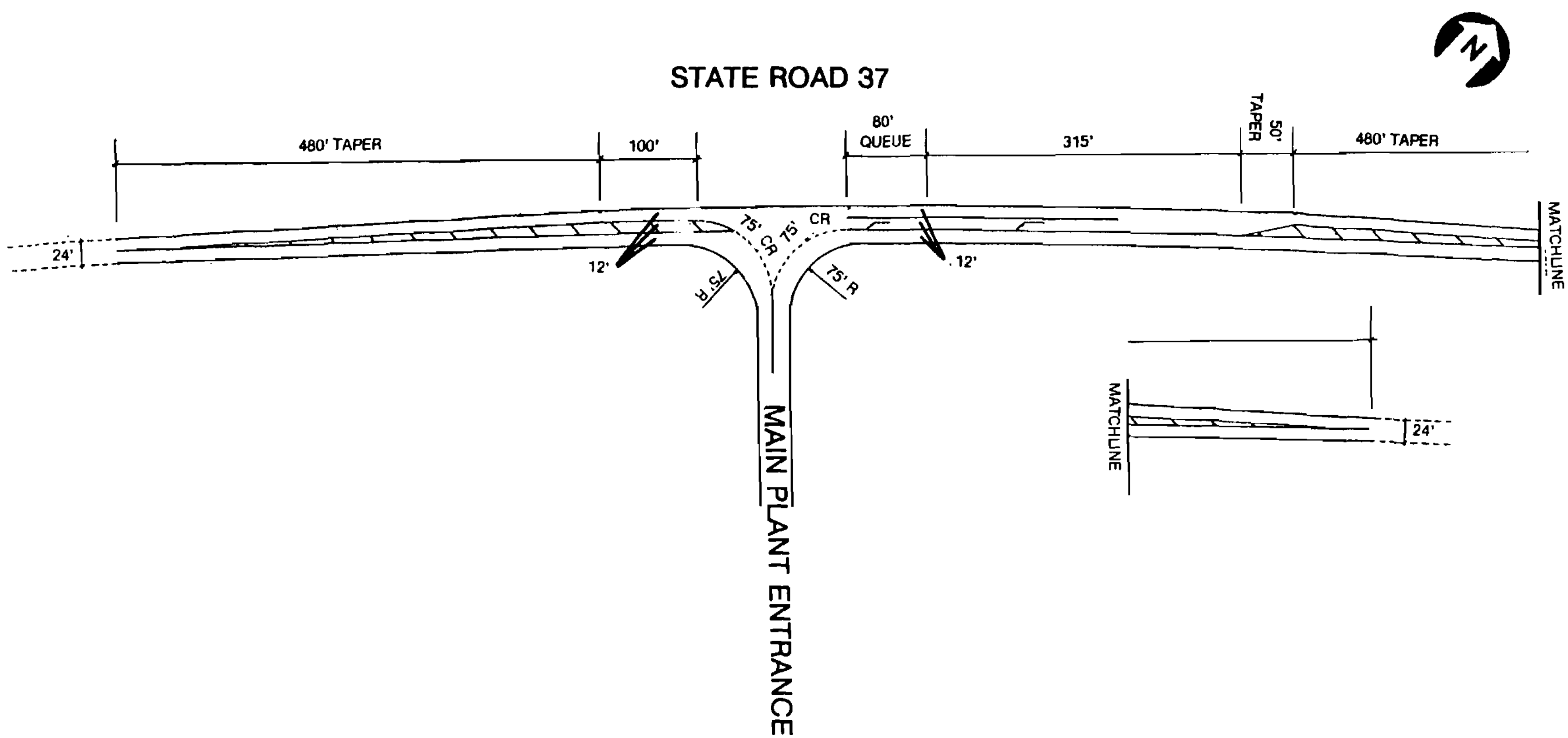
Under contractual arrangements with Tampa Electric Company, individual contractors will be responsible for handling any potential hazardous materials and wastes resulting from their onsite activities, including the appropriate offsite disposal of any wastes.

4.1.2 ROADS

During the initial construction phase of the Polk Power Station, the three planned access roads for the facility operations will be constructed (see Figure 3.2.0-2). Two of these roads will access SR 37 and one road will provide access to and from Fort Green Road (CR 663). The main plant and operational employee entrance road will connect with SR 37 at a point approximately 2,500 ft to the north of the Albritton Road intersection with SR 37 (i.e., approximately halfway between the Albritton Road and Bethlehem Road intersections on SR 37). The other entrance road on SR 37 will be located opposite the Bethlehem Road intersection. This entrance will primarily provide access for contracted construction labor and construction and operational deliveries. The Fort Green entrance road will also provide access for the construction workforce and construction and operational deliveries. All three of these entrance roads will have security checkpoints or be gated to control access to the plant site.

The planned access roads will be constructed in accordance with applicable FDOT and Polk County requirements to provide safe access to the site. Also, during the initial construction activities, Tampa Electric Company will construct certain geometric improvements at the intersections with SR 37 and Fort Green Road to accommodate the projected construction and operational workforces, while not adversely affecting the operations (i.e., LOS) of the existing roadways. Based on FDOT standards, schematic representations of these proposed driveway entrance improvements on the state road are shown in Figure 4.1.2-1 and 4.1.2-2 for the main and Bethlehem Road entrances, respectively. A detailed transportation analysis conducted for the Polk Power Station project (Lincks, 1992) demonstrated that the projected construction-related traffic will not lower other existing roadway links and intersections in the project area to unacceptable LOS levels in their current conditions and geometries (see Appendix 11.6).

As shown in Figure 3.2.0-2, two transmission line service roads will also be constructed for the project. One service road for the northern transmission line



NOTES:

1. TAPERS BASED ON 60 MPH DESIGN SPEED AND CENTERED WIDENING.
2. QUEUE LENGTH BASED ON OPERATIONAL PROJECT TRAFFIC.
3. THIS IS A CONCEPTUAL LAYOUT OF THE PROPOSED ROADWAY IMPROVEMENTS. THE ACTUAL DIMENSIONS ARE SUBJECT TO CHANGE BASED ON THE FINAL DESIGN AND FDOT APPROVAL.

FIGURE 4.1.2-1.

SCHEMATIC DRIVEWAY IMPROVEMENTS, SR 37 AT POLK POWER STATION MAIN PLANT ENTRANCE

Sources: FDOT, 1992. Lincks and Associates, 1992.

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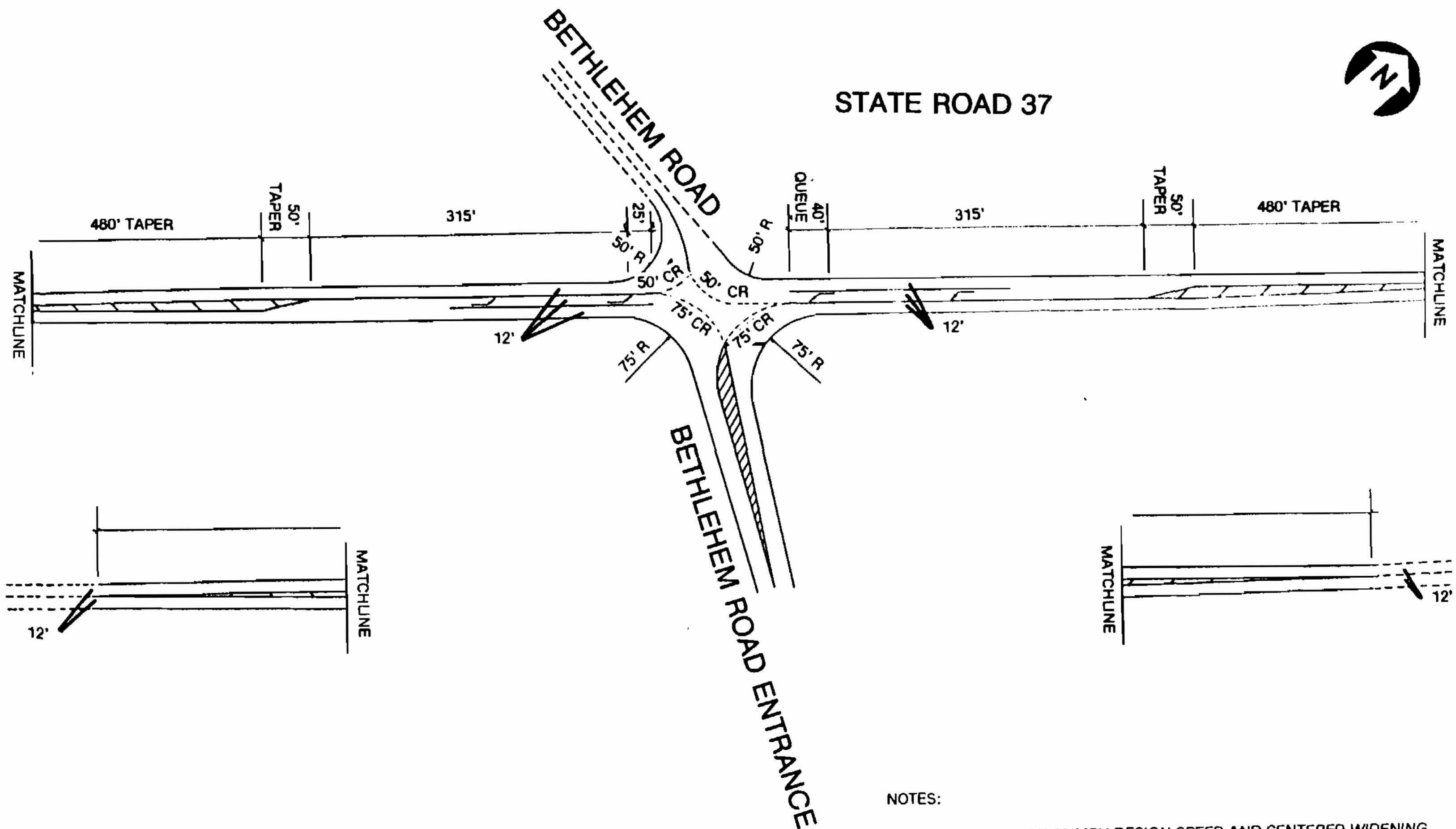

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3. THIS IS A CONCEPTUAL LAYOUT OF THE PROPOSED ROADWAY IMPROVEMENTS. THE ACTUAL DIMENSIONS ARE SUBJECT TO CHANGE BASED ON THE FINAL DESIGN AND FDOT APPROVAL.

FIGURE 4.1.2-2.

SCHEMATIC DRIVEWAY IMPROVEMENTS, SR 37 AT POLK POWER STATION BETHLEHEM ROAD ENTRANCE

Sources: FDOT, 1992. Lincks and Associates, 1992.

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corridor will access SR 37 at a point approximately 1,500 ft to the north of the Bethlehem Road entrance and the other service road for the eastern transmission line corridor will access Fort Green Road at a point approximately 1,300 ft south of CR 630. These service roads will only be used for periodic transmission line and corridor maintenance and inspection purposes and will have locked gates to control access from the existing roadways. Therefore, only a limited number of vehicles will be occasionally using these service roads and their construction and use will have no impacts on existing roadways.

4.1.3 FLOOD ZONES

As shown in Figure 2.1.0-1, portions of the Polk Power Station site were designated as 100-year floodplain areas by FEMA under land conditions which existed prior to recent phosphate mining activities (i.e., prior to 1983). These pre-mining floodplains were primarily associated with the headwater areas of Little Payne Creek and Payne Creek and the floodplain of the South Prong Alafia River. In general, the areas designated as 100-year floodplains were at elevations of less than 140 ft-NGVD. As shown in the recent aerial photograph of the site in Figure 2.1.0-2, the majority of these pre-mining floodplains on the site have been mined and are not currently connected to the creek and river systems. Mining of the floodplains was conducted in accordance with agency-approved mining and reclamation plans.

As discussed in Section 4.1.1, an unmined portion of the Polk Power Station site to the east of SR 37 will be cleared and filled to serve as the location for the main power plant facilities. The final elevations in this filled area will range from 140 to 145 ft-NGVD. Therefore, the main power plant facilities and structures will be located in areas with elevations above the 100-year floodplain elevation in compliance with federal and local flood program regulations.

In addition, all plant facilities and stormwater management systems have been designed to comply with all applicable SWFWMD, FDNR, and Polk County requirements regarding flood protection and control. After site development/reclamation, the proposed stormwater management systems, including the cooling reservoir, have been designed to significantly reduce the contribution of the site area to potential flooding conditions in downstream areas of the Little Payne Creek, Payne Creek, and South Prong Alafia River systems compared to pre-mining conditions on the site. As discussed in Section 3.8, the proposed onsite stormwater management and drainage systems will control and significantly reduce peak flow runoff rates from the site during extreme storm events (e.g., the 24-hour, 25-year design storm). Therefore, the proposed project will not have any adverse flooding impacts on offsite properties and will have beneficial effects by reducing the contribution of the site to potential downstream flooding conditions during extreme storm events.

4.1.4 TOPOGRAPHY AND SOILS

Previous and ongoing phosphate mining activities have significantly altered the historical topography of the Polk Power Station site. As discussed in Section 2.3.1, prior to the recent (i.e., since the early 1980s) mining activities, land surface elevations ranged from approximately 130 to 200 ft-NGVD. The low elevation occurred in the southeast corner of the site, while the high elevations occurred in the northeast portion of the site where old mine sand tailings mounds from mining activities in the early 1900s are located. Other pre-recent mining elevations on the site generally ranged from 130 to 150 ft-NGVD on the site tract to the east of SR 37 and from 110 to 145 ft-NGVD on the tract to the west of SR 37. Again, prior to recent mining, the land surface on the site was relatively flat with gentle slopes, except for the old mine tailing mound areas and along the unnamed tributary to the South Prong Alafia River in the northwest corner of the site.

The recent and ongoing mining activities have created or will create topographic features primarily consisting of mine cuts and spoil piles. The highest spoil pile elevations range from 170 to 180 ft-NGVD. The mine cuts, mostly water-filled, generally have bottom elevations ranging from approximately 100 to 120 ft-NGVD.

The proposed site preparation and construction activities will involve altering the existing topography of the site to facilitate construction of the plant facilities and cooling reservoir and to reclaim other mined areas in accordance with agency-approved reclamation plans. Also, as discussed in Section 3.8, the proposed plans include the re-establishment of drainage system watershed divides and acreages to pre-mining conditions. The general site preparation activities will involve the use of cut and fill soil materials from within the site. Soil materials will not be imported to or exported from the site, except for specific foundation supporting materials such as crushed limerock and gravel for structures and onsite roads and possibly clay to reduce seepage through the reservoir berms. Therefore, except in the immediate areas of the main plant facilities and roads, general onsite soil conditions, percolation rates, and stormwater runoff rates after site development/reclamation will be similar to those which currently exist on the site or existed prior to mining. The immediate areas for the main plant facilities comprise only approximately 150 acres of the entire 4,348-acre site.

With appropriate compaction and densification activities, the bearing strengths and stability of soils on the site are expected to be suitable for general foundation preparation activities and construction of the berms surrounding and inside the cooling reservoir. Depending on the site-specific soil conditions and load bearing requirements of specific structures, foundations for the proposed facilities will consist of concrete or crushed stone mats, individual spread footings, or pile-supported foundations. These site preparation measures and foundation construction techniques will minimize any potential settlement impacts for the main plant structures.

The cooling reservoir will be constructed in mined-out lands to the east and south of the main plant facility site. The proposed design of the reservoir is described in Section 3.5.1. The cooling reservoir will be primarily a below-grade facility with bottom elevations of approximately 120 ft-NGVD and a normal operating water surface elevation of approximately 136 ft-NGVD. The earthen berms surrounding and inside the reservoir will be constructed with soil materials excavated from within the mined-out reservoir area. The berms will have top elevations of approximately 145 ft-NGVD and gentle interior and exterior slopes of 4:1 (horizontal and vertical) to provide for structural stability and minimize potential soil erosion impacts. The berms will be grassed and/or planted with other materials, and the vegetation growth will be actively managed and controlled to prevent soil erosion. Stone rip-rap or other appropriate materials will also be used, as needed, along berm areas with relatively higher velocity water flows (e.g., near internal intake and discharge structures and the outfall control structure) to prevent potential erosion impacts. The construction and operation of the cooling reservoir will increase evaporation and groundwater seepage to the surficial aquifer compared to pre-mining conditions in the reservoir area (see Section 5.1).

The coal and fuel oil storage areas, temporary slag by-product and industrial wastewater treatment sludge storage areas, and permanent storage cells for brine from the gasification process water system will be lined with low-permeability materials which will preclude groundwater seepage from the areas. Also, stormwater runoff from these areas will be collected and appropriately treated prior to being routed to the cooling reservoir for reuse. The design and operation of these areas and systems are described in Section 3.0. By design, the stormwater runoff and groundwater percolation rates from these areas will be altered from pre-mining and existing conditions. However, as discussed in Section 5.3, these alterations will not adversely impact groundwater and surface water quality and quantities on the Polk Power Station site or on offsite properties.

As discussed in Section 2.3.2.2, the potential for sinkhole development on the Polk Power Station site is relatively low compared to most other areas in Polk County. The proposed site preparation and construction activities as well as the facility operations are not expected to adversely impact site conditions for, or be conducive to, potential sinkhole development (see Appendix 11.7.5).

As discussed in Section 4.2, an appropriately designed soil erosion and sedimentation plan will be implemented during site preparation and construction activities to minimize potential soil erosion impacts. According to this plan, all stormwater runoff from areas under preparation and construction during the initial site development phase will be collected and maintained on the site within specific subareas or basins. The plan also includes the use of sediment control measures such as straw bailing and silt fences, as needed, in specific areas under construction. After final grading and contouring, the areas will be seeded and/or planted with other vegetation to stabilize the soils. The onsite stormwater runoff management plan after the initial site preparation and construction activities is described in Section 3.8.

Construction-related alterations in site topography and soils will have no adverse effects on aesthetics and visual qualities in the site vicinity, especially relative to currently existing condition on the site. As shown on Figure 3.2.0-1, the proposed site development/reclamation activities will include the creation of planted vegetation buffer areas along public roadways surrounding the main plant facility and cooling reservoir areas on the site tract to the east of SR 37. In addition, the main plant structures are set back from these nearest public viewsheds by at least 2,500 ft. Therefore, after construction, only the relatively taller plant structures (e.g., CG facilities and certain exhaust stacks) will be potentially visible from nearby public viewpoints. Further, since the property tract to the west of SR 37 will not contain power plant facilities and will develop as a wildlife habitat/corridor area, the proposed site development activities for this area will enhance aesthetic and visual qualities in the vicinity of the Polk Power Station site.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 IMPACT ASSESSMENT

4.2.1.1 Hydrological Impacts

Significant construction activities with respect to surface water will involve the construction of the cooling reservoir, plant facilities, and overall site reclamation activities. Construction of the reservoir will essentially involve moving the overburden piles between the mine cuts to form the surrounding and internal berms, significantly reducing the requirements for fill and excavation. The cooling reservoir itself will be primarily below-grade. The surrounding berm will provide above-grade storage to accommodate stormwater primarily falling directly on the reservoir. The base of the cooling reservoir will have a maximum elevation of 120 ft-NGVD and the top of the berm will be at approximately 145 ft-NGVD. The perimeter berm of the cooling reservoir will have an inner and outer slope of 4:1 (4-ft horizontal to 1-ft vertical), and the top width of the berm is 25 ft.

The earthmoving activities will include excavation, fill, and grading of the soil onsite. To minimize the amount of cut and fill quantity, the existing onsite mine pits will be used for the reservoir construction. A total of approximately 4.9 million cubic yards of excavated material will be removed from the existing mined-out area to create the 860-acre, including surrounding berm, cooling water reservoir. This material will be used as fill material for the main plant facility site and reservoir berm construction. During construction of the reservoir, portions of the construction site will be dewatered to accommodate the construction equipment, e.g., pan scrappers, bulldozers, backhoes, motoring graders, etc. To minimize the hydrologic and water quality impacts during construction, the construction plan has been designed so that the dewatering activities will not cause any offsite surface water discharges.

The cooling reservoir will be divided into three subareas separated by temporary berms. Each subarea of the cooling reservoir will be constructed in phases. The water in the active subarea under construction will be pumped into the inactive subareas or to other onsite mined-out or reclaimed areas.

The inactive subareas of the cooling reservoir and the onsite reclaimed lakes will have sufficient storage capacity to eliminate the need for offsite surface water discharges. The proposed dewatering plan is described in detail in Section 4.3.

In addition to redistribution of the overburden on the site, excavation activities will occur for the required foundations, overall site grading and leveling, road construction, rail spur construction, and reclamation activities. All of these activities will require the moving, leveling, and compacting of soils. Mining has significantly altered the historical topography of the area. Some of the overburden will be redistributed to accommodate the plant facilities and replicate pre-mining drainage patterns. The foundation for the plant facilities will be at 140 to 145 ft-NGVD. The old mine cut lake located south of SR 630 and the reclaimed lake near Fort Green Road, on the eastern Polk Power Station boundary, will remain essentially unaltered, except for minor grading to improve drainage patterns to pre-mining conditions.

A comprehensive sedimentation and erosion control plan will be developed for the Polk Power Station in compliance with the requirements of the appropriate regulatory agencies. The erosion control plan will prevent soil loss caused by stormwater runoff during project construction and operation. Both structural and non-structural (vegetative) erosion control measures will be designed, implemented, and properly maintained in accordance with best management practices.

The erosion and sedimentation control practices will include the following:

- Scheduling of activities to minimize the amount of disturbed area at any one time;
- Locating roads, railroad spurs, and parking areas on contour;
- Limiting construction traffic to access roads and areas to be graded and traffic avoidance to the extent feasible at streams or drainage ditches;
- Compacting loose soil as soon as possible after excavation, grading, or filling;

- Using silt fences, straw bales, temporary rip-rap, etc., to minimize transport of sediment;
- Implementing the erosion and sedimentation control plan and ensuring that construction personnel are familiar with and adhere to the plan; and
- Managing runoff during construction.

In addition to the erosion control practices described previously, Tampa Electric Company will employ various vegetative practices to control erosion and sedimentation, including seeding of the cooling reservoir berms and swales.

Other erosion control structure practices will include, as necessary, the construction of temporary perimeter berms, rip-rap in potentially high-velocity areas, straw bales or other barriers, silt fences, diversionary berms or swales, and graveled road and railroad beds.

The construction plan is to direct nearly all stormwater under normal rainfall conditions into the cooling reservoir area and other mined-out areas on the site. The mine cuts, which are below-grade, will be capable of retaining a considerable amount of stormwater. This capacity will increase as the above-grade berm surrounding the reservoir area is constructed from the overburden. By capturing the dewatering water and stormwater runoff, Tampa Electric Company will begin filling the cooling reservoir so that there will be sufficient water available prior to operation.

In the event that small isolated sedimentation basins during construction activities are required, these will be constructed by excavation. These basins will be cleaned out as needed. A typical cross-section of the sediment basin is shown in Figure 4.2.1-1.

Swales will be constructed for directing runoff around the construction site to the cooling reservoir or to sedimentation basins. These swales will be excavated, graded,

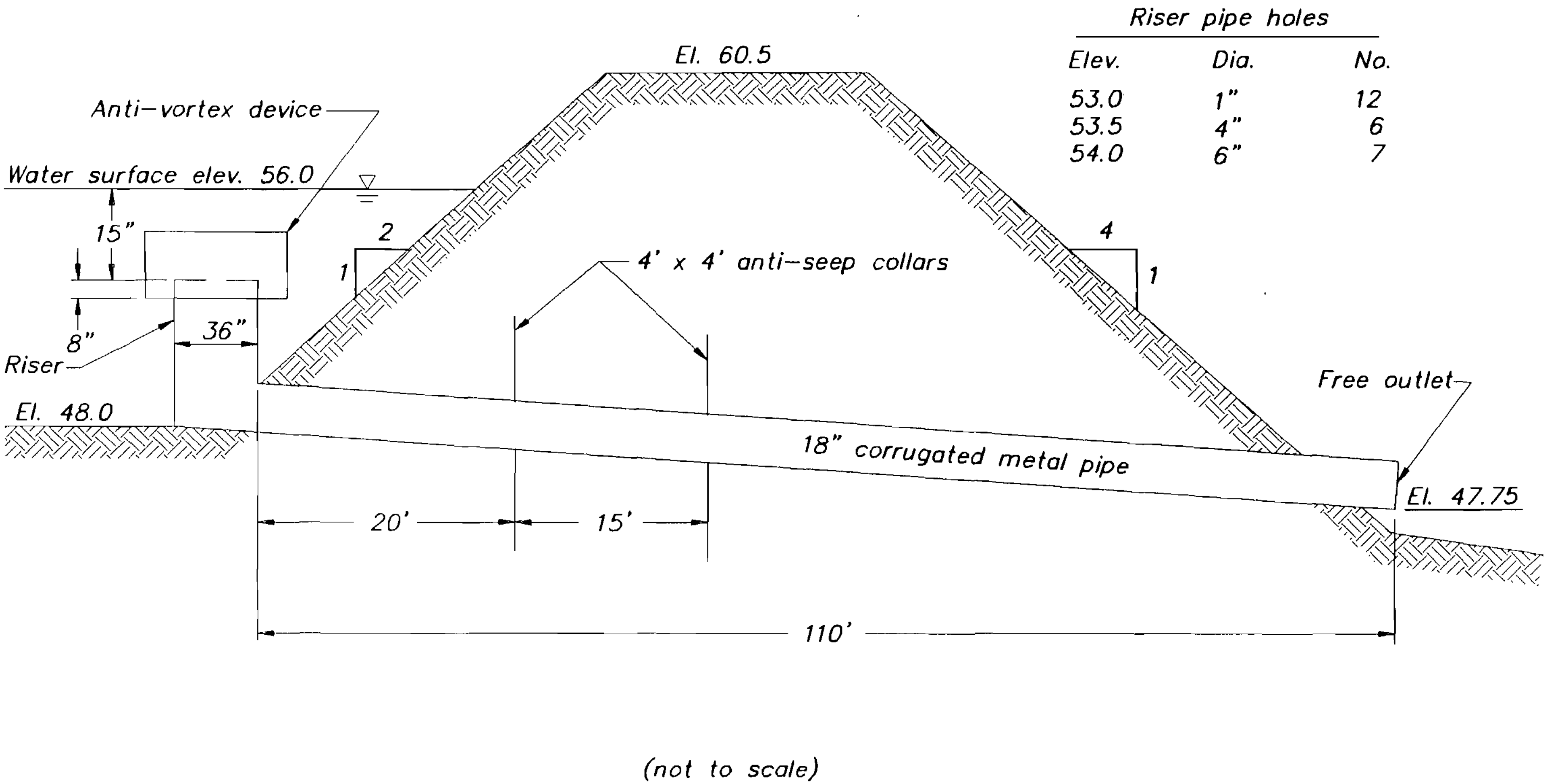

FIGURE 4.2.1-1.

TYPICAL CROSS SECTION OF SEDIMENT BASIN

Source: UE&C, 1992.

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and stabilized with gravel, sod, etc. The cross-sectional area of these swales will be designed such that erosional velocities are not reached.

Straw bale berms and silt fences will be constructed as needed. These barriers will be embedded (4 inches for bales and 8 inches for silt fences) into the soil to prevent washout. Steel rods or steel posts will be used as required to anchor these barriers. The construction detail of a typical silt fence is shown in Figure 4.2.1-2.

Some stormwater runoff may need to be discharged offsite to the adjacent surface water body systems. The runoff will be initially detained within the cooling reservoir and mined-out areas or in sedimentation basins. Also, sediment transport associated with any discharges from these areas will be further controlled by use of appropriate measures such as straw bales and silt fences.

In summary, the construction activities will cause no consumption of the surface water and will create no surface discharge of sanitary and industrial wastes. Any dewatering water from areas under construction will be detained on the site and sediments in any stormwater runoff discharges from the site will be controlled by appropriate design measures. Any potential effects of the proposed activities will be similar to those associated with the reclamation of mined-out lands in the site area and would occur from the required reclamation of the site even without the proposed project. Therefore, the site preparation and construction of the proposed project are not expected to have adverse hydrologic and water quality impacts on offsite surface water bodies.

4.2.1.2 Ecological Impacts

No direct impacts to the aquatic systems of Little Payne Creek, Payne Creek, or South Prong Alafia River from site preparation and plant and associated facilities construction are anticipated. No structures will be constructed either within streambeds or floodplains within the existing drainages. The majority of the power plant and associated facilities will be constructed within lands that have been

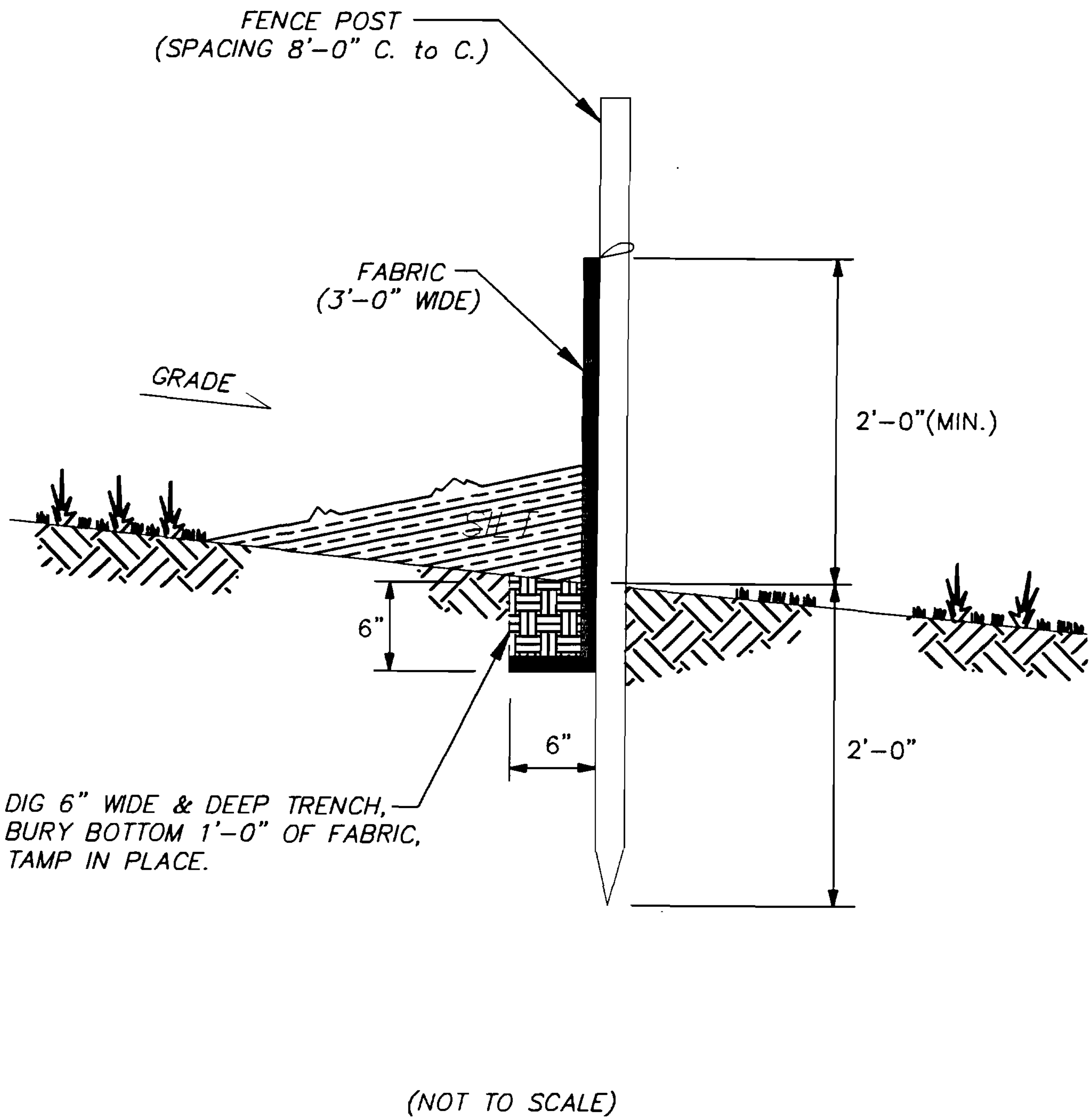

FIGURE 4.2.1-2.

TYPICAL SILT FENCE CONSTRUCTION

Source: UE&C, 1992.

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previously mined or highly altered from mining operations. The mined lands within the areas of the proposed development support open water mine cuts and littoral zone wetlands artificially created through mining operations. Small, isolated areas of unmined but disturbed lands within the area of the main plant facilities contain hydrologically isolated remnant wetlands which have been highly altered through surface water drainage, groundwater drawdowns, and other disturbances associated with mining equipment.

Approximately 32 acres of disturbed mixed herbaceous and early successional forested wetlands will be filled on the site for construction of the main power plant facilities. Tampa Electric Company has submitted a dredge-and-fill application for the development of these wetlands and mine cuts as part of this project (see Appendix 11.12). No significant or unique wildlife habitats will be lost due to the proposed project. As stated previously, the proposed site development and reclamation plans for the site will provide for mitigation of the disturbed wetland losses and increase the wetland and upland forested acreages on the site over pre-mining conditions, thereby increasing the available wildlife habitat for local and regional wildlife populations.

4.2.2 MEASURING AND MONITORING PROGRAMS

In general, all erosion and sedimentation controls will be checked weekly and after major storms and maintained, as necessary. The following items will be checked:

- Sedimentation basins, if used, will be cleaned;
- Gravel and rip-rap will be checked for washout or sediment buildup and replaced or cleaned as necessary;
- Straw bale barriers will be checked for washout or deterioration and replaced or reinforced as necessary;
- Seeded areas will be checked, re-seeded if necessary, and if required, fertilized carefully so that excess nutrients are not introduced into surface waters;
- Silt fences will be checked for washout and will be repaired, reinforced, or replaced as necessary; and
- Sediment deposits at any of the aforementioned barriers will be periodically removed as necessary.

All stormwater runoff will be collected and managed using appropriate erosion and sedimentation controls. Therefore, by use of the proposed control measures, monitoring is unnecessary in the surrounding water bodies, i.e, Payne Creek, Little Payne Creek, and South Prong Alafia River, since no adverse water quality impacts are expected during construction activities.

4.3 GROUNDWATER IMPACTS

4.3.1 IMPACT ASSESSMENT

The proposed site preparation and facility construction activities for the Polk Power Station will have potential short-term effects on groundwater in the surficial aquifer on the site and in certain offsite areas due to temporary dewatering activities. These temporary (i.e., approximately 1 year) dewatering activities will be primarily required during the excavation and construction activities for the cooling reservoir and reclaimed wetland areas within mined-out areas on the site. Some limited, temporary dewatering will also be required for several plant facilities which have relatively deeper foundations or locational requirements for their operation.

These temporary dewatering activities are expected to be of similar scales and have similar potential effects on the onsite and offsite surficial aquifer system as that created by the previous and ongoing phosphate mining activities and/or would occur during similar, agency-required land reclamation activities for mined-out lands in the central Florida phosphate district. These activities are not anticipated to affect the intermediate and Floridan aquifers on or in the vicinity of the site. Therefore, the proposed temporary dewatering activities for the Polk Power Station are not expected to adversely impact onsite and offsite groundwater resources. Also, any potential impacts will be temporary and will be relatively similar to impacts previously or currently occurring in the area due to mining activities or would be experienced during reclamation of the mined areas. The following describes the specific dewatering activities proposed for the preparation and construction of the project.

The primary dewatering requirements will involve the excavation, earthmoving, and construction activities for the cooling reservoir and its surrounding and internal berms and the reclaimed wetland areas on the site within mined areas. The proposed construction of the cooling reservoir within mined-out lands will actually limit the amount of disturbance of soils and groundwater systems required for the facility. The design bottom elevation of the cooling reservoir is 120 ft-NGVD. Therefore, to allow for the proposed earthmoving activities, the reservoir area will need to be dewatered to a depth of approximately 120 ft-NGVD, which also occurred during mining of these areas.

As discussed in Section 4.1, these dewatering requirements will be accomplished according to a specifically designed plan to sequentially dewater subareas of the site to allow the required earthmoving activities to proceed, while maintaining the dewatering water within other subareas of the site with no offsite discharges of the water. As shown in Figure 4.3.1-1, the site preparation and construction activities for the cooling reservoir, main plant facilities, and adjacent reclaimed wetland areas on the site tract to the east of SR 37 will involve the sequential dewatering of five subareas. The proposed schedule and plan for these dewatering activities, including the modeled, estimated dewatering withdrawal rates, are provided in Table 4.3.1-1. As indicated on this table, some of the dewatering water from the subareas on the site to the east of SR 37 will be temporarily routed to and contained within mined-out subareas on the site to the west of SR 37 in order to provide for adequate storage capacity for the water within the site boundaries.

In general, since the withdrawn dewatering water is sequentially routed to and maintained within adjacent mined-out subareas or subareas in which construction activities have been completed, the proposed withdrawals from the surficial aquifer system are balanced by the increased infiltration and replenishment of water to the system from the adjacent water storage subareas. Therefore, potential surficial aquifer groundwater impacts from dewatering activities for the cooling reservoir, plant facilities, and adjacent, reclaimed wetland areas on the site tract to the east of SR 37 will be limited and short-term. Based on groundwater flow modeling analyses conducted for the project, the primary surficial aquifer drawdown impacts will occur within the Polk Power Station site boundaries. The modeled potential offsite groundwater impacts show that short-term drawdowns of the surficial aquifer will be approximately 8 to 10 ft at the site boundary north of Bethlehem Road and west of SR 37 and approximately 8 ft at the eastern site boundary. The modeled potential drawdown effects will be approximately 12 ft along the southern property boundary

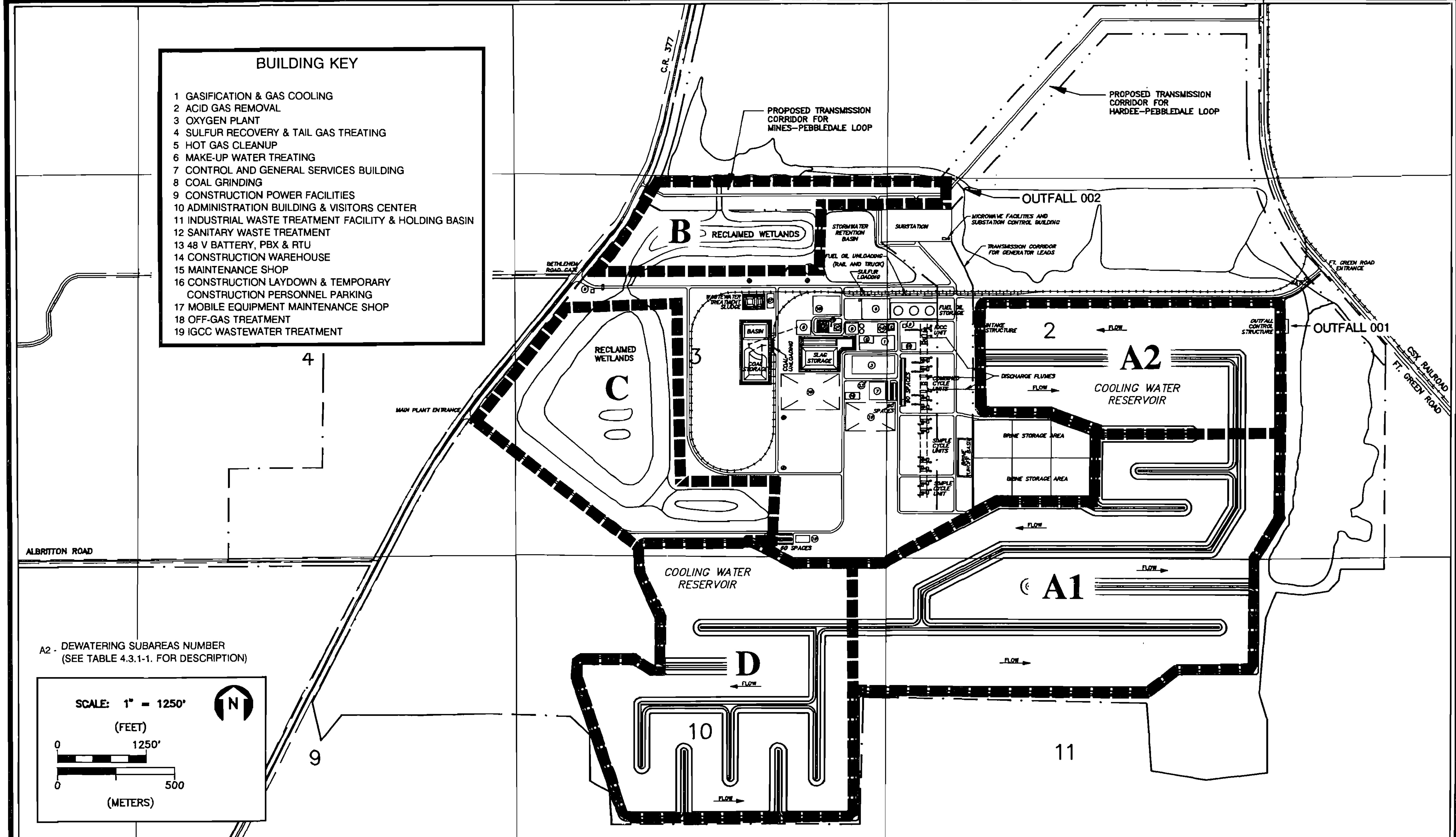


FIGURE 4.3.1-1.

DEWATERING SUBAREAS FOR COOLING WATER RESERVOIR AND WETLAND AREAS

Source: ECT, 1992.

Table 4.3.1-1. Proposed Dewatering Schedule and Plan Summary

Dates	Dewatered Units	Withdrawn Water Application to	Approximate Dewatering Duration (days)	Main Dewatering Duration (days)	Estimated Withdrawal Rates (gpd)	(gpm)
Late 1993 and early 1994		START DEWATERING				
	A1	A2 and D (75 percent)/ west wetland (25 percent)	31		87,480,000	60,750
	B	C	31		16,126,000	11,200
Mid-1994	A1	A2 and D		122	32,595,000	22,635
	B	C		122	8,842,000	6,140
	A2	A1	15		28,936,000	20,090
	A2	A1		30	18,656,000	12,955
		Removing berm 2		15	--	--
Late 1994	D	A1 and A2	31		16,974,000	11,790
	C	A1 and A2	31		33,614,000	23,340
	D	A1 and A2		120	1,996,000	1,385
	C	A1 and A2		120	15,334,000	10,650
Early 1995		FINISH DEWATERING				

Sources: UEC, 1992.
ECT, 1992.

which is adjacent to a series of clay settling areas. Detailed descriptions of the groundwater modeling analyses and results used to simulate and assess the proposed dewatering activities are provided in Appendix 11.7.6.

These modeled potential groundwater drawdown effects on the surficial aquifer are similar to impacts which would have occurred during required reclamation activities of the mined areas. Based on existing site and adjacent offsite conditions, these potential groundwater drawdowns will have no significant impacts on wetlands and surface water bodies in the vicinity of the site. Also, since the surficial aquifer in the site area is not used for potable water supply purposes and due to the confining layer between the aquifers, the temporary surficial aquifer drawdowns will not affect drinking water supplies and other uses of deeper aquifer systems in the Polk Power Station site area.

In addition to the cooling reservoir and reclaimed wetland areas, plant structures which will require dewatering activities for construction include:

- Coal unloading dump hopper,
- Recirculating water pipelines, and
- Recirculating water pumping facilities.

The proposed foundation/excavation dimensions and depths and dewatering plans for these structures are provided in Table 4.3.1-2. Other plant facility and structure foundations will consist of concrete or crushed stone mats or spread footings for relatively lighter load-bearing facilities and pilings for heavier structures. Construction of these types of foundations generally will not require dewatering activities. Water withdrawn by dewatering to facilitate construction of proposed facilities and structures on the site will be managed and routed to the site subareas which are planned for the sequential storage of water from the required dewatering of the cooling reservoir and reclaimed wetland areas.

Table 4.3.1-2. Plant Structures Requiring Dewatering Activities and Dewatering Plans

Coal Unloading Dump Hopper	
Foundation dimensions	120 ft x 60 ft x 40 ft
Excavation method	Sheet pile and shoring
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 35 ft
Pumping duration	4 months
Subarea receiving water	A1 and A2
Recirculating Water Lines	
Excavation dimensions	1,075 ft x 23 ft x 8 ft
Excavation method	Open cut or sheet pile and shoring
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 8 ft
Pumping duration	3 months
Subarea receiving water	A1 and A2
Recirculating Water Pump Structure	
Excavation dimensions	58 ft x 24 ft x 22 ft
Excavation method	Sheet pile and shoring
Dewatering method	Well points or perimeter drain
Dewatering depth	Approximately 22 ft
Pumping duration	7 months
Subarea receiving water	A1

Source: UEC, 1992.

Potential chemical effects from dewatering activities can result from the disturbance (mobilization) of constituents from the soils into the water and from oxidation of the groundwater. The undifferentiated, surficial soils on the site are composed primarily of quartz sands with several soluble constituents (including calcite, phosphate, and iron). The oxidation can cause the disassociation of calcite releasing bicarbonate and calcium anions which can increase the hardness of water. Oxidation of the dissolved iron can cause ferrous iron to form ferric iron. However, in the onsite aquifer system composed primarily of silica sands, the oxidation reactions will be minimal and potential groundwater quality impacts will be insignificant.

Additionally, the engineering tests discussed in Section 2.3.2 indicated that the undisturbed aquifer will act to filter out suspended constituents and limit migration of these constituents in the surficial aquifer.

4.3.2 MEASURING AND MONITORING PROGRAMS

The modeling program used to assess the potential dewatering drawdown effects on the surficial aquifer and the detailed modeling results are described in Appendix 11.7.6. This modeling program used information on the surficial aquifer characteristics which was collected during the site-specific geohydrology monitoring and testing program on the Polk Power Station site. The site-specific monitoring program is described in Section 2.3.2.

No additional groundwater measuring and monitoring programs are needed during the site preparation and construction activities. However, a groundwater monitoring program will be developed and implemented for the operation of the proposed project in accordance with applicable FDER regulatory requirements under Chapter 17-28, Part VII, F.A.C. (see Appendix 11.7.8).

4.4 ECOLOGICAL IMPACTS

4.4.1 IMPACT ASSESSMENT

4.4.1.1 Aquatic Systems

The aquatic systems that will be impacted by construction of the Polk Power Station are primarily waters in mine cuts. However, the net effect of construction will be similar to agency-required reclamation of the site and will result in increased acreage of aquatic habitats onsite. No natural aquatic systems onsite or offsite will be impacted.

Construction of the main plant facility and cooling reservoir areas will occur in stages with various portions of the site (subareas) being developed sequentially. As a subarea is dewatered, those manmade aquatic habitats will be lost. But as each subarea of the reservoir is completed, it will receive waters from other portions of the site, thereby creating new aquatic habitats.

Stormwater runoff during construction will generally be directed to these subareas or to constructed stormwater detention basins. Other various sediment and erosion control measures will be used to control erosion and sediment transport from the site (Section 4.2.1.2). Some stormwater may be discharged from the site during reservoir and initial plant facilities construction. This potential runoff will be appropriately controlled and managed as described in Section 4.2. As future units are added to the project, some stormwater runoff due to construction may then be routed through the permanent onsite stormwater management system and ultimately discharged into the Little Payne Creek. Stormwater runoff due to construction activities will not adversely affect any natural aquatic systems nor will it significantly affect water quality or quantity within the Little Payne Creek, Payne Creek, or South Prong Alafia River drainages. The net effect of reservoir creation will be an increase in aquatic habitats onsite.

4.4.1.2 Terrestrial Systems

Vegetation

The power plant, cooling water reservoir, and other associated onsite power facilities such as parking lots, by-product storage, stormwater retention, wastewater, sanitary and industrial waste treatment basins, substation, transmission line, railspur, and roads will occupy approximately 1,090 acres of land. Most of the project facilities (primarily the cooling reservoir) will be located on mined, highly disturbed through mining, or otherwise altered/converted land. Approximately 98 acres or 4.7 percent of the disturbed, remnant, or artificially created upland and wetland habitats will be eliminated through development of the power plant facilities (see Table 4.4.1-1). Therefore, the construction of the Tampa Electric Company Polk Power Station will have little relative impact on local or regional natural vegetation communities. By comparison, the majority of past, current, and future impacts to onsite vegetative communities is associated with the mining of phosphate ore.

Previous and ongoing onsite mining activities include the clearing of vegetation; excavation of overburden and phosphate matrix; and construction of access roads, material storage areas, and other related facilities. Dragline mining operations have a direct impact on the flora and fauna on the site. Short- and long-term impacts to biota on and in areas adjoining the mined areas may also occur as a result of the activities. As stated previously, the majority of the property has or will be disturbed by mining prior to Tampa Electric Company's use of the site. The land remaining after mining will either be left intact (i.e., unmined areas), reclaimed, or used for the proposed Polk Power Station facilities. Potential impacts associated with the phosphate mining and/or power plant facility construction are the direct loss of plant communities/wildlife habitats and a portion of the resident animal populations. However, the overall significance of these impacts depends upon the relative ecological value, regional abundance, and ability to restore the altered resources.

To mitigate for the impacts to biota associated with mining and power plant development, the natural functions of the pre-existing important habitats will be restored or

Table 4.4.1-1. Estimated Premining, Disturbed, and Post-Reclamation Acreages and Percentages of Land Use/Cover on the Tampa Electric Company Polk Power Station

		Premining†		Pre-1992 Disturbances from Mining**		Pre-1992 Disturbances from Powerline**		Post-1992 Disturbances from Mining††		Post-1992 Disturbances from Tampa Electric Company Polk Power Station††		Agrico's Current Post-Reclamation Plan		Tampa Electric Company Polk Power Station Post-Reclamation	
Code	Land Use/Cover*	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
140	Transportation	0	0	0	0	0	0	0	0	0	0	0	0	3	0.1
148	Gas transmission pipeline	13	0.3	0	0	0	0	0	0	0	0	13	0.3	14 †††	0.3
151	Electrical power facilities	0	0	0	0	0	0	0	0	0	0	0	0	337	7.8
152	Electrical transmission line	0	0	0	0	0	0	0	0	0	0	27	0.6	141 †††	3.2
210	Pastureland	886	20.3	381	13.7	11	40.7	82	14.9	60	36.6	973	22.4	500	11.5
230	Citrus grove	59	1.4	42	1.5	0	0	1	0.2	0	0	0	0	18	0.5
310	Grassland	20	0.4	20	0.7	0	0	0	0	0	0	49	1.1	0	0
320	Shrub and brushland	995	22.9	856	30.9	0	0	12	2.2	6	3.7	57	1.3	581	13.4
330	Mixed rangeland	159	3.7	159	5.9	0	0	0	0	0	0	1,067	24.5	6	0.1
410	Coniferous forest	439	10.1	355	12.8	0	0	65	11.8	0	0	59	1.4	0	0
420	Upland hardwood forest	53	1.2	85	3.1	3	11.1	24	4.4	9	5.5	38	0.9	101	2.3
430	Upland mixed forest	965	22.2	423	15.3	11	40.7	294	53.5	59	36.0	565	13.0	756	17.4
520	Lakes***	147	3.4	11	0.4	0	0	18	3.3	0	0	710	16.3	252	5.8
530	Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	840 ****	19.3
620	Wetland hardwood forest	68	1.6	0	0	2	7.5	17	3.1	5	3.0	59	1.4	61	1.4
630	Wetland mixed forest	267	6.1	267	9.6	0	0	0	0	0	0	264	6.1	310	7.1
640	Herbaceous wetland	277	6.4	170	6.1	0	0	36	6.6	25	15.2	467	10.7	428	9.8
	TOTAL	**4,348**	**100**	**2,769**	**100**	**27**	**100**	**549**	**100**	**164**	**100**	**4,348**	**100**	**4,348**	**100**

*The FLUCCS, 1976 was utilized for the land use and cover classification on the Tampa Electric Company Polk Power Station project. Level II FLUCCS is used for 200 to 600 series classifications, while urban or built-up (100) uses are classified at Level III.

†Refers to the land uses and cover present on the site prior to mining activities circa 1981.

**Pre-1992 disturbances refer to all disturbances from mining (Agrico, Inc.; IMC Fertilizer, Inc.; and American Cyanamid, Inc.) and powerline (Tampa Electric Company Hardee-Pebbledale 230-kV) construction to premining land uses and cover prior to 1992.

††Post-1992 disturbances refer to all proposed disturbances from mining and power plant development to premining land uses and cover after 1992. An additional 926 acres of formerly altered land (154 acres of scraped-over areas and spoil piles and 772 acres of phosphate mined land) are also proposed to be used in the construction of the power plant facilities and cooling water reservoir (total acreage, 1,090 acres).

***The 520, Lakes classification refers to all man-made, open surface waters on the property other than the proposed cooling water reservoir.

†††Approximately 13 acres of the gas transmission pipeline (148) will remain in pasture; 141 acres of the electric transmission line rights-of-way (152) will also be maintained as pastureland.

****The approximate acreage of the proposed cooling reservoir including the inside portions of the surrounding berm and the area of the internal berms.

Source: ECT, 1992.

enhanced through the proposed reclamation plans for the site. The pre-existing land forms on the site were primarily pine flatwoods/pine plantation, oak/pine woods, hardwood hammock, mixed swamp, hardwood swamp, freshwater marsh, shrub and brushland, grassland, mixed rangeland, lakes, citrus groves, and pastureland. The proposed reclamation plan for the site is summarized in Chapter 9.0 of this SCA. Reclamation plan objectives include restoring the disturbed lands to physical and functional conditions that are as similar to pre-mining/pre-development conditions, as practicable. To achieve these goals and mitigate potential habitat losses, all of the disturbed wetland and upland hardwood forest acreage will be increased through reclamation and the majority of the remaining lands will either be developed for the power plant facilities, left intact, or reclaimed. Furthermore, the proposed reclamation plans for the site will meet FDNR's phosphate mining reclamation rules (Sections 211 and 378, F.S.; Chapters 16C-16 and 16C-17, F.A.C.), and the goals of Polk County's Comprehensive Plan and the Polk County Phosphate Mining Ordinance 88-19.

Table 4.4.1-1 lists the acreages of the various land use/cover categories for pre-mining, disturbed, and reclaimed land. Pre-mining acreages refer to the land uses and cover present on the site circa 1981. Although mining occurred prior to 1981, no figures are available for land use/cover at that time. Disturbed acreages by FLUCCS include all disturbances from mining and power plant/transmission line development for pre- and post-1992 site conditions. Reclaimed acreages by FLUCCS categories are based on both the post-reclamation plans which are currently approved for Agrico's Fort Green Mine and proposed by Tampa Electric Company for the Polk Power Station site. As indicated in Table 4.4.1-1, taken collectively, the four dominant land forms to be restored on the site, according to Tampa Electric Company's proposed reclamation plan, include improved pasture, forested uplands, forested wetlands, and nonforested wetlands, in addition to the cooling reservoir area.

According to Tampa Electric Company's proposed plans, improved pasture areas have been or will be planted in forage grasses and legumes on approximately 655 acres of the site. This planting of forage grasses and legumes for the establishment of pastureland will be a dominant vegetation type on the site. Pasture was chosen as a dominant post-reclamation land use because of the following reasons:

1. Seeding the majority of land with grasses stabilizes reclaimed soils, limits erosion, encourages the development of organic matter, and increases nutrient/moisture retention;
2. Improved pasture can be easily converted to alternative future land uses as desired; and
3. A total of 155-acres of pasture located underneath the electrical transmission lines and over the gas transmission line allows for easy maintenance and accessibility.

The particular grass and legume species to be planted will be selected based on soil characteristics, topography, and other site-specific attributes.

Approximately 857 acres of upland forest will be left intact or reclaimed on the site. Whenever possible, these forest types will be mulched with topsoil acquired from donor sites and then planted with native xeric and/or mesic species common to the region. Reclaimed hardwood forest will be planted with a variety of hardwood tree species such as laurel oak, water oak, live oak, sweet gum, persimmon, and black cherry. However, the actual composition of planted seedlings will depend upon the availability of various species from commercial native plant nurseries. Bare root, potted, or containerized seedlings will be planted in a random pattern to yield an initial density of 200 trees per acre. Reclaimed upland forest will also be planted with pines and oaks. Slash pine, longleaf pine, and various oak seedlings will be hand planted in a random pattern at a density of 400 trees per acre to ensure a final density of 200 trees per acre for the reclamation of oak/pine woods. Saw palmetto will be planted throughout the pine and oak/pine dominated areas on 5-ft centers to mimic a typical flatwoods understory stratum. Other understory native woody and herbaceous species such as gallberry, dwarf live oak, running oak, gopher apple, prickly pear, and others will also be planted randomly throughout each oak/pine woods area. All planting densities will be based upon FDNR reclamation rules [Chapter 16C-16.0051(9), F.A.C.]. The final selection of herbaceous and understory woody species and the timing/spacing of plantings will be based upon the availability of nursery-grown plant species at the time of planting and past success with similar plantings on reclaimed lands.

Tampa Electric Company's proposed plan provides for the reclamation of all pre-mining acreages of forested and nonforested wetland types on the site disturbed by mining, power plant development, and related activities. Wetlands within mined areas will mostly be created by recontouring overburden to create a topography resulting in a favorable hydroperiod. The regraded lowland areas will then be planted with indigenous aquatic herbaceous, shrub and/or tree species. Species selected for planting will be based upon the community type to be created and the onsite dominant plant species associated with the reference wetland types previously mined.

Approximately 371 acres of freshwater swamp will either be reclaimed or left in an undisturbed condition on the site. Reclaimed hardwood swamp will be planted with a mixture of aquatic hardwoods such as swamp redbay, red maple, black gum, sweet bay, dahoon holly, buttonbush, and wax myrtle. In addition to the referenced hardwood species, approximately 310 acres of the site will also be planted with pond and/or bald cypress for the creation of mixed conifer-hardwood swamp. All of the swampland will also be planted with herbaceous hydrophytes such as maidencane, pickerelweed, and arrowhead in the ground stratum. Bare root, potted, or containerized seedlings will be planted to yield an initial density of 800 trees per acre to ensure a final density of 400 trees per acre. It is expected that the tree cover will exceed 33 percent of the vegetational cover 5 years after planting, and in no area of an acre or more in size will the tree cover be less than 20 percent. Herbaceous vegetation will be planted on 3-ft centers and, thereafter, allowed to reproduce naturally within the forested wetland.

Approximately 428 acres of freshwater marsh will either be reclaimed or left in a pre-existing condition on the site. The proposed revegetation plan for these marshes is to plant bare root or liner size wetland herbs on 3-ft centers. Aquatic macrophytes anticipated to be used for marsh restoration, include arrowhead, maidencane, pickerelweed, sand cordgrass, and fire flag. It is anticipated that these reclaimed marshes will exhibit a plant cover of at least 80 percent of desirable wetland species per each restored acre after two growing seasons. To ensure plant survival rates, reclaimed swamps and marshes will undergo a periodic maintenance and monitoring program over a minimum 2- to 5-year period which will include noxious exotic species eradication, ecological surveys/reports to evaluate success, and replantings, if necessary.

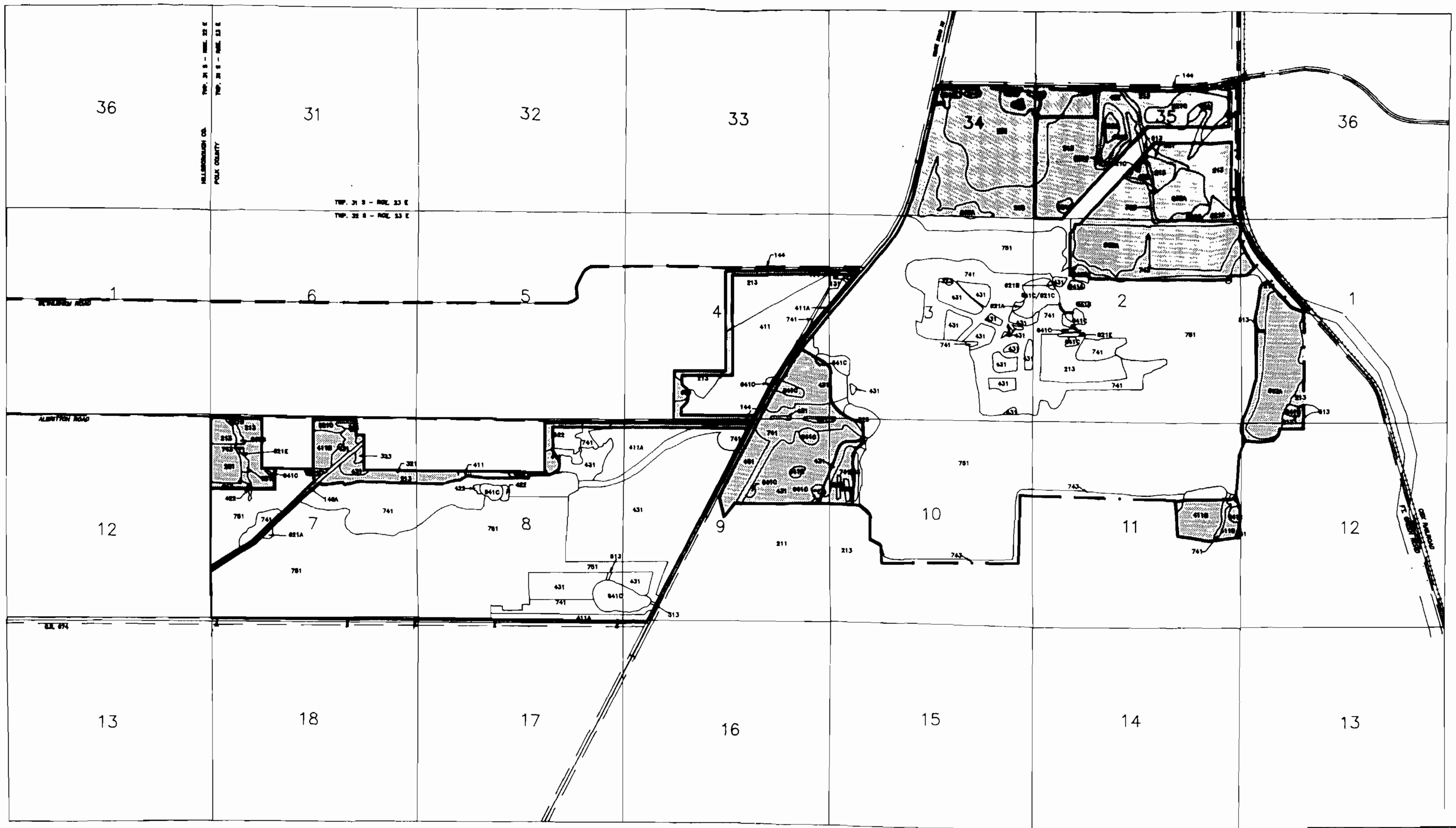
The reclaimed wetlands will be located on the site tracts both to the east and west of SR 37 within all three of the onsite drainage basins: South Prong Alafia River, Payne Creek, and Little Payne Creek.

The proposed reclamation operations will proceed immediately after certification of the Polk Power Station project or earlier if appropriate agency approvals are granted prior to final certification of the project. Mining of the western tract of the property is expected to conclude in 1994. Reclamation is anticipated to be completed within 3 years after mining ends; allowing 2 years for development operations and 1 year for planting.

According to the currently approved reclamation plan for the site tract to the west of SR 37, the property was scheduled for a land-and-lakes type reclamation as indicated on Table 4.4.1-1. This reclamation process would have resulted in the recontouring of overburden and mined-out areas for land-and-lakes. The land-and-lakes land form would have been reclaimed to agricultural land, pine flatwoods, hardwood forest, mixed forest, wetlands, and lakes. The predominant feature of post-reclamation would have been a mosaic of lakes constructed from the former mine cuts. The resultant post-reclamation land would have had less wetland and forested upland acreage than that proposed for this project (approximately 204 acres less overall). The area to the east of SR 37 was scheduled for primarily above-grade clay waste disposal under the currently approved reclamation plan. This would have eventually developed into pastureland and mixed rangeland. This area will now be dominated by the proposed power plant facility and cooling reservoir.

Based upon the Polk County Comprehensive Plan Conservation Element Support Document (July 1990), it is estimated that approximately 353,724 acres or 28 percent of the county consists of native habitat. Approximately 144,573 acres of these native lands comprise freshwater wetlands. The reclamation of wetlands on the site will result in a net increase in wetland habitat county-wide.

According to the proposed reclamation/development plans, approximately 996 acres of remnant, but previously disturbed uplands, wetlands, and surface waters on the property following all mining, power plant development, and reclamation activities will be relatively disturbed by the project (see Figure 4.4.1-1). Except for some minor sites (69 acres) distributed along the northern boundary of the western tract, the areas to be left intact after all mining/development/reclamation ceases consist of five distinct and separate parcels of land. On the western tract of the site, all of the unmined portions within the area west of the FGT pipeline will be mostly left undisturbed, except for the creation of a vegetated, drainage swale. The swale will connect the western terminus of the South Prong Alafia River drainage basin on the property directly to the unnamed tributary of the South Prong Alafia River along the northwestern property boundary. The swale will almost be entirely located within improved pasture situated to the east of the unnamed tributary. Approximately 98 acres of remnant upland, wetland, and surface water communities (i.e., longleaf pine flatwoods, shrub and brushland, mixed hardwood swamp, mixed oak/pine forest, pasture, oak hammock, disturbed mixed marsh, citrus grove, a pond, and an intermittent creek) will be left at this location. An old, inactive bald eagle's nest is located within the pine flatwoods at this locale.



LEGEND (FLUCCS, 1976)

110	RESIDENTIAL	323	SHRUB AND BRUSHLAND	621	WETLAND FORESTED
131	LIGHT INDUSTRIAL	330	MIXED RANGELAND	A	BAY HEAD SWAMP
144	ROADS AND HIGHWAYS	410	CONIFEROUS FOREST	B	RED MAPLE SWAMP
148A	FGT GAS PIPELINE	411A	SLASH PINE FLATWOODS	C	WILLOW / ELDERBERRY SWAMP
148B	TAMPA ELECTRIC COMPANY 230-KV TRANSMISSION LINE (HARDEE-PEBBLEDALE)	411B	LONGLEAF PINE FLATWOODS	D	MIXED HARDWOOD SWAMP
		420	HARDWOOD FOREST	E	PRIMROSE WILLOW SWAMP
		422	OAK HAMMOCK	630	WETLAND – MIXED FOREST
152	OVERHEAD TRANSMISSION LINES	430	MIXED UPLAND FOREST	640	WETLAND – VEGETATED NON-FORESTED
210	CROP AND PASTURELAND	431	MIXED OAK/PINE FOREST	641	NON-FORESTED WETLAND
211	ROWCROPS	520	LAKES	A	MAIDENCANE MARSH
213	IMPROVED PASTURE	513	CANAL/DITCH	B	MAIDENCANE – BUTTONBUSH
230	CITRUS GROVE	563	PONDS	C	DISTURBED MIXED MARSH
231	ORANGE GROVE	580	OTHER WATER AREAS	741	SCRAPED AREAS/OLD FIELDS
310	GRASSLAND	A	MINE PONDS	751	PHOSPHATE MINED LANDS
320	SHRUB AND BRUSHLAND	B	OTHER WATER AREAS	743	VEGETATED SPOIL BANK
321	PALMETTO PRAIRIE	620	WETLAND – HARDWOOD FOREST		

AREAS TO REMAIN INTACT

NOTE:

INFORMATION TAKEN FROM AERIAL PHOTOGRAPH DATED 8-13-91
BY I.F. ROOKS & ASSOCIATES, INC.
108 NORTHWEST DRANE STREET
PLANT CITY, FLORIDA 33566
AND MODIFIED USING INFORMATION COLLECTED
DURING GROUND TRUTHING ON 12-19-91

SCALE: 1" = 3000'

(FEET)
0 3000'
0 1000
(METERS)

N

FIGURE 4.4.1-1

LANDS TO BE LEFT INTACT

SOURCE: ECT, 1992.

TAMPA ELECTRIC
A TECO ENERGY COMPANY

POLK POWER STATION

The four remaining parcels to be left undisturbed are situated in the eastern tract of the site. These parcels include a 33-acre area of primarily pine flatwoods situated at the southeastern corner of the eastern tract which contains 27 acres of pine flatwoods, 3 acres of marsh, and 3 acres of grassy altered land. This parcel also contains an abandoned eagle's nest that was used by great horned owls in 1991. A 215-acre area located at the southwestern corner of the eastern tract just east of SR 37 is also not scheduled for development. The land cover types within this parcel to be left intact after development include marsh, mixed oak/pine forest, shrub and brushland, grassy altered land, and some lands disturbed by associated mining activities. This parcel contains marginally suitable habitat for a variety of plant and animal species, including important taxa such as the wild coco orchid. A third parcel to be left intact is located at the east-central edge of the tract. This 103-acre parcel contains 27 acres of reclaimed pasture, 1 acre of ditches, 2 acres of disturbed marsh, and a 73-acre reclaimed lake. The fourth area to be left intact is a large area covering both the northeastern and northwestern portions of the tract east of SR 37 and south of CR 630. The northeastern portion of this area consists of old mined but unreclaimed lands. This parcel mostly consists of pasture, naturally revegetated unreclaimed uplands, and wetlands and old mine cut lakes. The northwestern portion of this area has been recently mined and reclaimed but will also be left intact by the proposed power plant construction. This area now consists of reclaimed pasture, wetlands, and reclaimed lakes.

Vegetation communities/wildlife habitats to be left relatively intact on the site and other undisturbed uplands and wetlands in the project vicinity that are not directly disturbed by the previous and ongoing mining activities or proposed project construction activities have the potential to be indirectly affected. These secondary effects could include a temporary lowering of surface and groundwater levels, increased sedimentation, increased surface runoff, erosion, fugitive dust, and mechanical damage. As discussed in Section 4.3, the water table level in the vicinity of the cooling water reservoir area will fluctuate due to dewatering activities during the reservoir construction. These dewatering activities could potentially decrease the amount of soil moisture or standing water in adjacent wetlands depending upon the period of drawdown, the proximity of the wetlands to the dewatered area, and ambient rainfall. Such dewatering effects could result in changes in plant biomass, species composition, and the proportion of aquatic plant species within wetlands. However, as discussed in Section 4.3.1, the impacts to the surficial aquifer as a result of dewatering activities for the proposed project will be limited and short-term. Furthermore, these impacts will be similar to those already experienced onsite as a result of past and ongoing activities. Therefore, the proposed dewatering activities will have no significant impact on vegetation and wildlife habitats.

Clearing of vegetation and subsequent excavations associated with construction will expose soils to erosion by winds and stormwaters. Increased stormwater runoff and erosion into downstream wetlands and surface waters have the potential to accelerate eutrophication. Eutrophic waters exhibit an increase in turbidity, nutrient and bacterial levels, and oxygen demands, and a decrease in dissolved oxygen, producing an environment that favors plant over animal life. Fugitive dust from clearing operations may affect vegetation in the vicinity of the project site. Dust particles can accumulate on leaf surfaces reducing evapotranspiration and photosynthesis. Such long-term exposure could potentially result in the mortality of some terrestrial and epiphytic herbaceous plants. Damage to vegetation could also result as a consequence of vehicular traffic and heavy machinery during construction activities in the area. As discussed in Sections 4.2 and 4.5, potential erosion, sediment transport, and fugitive dust from the site will be controlled by a variety of techniques during the construction of the proposed project. Also, the potential for such impacts for the proposed project would be similar to that from agency-required reclamation activities for the site.

No significant impacts to the surficial aquifer are expected to occur during project excavations because the withdrawals will be balanced by the application of the water into the adjacent mine cuts and reservoir areas (see Section 4.3). Stormwater runoff into Payne Creek, Little Payne Creek, South Prong Alafia River, and onsite wetlands will be appropriately managed by the implementation of both temporary and permanent measures to control sediment transport. Erosion and sediment control methods will be implemented during and after construction, such as, seeding, or mulching along newly exposed areas, silt screens and hay bales along the sloped edges of surface water features and wetlands, and redirection of stormwater runoff by the construction of swales, basins, and berms. Thus, any stormwater runoff discharges exiting site boundaries will not adversely degrade the water quality or significantly alter the water quantity within the three drainage systems on the site.

Overall, any secondary impacts to downstream, nearby, or onsite systems are expected to be negligible to minimal. The existing vegetation communities to be left intact have been previously disturbed through mining operations. These systems exhibit the effects of numerous past perturbations from clearing activities, dumping, removal of large oak trees for nursery purposes, absence of periodic fires, fugitive dust from mining, altered hydroperiods from drainage interruptions, and lowered groundwater levels associated with mining. The continued mining operations and construction of the power plant facilities on the site are not expected to result in a significant change to current conditions within the existing habitats to be left intact. After reclamation has been completed, these areas will be managed along with the newly reclaimed lands to promote a natural ecological conditions.

All of the plant species considered to be of local and/or regional importance by USFWS, FNAI, FCREPA, CITES, and FDACS for the study area were reviewed for likelihood of occurrence on the property based upon range and habitat suitability. Of the 18 species determined to have a low to high probability of occurrence on the site, only 10 were actually observed within property boundaries. Aspidium fern, wild azalea, bluestem, golden polypody, dahoon holly, netted chain fern, cinnamon fern, and royal fern are common associates of forested wetlands in Florida. These listed species were mostly observed within the floodplain swamp contiguous to the unnamed tributary to the South Prong Alafia River in the northwest corner of the site. The forested wetland reaches of this tributary on the property are not proposed to be mined or distributed by the proposed project. Therefore, no significant impacts to regional or local populations of the referenced important species are anticipated from the proposed project.

Prickly pear inhabits the drier, unmined forested areas of the property. Prickly pear occurs within the northeastern unmined area of the eastern tract which is scheduled for construction of the power plant. However, this species is common throughout the state and no significant adverse effects to regional populations of prickly pear are expected.

Populations in excess of 500 individuals of the wild coco orchid were observed flowering within the old fields on the northeastern portion of the unmined area of the eastern site tract where the main power facilities will be located. Typically, this species inhabits the well-drained sandy soils of sandhill, scrub, and flatwoods communities in central and south Florida. The occurrence of wild coco within the highly altered, scraped-over old field areas on the site attests to its adaptability after major disturbances. Smaller populations of this orchid were also observed within the unmined parcel of the southwestern area of the eastern tract. Since this southwestern area is not scheduled for mining or power plant development, wild coco should persist and eventually extend into the open, wooded communities to be reclaimed on the site.

Although not observed on the site, six other listed plant taxa, namely three Habenaria orchids, the red-needle leaf bromeliad, spoon-flower, and shoestring fern, have a high likelihood for occurrence on the site. These plant species are either listed as threatened by FDACS or rare by FCREPA. Although listed as threatened species, most of these plants are actually quite common and widespread throughout Florida. These species were listed as threatened by FDACS to control their commercial exploitation in the nursery trade, rather than to provide an indication of their biological status. Therefore, the potential occurrence of these species is not considered regionally significant. None of these species were actually observed during site field surveys. However, the floodplain swamp located along the unnamed tributary to the South Prong Alafia River in the northwest corner of the site could provide suitable habitat for these shade tolerant and/or canopy dwelling species. This tributary and associated floodplain swamp are not proposed for mining and will not be affected by power plant construction or operation. Therefore, no significant adverse impacts to regional populations of the listed taxa are anticipated due to the proposed action.

Wildlife

Construction impacts to wildlife resources at the Polk Power Station may potentially occur in the form of direct impacts (displacement, mortality) or indirect impacts (habitat changes, noise, or human presence). Consideration of any impacts due to the plant construction activities are tempered by the fact that the site is extremely disturbed due to past and ongoing mining activities and that noise and human presence are already present on the site. Also, any such potential impacts would occur as the result of required reclamation activities for mined-out areas on the site even if the proposed Polk Power Station project were not constructed on the site.

Proposed plant construction activities such as habitat alteration, earth-moving, human presence, and noise will force some species to be either permanently or temporarily displaced. Certain species currently inhabiting areas in the main plant facility or reservoir locations will be permanently displaced. Some less motile or fossorial species may be lost during earth-moving activities. Species inhabiting the areas outside the plant facility and reservoir areas may be temporarily displaced while activities are underway. Once the activities are completed, remaining habitats or newly created habitats will again attract similar species. The great diversity of water birds and wading birds associated with the reclaimed and unreclaimed lakes on the eastern portion of the site may move elsewhere for feeding and roosting during construction, but should return and utilize these areas once construction is completed.

As previously discussed, the proposed site development/reclamation plan will actually increase the wetland acreage on the site compared to pre-mining conditions, thereby increasing habitat for water-dependent species. The old mine cut lake on the northeastern portion of the eastern tract where the greatest water and wading bird activity was observed will not be significantly disturbed by the proposed project activities. No nesting areas for these species were identified onsite, so no impacts to nesting of these water-dependent species are expected.

The proposed increase in natural habitats as a result of reclamation/mitigation on the western tract will potentially increase species diversity and use of the site. Other important naturally vegetated areas previously described will be left undisturbed.

Wildlife habitats which will actually be increased from pre-mining conditions include upland hardwood forest, reservoirs, wetland mixed forest, and herbaceous wetlands. This could eventually result in an increase in wetland-dependent species on the site. Also, other indirect impacts (human presence and noise) will not result in significant effects on wildlife since such impacts are currently present as a result of ongoing mining operations.

Since recreational use of the site is currently limited and controlled, no impacts to the recreational use of the site will occur as a result of power plant development. Recreational species (game birds, mammals, and fish) occurring on the site are expected to occur after construction is completed.

The Polk Power Station construction is not expected to affect regional populations of any endangered, threatened, or species of special concern. Of the 31 important wildlife species evaluated for this project (Section 2.3.6), 23 were observed onsite or considered to have a moderate to high likelihood of occurring on the site. Of those, the wetland dependent species such as alligator, osprey, little blue heron, great egret, snowy egret, tricolored heron, black-crowned night heron, least bittern, glossy ibis, white ibis, woodstork, sandhill crane, limpkin, and round-tailed muskrat may experience temporary displacement during plant construction and site reclamation activities. Similar habitats are abundant on other areas of the site as well as offsite for these species. However, the proposed net increase in open water/wetland habitats created by this project should increase potential use of the site by these species in the future.

The gopher tortoise and potential commensals such as indigo snake, pine snake, short-tailed snake, and gopher frog are generally expected in areas on the site not scheduled for power plant development. Therefore, impacts to these species should be minimal.

The Florida scrub jay was observed once in the area scheduled to be developed for the main plant facilities. However, repeated field survey efforts to confirm its presence or nesting on the site were unsuccessful. Therefore, it is believed no impacts to this species will occur.

Other upland species such as the southeastern kestrel, Cooper's hawk, and Sherman's fox squirrel occur on the fringes of the site or in areas not scheduled for power plant development. Therefore, no impacts to these species are anticipated.

The presence of bald eagles in the site area is exhibited by one active nest adjacent to the site and two abandoned nests onsite. The two abandoned nests are in areas not scheduled for power plant development or disturbance by reclamation activities. The one active nest previously described in Section 2.3.6 occurs offsite along Fort Green Road. Since this nest is 1.5 miles away from the main power block area and 2,500 ft away from the cooling reservoir, construction impacts to this nest are not expected. The pair of eagles are also accustomed to human presence and noise due to the fact their nest is located on a farmstead and close to a county road and active railroad. Since wetland habitats both on- and offsite will be available for foraging, the eagles should continue to use this area. After construction is completed, more open water habitat will be available for foraging.

In summary, the proposed construction/reclamation activities for the Polk Power Station will not significantly affect regional populations of any wildlife species, particularly those that are endangered or threatened. Overall, species will benefit from the proposed project due to the creation of additional higher quality wetland and upland habitats in place of disturbed mined lands. The proposed reclamation plan for the western tract of the site as a wildlife habitat/corridor area will ensure the creation and maintenance of quality wildlife habitats on the Polk Power Station property.

4.4.2 MEASURING AND MONITORING PROGRAMS

The ecological monitoring program conducted on the site in support of this SCA is described in Section 2.3.6. No continued monitoring programs are proposed for biological resources during the proposed construction/reclamation of the site.

4.5 AIR IMPACT

4.5.1 EMISSIONS

Three general activities will generate air emissions during construction of the Polk Power Station. First, land clearing, site preparation and vehicle movement will generate fugitive dust emissions. Second, open burning of cleared land debris may be required and would result in air emissions. And third, internal combustion engines will release nitrogen oxides, carbon monoxide and other combustion products.

The quantity of any emissions released during the construction process will generally be very low, but will vary on an hourly and daily basis as construction progresses. Fugitive dust emissions will be greater during the land clearing and site preparation phases. Fugitive dust emissions will also be greater during the more active construction periods as a result of increased vehicle traffic on the site.

Open burning would result in emissions of PM, CO, NO_x, and hydrocarbons. This activity would be conducted for short periods at a time. The land clearing and construction debris will generally consist of wood products and other relatively clean-burning components. Emissions would depend upon the amount and moisture content of the debris.

Increased emissions from internal combustion engines will occur during the site preparation and facility construction due to the amount of onsite equipment using engines for site excavation and grading, concrete placement, and structural steel and major equipment installation. Potential minor sources of volatile organic compounds include:

1. Evaporative losses from onsite painting,
2. Refueling of construction equipment, and
3. The application of adhesives and waterproofing chemicals.

4.5.2 EMISSION CONTROL MEASURES

Fugitive dust emissions from the construction site will be minimized using appropriate dust suppression control methods. These control methods will include paving roads, applying dust suppressing chemicals or water to roads and other exposed surfaces, or other methods, as needed. Existing public roads leaving the site are currently paved. Permanent, more heavily travelled roads on the site will be paved during the construction period. Spilled and tracked dirt (or other materials) will be removed from roadways and other paved areas in a timely manner. Of course, all construction related fugitive dust emissions will be temporary and will stop once construction is completed. Emissions from open burning will be limited by removing materials whose burning would produce excessive smoke (e.g., green vegetative materials), and by conducting this activity in compliance with applicable state and local regulations and ordinances.

The implementation of appropriate erosion and sedimentation controls will also minimize fugitive dust emission and water quality impacts.

4.5.3 POTENTIAL IMPACTS AND MONITORING PROGRAMS

The air quality impacts caused by construction activity will vary as a function of the level of activity, the specific nature of the activity, the weather conditions while the activity is occurring, and the emission controls applied to the activity. However, even under worst-case conditions, the maximum ambient impacts caused by construction emissions are expected to be very small and limited to the specific area of the site under construction. Also, any potential emissions are expected to be well below any applicable ambient air quality standard. Therefore, no air quality monitoring programs are needed or will be conducted during the construction of the Polk Power Station. As required, Tampa Electric Company will conduct an air quality monitoring program during the project operations (see Section 5.6.2).

4.6 IMPACT ON HUMAN POPULATIONS

4.6.1 LAND USE IMPACTS

Projected construction impacts to the existing land uses within the Polk Power Station site are expected to be insignificant due to its existing disturbed condition resulting from previous and ongoing phosphate mining activities. As previously stated, more than 94 percent of the site has been or will be disturbed by mining operations prior to development and use of the site by Tampa Electric Company.

Similarly, projected construction impacts to the surrounding land uses are expected to be minimal based on the predominance of phosphate mining activities in the area. The nearest single-family residence to the planned location of the Polk Power Station power block and fuel storage area is located approximately 7,000 ft (1.3 miles) east, along Fort Green Road. Approximately 85 homes are located west of SR 37 and north of the Polk Power Station site along Bethlehem and Albritton Roads, with the closest residence in this grouping being approximately 8,000 ft (1.5 miles) west of the power block and fuel storage area. Another 30 homes are located west of the Polk Power Station site boundary in Hillsborough County along and near SR 674, approximately 20,500 ft (3.9 miles) west of the power block and fuel storage area. Further, 14 homes are located along Mills Road off Fort Green Road, approximately 14,700 ft (2.8 miles) southeast of the power block and fuel storage area.

The conceptual site and reclamation plan was previously shown in Figure 3.2.0-1. The site plan shows the planned locations for construction of the main power plant structures (i.e., power block, fuel storage, and by-product storage), parking areas, and road and railroad accesses. This plan also conceptually shows Tampa Electric Company's plans to provide setbacks from the site boundaries and to provide visual buffers for the main power plant facilities along SR 37, CR 630, and Fort Green Road from potential public viewpoints.

The main power block, fuel storage, and associated facilities will occupy only approximately 150 acres of the entire 4,348-acre site. These facilities will be constructed in the central portion of the site property to the east of SR 37. The mined-out lands surrounding the eastern and southern sides of the site for the main facilities will be developed into an approximately 860-acre, including the earthen berms, cooling reservoir which will be primarily below the pre-mining elevations after development/ reclamation of the site. The development of the Polk Power Station main power plant facilities will not adversely impact existing conditions and land uses onsite.

The power block and fuel storage facilities will be located approximately 2,600 ft from the nearest roadway, SR 37, or to offsite properties which are located northwest of the facility location. In all other directions, the power block and fuel storage areas are located at least 1 mile from offsite properties. Tampa Electric Company is planning to provide vegetative visual buffers along SR 37 and Fort Green Road so that only the tallest structures onsite (i.e., CG facilities and exhaust stacks) will be potentially visible from roadways or offsite property. The combination of significant setback distances and vegetative visual buffers will minimize any adverse offsite visual and land use impacts. Potential noise impacts resulting from the project construction activities are discussed in Section 4.9.

After completion of current phosphate mining activities, the approximately 1,511-acre portion of the site west of SR 37 will be reclaimed in accordance with the proposed reclamation plans, as approved by FDNR and Polk County. As previously shown in Figure 3.2.0-1, the proposed conceptual plans for this tract provide for reclaiming the mined-out lands into a natural system of forested and non-forested wetlands and uplands. No active power plant-related activities are planned on this tract. After reclamation, the tract will be allowed to evolve into a natural wildlife habitat system. Access to this 1,511-acre tract will be controlled which will allow the property to develop into a significant wildlife habitat resource in southwestern Polk County.

Scattered areas of single-family residential uses are located to the north of this western tract along Albritton and Bethlehem Roads and to the west in Hillsborough

County. The closest of these residences is located approximately 8,000 ft (1.5 miles) west of the planned power blocks and fuel storage areas. These residential uses will not be affected by the Polk Power Station development and operation since this western portion of the site will be reclaimed and used only as a natural area of wetlands and uplands and will not contain any of the main power plant facilities.

Due to the nature of proposed development plans of the Polk Power Station site west of SR 37, this portion of the site is compatible with the residential uses in the vicinity of the Polk Power Station site along Bethlehem and Albritton Roads.

4.6.2 COMPREHENSIVE PLANS IMPACTS

The Polk Power Station project is consistent with the goals and policies of the State Comprehensive Plan, Central Florida Comprehensive Regional Policy Plan, and the Polk County Comprehensive Plan. The development of the Polk Power Station will be consistent with, or will further several goals, objectives, and policies of each of these planning documents. Copies of these goals and policies are contained in Appendix 11.4. Table 4.6.2-1 provides a listing of the goals, objectives, and policies according to each plan.

As a Certified Electric-Power Generating Facility, the Polk Power Station is an allowed use within the phosphate mining future land use category designated for the Polk Power Station site, according to the Future Land Use Element of the Polk County Comprehensive Plan. The Comprehensive Plan allows for the development of Certified Electric Power Generating Facilities in the phosphate mining future land use category when such proposed development is reviewed and approved by Polk County by a CUP. The Polk Power Station power block site also satisfies locational, environmental, and development approval of Section 2.114-C of the Polk County Comprehensive Plan. Adjacent future land use categories are compatible with the power station and associated stormwater management areas. The suitability of the Polk Power Station site for the development of an electric-power generating facility is also supported by statements contained within Appendix B2.100 of the Future Land Use Support Document.

Therefore, the construction of the Polk Power Station and associated facilities will be consistent with future land use and comprehensive planning programs in Polk County and will not significantly impact the future use of lands adjacent to the Polk Power Station site.

Table 4.6.2-1. Listing of Goals, Objectives, and Policies of Planning Documents

- State Comprehensive Plan (Section 187, F.S.):
  - -- Energy, Policy 6;
  - -- Land Use, Policy 1; and
  - -- Public Facilities, Policies 1 and 6;
- Central Florida Comprehensive Regional Policy Plan:
  - -- Energy, Regional Issue (2), Regional Goal (a), Regional Policy (4);
  - -- Mining, Regional Issue (1), Regional Goal (a), Regional Policy (2);
  - -- Land Use, Regional Issue (1), Regional Goal (a), Regional Policy (2);
  - -- Public Facilities, Regional Issue (1), Regional Goal (a), Regional Policies (1) and (2); and
  - -- Transportation, Regional Issue (2), Regional Goal (1), Regional Policy (2);
- Polk County Comprehensive Plan;
- Future Land Use Element:
  Objective 2.102-A;
  - -- Policy 2.102-A1(a), Compatibility (of land uses);
  - -- Policy 2.102-A2, Distribution (of land uses); and
  - -- Policy 2.125-D1(b), Utilities Permitted Uses
- Conservation Element:
  Objective 2.302-A, Air Quality;
  - -- Policy 2.304-A4, Mineral Resources;
  - -- Policy 2.307-A3, Floodplains;
  - -- Policy 2.308-A3, Wetlands; and
  - -- Policy 2.310-A2, Hazardous Waste/Materials;
- Economic Element:
  - -- Policy 2.402-A1, Economic Base Maintenance;
  - -- Policy 2.402-A5, Economic Base Maintenance;
  - -- Policy 2.403-A2, Economic Base Diversification; and
  - -- Policy 2.404-A4, Economic Development Integrated with Planning;
- Infrastructure Element:
  - -- Policy 3.102-A1, Sanitary Sewer;
  - -- Policy 3.102-A2, Sanitary Sewer;
  - -- Policy 3.102-A3, Sanitary Sewer;
  - -- Policy 3.102-B4, Sanitary Sewer;
  - -- Policy 3.102-C1, Sanitary Sewer;
  - -- Policy 3.104-A5, Drainage;
  - -- Policy 3.104-A7, Drainage;
  - -- Policy 3.105-A1, Potable Water;
  - -- Policy 3.105-A2(d)(e), Potable Water;
  - -- Policy 3.105-A3, Potable Water; and
  - -- Policy 3.105-C1, Potable Water; and
- Traffic Circulation Element:
  Policy 3.205-A1, Protection of Rights-of-Way.

Source: ECT, 1992.

4.6.3 ZONING ORDINANCES IMPACTS

The Polk Power Station is considered a Class III Essential Service, which is an allowed conditional use for the RC zoning district designated for the Polk Power Station site. Therefore, a CUP was required for compliance with the Polk County Zoning Code. Under the county's zoning ordinance, CUPs are established to allow the approval of specific uses in addition to the permitted uses in each zoning district, and a CUP may be issued for the Polk Power Station site based on the recommendations of the Polk County Zoning Advisory Board and approval of the Board of County Commissioners. A CUP application was filed with Polk County on January 24, 1992, and provided the information required by the Polk County Zoning Ordinance to demonstrate that the Tampa Electric Company Polk Power Station complies with the applicable standards for approval of the CUP. The CUP application was approved by the Polk County Zoning Advisory Board on May 13, 1992, and by the Board of County Commissioners on June 2, 1992.

4.6.4 CONCURRENCY MANAGEMENT IMPACTS

The Polk Power Station will comply with the Polk County Concurrency Management Ordinance. As part of the concurrency determination, capacity will be reserved for transportation and solid waste and drainage standards will need to be met. As presented in the transportation analysis (see Appendix 11.6), based on projected traffic impacts and existing and projected traffic volumes, construction-related traffic is not expected to lower the LOS on roadway links and intersections to unacceptable levels in their current geometries. Sufficient capacity exists on roadways serving the Polk Power Station site. Adequate capacity also exists in county landfills to meet the solid waste disposal needs of the project. Drainage standards will be met through the appropriate design of drainage features and facilities. Capacity for potable water and wastewater will not have to be reserved because connections to municipal services are not required. Concurrency provisions for recreation and open space are not required as the Polk Power Station contains no residential element.

4.6.5 CONSTRUCTION EMPLOYMENT

As shown in Table 4.6.5-1 and Figure 4.6.5-1, the construction workforce is estimated to peak at approximately 600 workers for a 9-month duration. Employment is expected to be highest during the initial project phases (i.e., 1994 to mid-1996) because of the construction activities associated with overall site reclamation, the coal gasification facilities, and ancillary facilities (e.g., cooling reservoir, administrative/control buildings, parking) which will be constructed for ultimate build-out. Construction employment is expected to average approximately 400 workers throughout the projected 27-month initial construction phase. Beyond this initial construction timeframe, an average of 15 and peak of 20 construction workers would be employed for 6 to 9 months for the free-standing CT units, and an average of 40 and peak of 60 construction workers would be employed for 12 to 18 months for the CC units.

The construction workforce is expected to be primarily drawn from Hillsborough and Polk Counties; however, weekly construction commutes of up to 200 miles are possible (EPRI, 1982). It is estimated that approximately 60 percent of the construction workforce will be drawn from Polk County, 30 percent from Hillsborough County, 5 percent total combined from both Manatee and Hardee Counties, and 5 percent from outside the region or state. The geographic distribution of this construction workforce is shown in Table 4.6.5-2, which shows that the 5 percent drawn from outside the region is expected to range from 20 to 30 persons respectively at average and peak employment during the initial (through IGCC unit) construction phase. This 5 percent of the construction workforce drawn from outside the region is anticipated to occupy available rental housing units or recreational vehicle (RV) park sites. However, at 20 to 30 persons, the associated potential impacts on housing, schools, and other public facilities and services will be minimal. Based on the predicted size of the construction workforce to be employed for the subsequent construction of the CT and CC units (see Table 4.6.5-2), their impact on public services and facilities is expected to be negligible. Construction is expected to occur

Table 4.6.5-1. Construction Personnel Requirements

Year	Unit Additions	Total Nominal Station Capacity (MW)	Construction Personnel		Comments
			Average	Peak	
1994	None	0	400	400	Construction of CT and IGCC starts January
1995	One 150-MW CT	150	400	600	Peak personnel, January through September 1995
1996	CG conversion of one 150-MW CT	260	400	400	Construction ends July 1996
1998	None	260	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 1998
1999	One 75-MW CT	335	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 1999
2000	One 75-MW CT	410	15	20	Construction of CC plant starts in April; peak personnel, July through September 2000
2001	CC conversion of two 75-MW CTs	480	40	60	Construction of next 75-MW CT and 220-MW CC units starts in April 2001; peak at December
2002	One 75-MW CT	555	40	60	Peak personnel, January through May 2002
2003	One 220-MW CC	775	40	40	Construction ends January 2003
2005	None	775	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 2005
2006	One 75-MW CT	850	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 2006
2007	One 75-MW CT	925	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 2007

Table 4.6.5-1. Construction Personnel Requirements (Continued, Page 2 of 2)

Year	Unit Additions	Total Nominal Station Capacity (MW)	Construction Personnel Average	Construction Personnel Peak	Comments
2008	One 75-MW CT	1,000	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 2008
2009	One 75-MW CT	1,075	15	20	Construction of next 75-MW unit starts in April; peak personnel, July through September 2009
2010	One 75-MW CT	1,150	15	20	Construction ends January 2010

Source: UE&C, 1992.

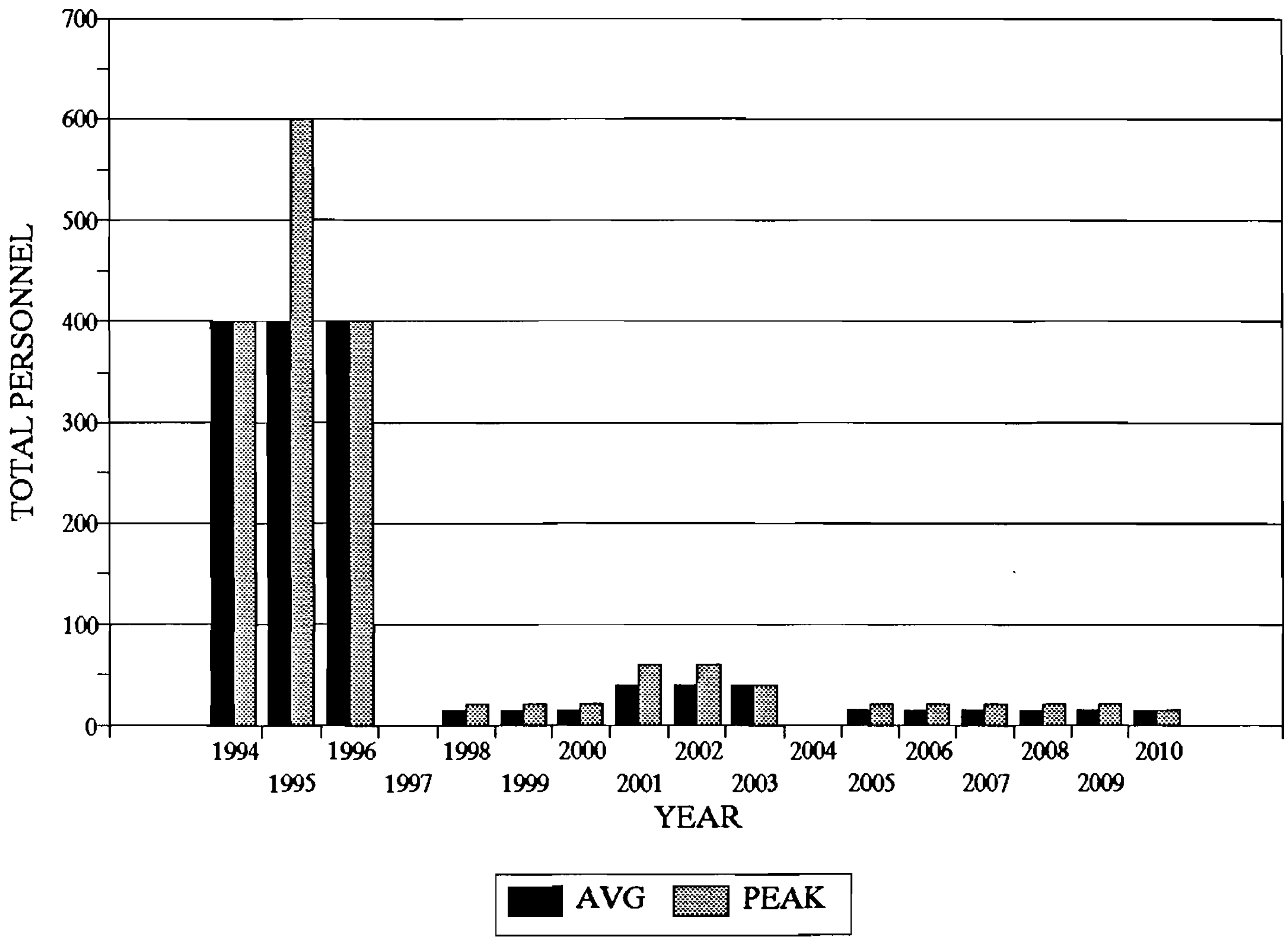


FIGURE 4.6.5-1.

TAMPA ELECTRIC COMPANY POLK POWER STATION CONSTRUCTION PERSONNEL REQUIREMENTS

Source: UEC, 1992.

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Table 4.6.5-2. Estimated Distribution of Construction Workforce

County	Average Construction Workforce	Peak Construction Workforce	Peak CT Construction Employment	Peak CC Construction Employment
Polk (60 percent)	240	360	12	36
Hillsborough (30 percent)	120	180	6	18
Hardee and Manatee (5 percent)	20	30	1	3
Outside region/state (5 percent)	20	30	1	3
TOTAL	**400**	**600**	**20**	**60**

Sources: UE&C, 1992.
ECT, 1992.

during daylight hours, with the majority of the construction workers onsite between 7 a.m. and 4 p.m.

4.6.6 TRANSPORTATION IMPACTS

Some construction-related transportation impacts are expected as a result of the movement of construction workers, machines, and equipment to and from the Polk Power Station site. The transportation analysis for the Polk Power Station indicates that these impacts are expected to be temporary and will not have significant adverse effects on the LOS ratings of roadway links and intersections in the vicinity of the site (see Appendix 11.6).

Access points for the construction workforce and deliveries will be provided by two entrance roadways: Bethlehem Road entrance from SR 37 and the Fort Green Road entrance. The main plant entrance roadway will be used for operational employees and visitors. All entrances will be gated and access to the plant site will be controlled. These entrances will be designed with appropriate geometric improvements, deceleration, acceleration, and turn lanes, based on FDOT standards, to accommodate construction and operational traffic so that roadway volumes are not lowered to an unacceptable LOS. As previously discussed, these roadway improvements will be constructed during the initial construction activities to accommodate construction-related traffic. A copy of the letter request to FDOT for conceptual review of driveway connections to SR 37 is provided in Appendix 11.2.4.

Based on past construction experience and traffic analyses for similar power plants, a construction-related trip generation rate of 2.0 and a vehicle occupancy rate of 1.4 is expected for the Polk Power Station. Based on these trip generation and vehicle occupancy rates and an assumed trip distribution of 75 percent northbound and 25 percent southbound, a maximum of 644 northbound and 214 southbound daily trips are expected during the 9-month peak of construction. For the expected average of 400 construction workers, 429 northbound and 143 southbound daily trips are estimated for the remaining 18 months of the 27-month initial construction phase. The estimated traffic impacts associated with the subsequent CT and CC units range from a total of 22 to 86 daily trips during the peak of each construction phase. These maximum daily and average trips during initial construction phase and total daily trips for subsequent construction of CT and CC units are not expected to lower regional road networks to unacceptable LOS standards.

Further, Tampa Electric Company will encourage transportation demand management techniques to reduce the number of temporary construction-related vehicle trips on the road networks. These techniques will include placing a bulletin board onsite which may be used by construction contractors to place car-pooling advertisements. All construction contractors will be requested to inform their employees that this service is available.

During the peak construction activities, construction vehicles (e.g., graders, bulldozers, dump trucks) will also access the site. However, the majority of these heavy construction vehicles are anticipated to remain onsite for the duration of the initial construction activities, entering at initiation and exiting at completion. Since the majority of these vehicles are not expected to make daily trips to and from the site, the potential traffic impacts from the vehicles are expected to be minimal to the regional road network.

4.6.7 HOUSING IMPACTS

For the year 1990, FDLES reported more than 35,000 construction workers in the four-county study area of Polk, Hillsborough, Hardee, and Manatee Counties (BEBR, 1991). Based on this available construction workforce and as previously discussed in Section 4.6.5, the majority of construction workers are expected to be drawn from within the four-county area and will not permanently relocated to the area. It is therefore expected for the majority of these construction workers to commute daily to and from the Polk Power Station site. Some construction workers may choose to drive an RV to the area and stay at available camp sites during the week, returning to their families on the weekends. Because the majority of the construction workforce is anticipated to commute daily, those using RVs and campground facilities are not expected to significantly increase demands upon RV campground facilities.

As previously discussed in Section 4.6.5 and as shown in Table 4.6.5-2, the number of construction workers expected to be drawn from outside the region is predicted to range from an average of 20 to a peak of 30 persons during the initial (through IGCC unit) construction phase. These 20 to 30 persons are anticipated to occupy available rental housing and/or RV sites in the area. Relatively few construction workers are anticipated to be employed during subsequent construction of CT and CC units (see Tables 4.6.5-1 and 4.6.5-2), and consequently, associated impacts on housing are anticipated to be negligible.

As previously discussed in Section 2.2.7, and as shown in Table 4.6.5-2 (1990 Housing Stock), 1990 rental housing vacancy rates ranged from 11.8 percent in Manatee County to 12.6 percent in Polk, 13.5 percent in Hillsborough, and 15.5 percent in Hardee County. In 1990, 30,256 available rental units including seasonal and recreational units were recorded in Polk County, with a total of 98,859 available housing units in the four-county area (BEBR, 1991). Therefore, the relatively small additional temporary demand for rental housing associated with the Polk Power Station construction workforce is expected to be readily absorbed by available rental housing in Polk County and/or the four-county region. Those commuting workers are expected to maintain their established patterns of use based on their existing residences, which should not create any additional housing demands to the area.

4.6.8 PUBLIC SERVICES AND FACILITIES IMPACTS

As with potential housing impacts, construction-related impacts to public services and facilities are not expected to be significant. The majority of the construction workforce is anticipated to commute from their current residences, with only minimal temporary relocations expected. Therefore, because the workforce is currently provided with public services and facilities associated with their existing residences, no significant changes in the patterns of use or demands upon public services are expected.

4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS

No federal, state, regional, or local scenic, cultural, or natural landmarks are located within the 5-mile study area surrounding the Polk Power Station. Therefore, the construction of the Polk Power Station will have no impact upon such resources.

4.8 IMPACT OF ARCHAEOLOGICAL AND HISTORIC SITES

Based on the cultural resources assessment conducted for the site and confirmation of those results by FDHR (see Appendix 11.5), the construction of the Polk Power Station is not expected to disturb any archaeological or historical features eligible for the National Register of Historic Places. Therefore, no mitigation to such impacts will be required. In the unexpected event that such a feature is encountered during construction, activities will be halted until a certified archaeologist evaluates the site or find and determines its significance. If the find is significant, Tampa Electric Company will take the appropriate measures to preserve or mitigate the impact to the site or find in coordination with FDHR.

4.9 NOISE IMPACTS

The major construction activities for the Polk Power Station project involve the construction of the IGCC and overall site reclamation, the two CC units, and the six simple-cycle CTs. The construction activities can be divided into four stages for purposes of assessing potential noise impacts:

1. Site preparation and excavation,
2. Foundation preparation and pouring,
3. Steel erection and equipment installation, and
4. Site cleanup and plant startup.

During the initial stage, heavy diesel-powered earthmoving equipment will be the major source of noise. This equipment will include bulldozers, graders, backhoes, front-end loaders, dump trucks, scraper pans, sheepsfoot rollers, and dewatering pumps. Typical noise levels such equipment produces could approach 91 dBA at 50 ft [United Engineers & Constructors, Inc. (UE&C), 1992]. Noise levels for each piece of equipment are listed in Table 4.9.0-1. The location of activity in this stage includes reclamation over the entire site, heavy activity at the plant site and the cooling reservoir, and activities near the site boundaries such as access roads and gates and the rail spur (UE&C, 1992).

For the addition of the CC units and CTs in the later phases of construction, site preparation and excavation activities will be limited to the immediate power block areas and the circulating water lines for the CC units.

Equipment used during second stage activities will include concrete trucks, cranes, pile drivers, air compressors, concrete pumps, and some earthmoving equipment. Typical maximum noise levels could reach 95 dBA at 50 ft (UE&C, 1992). A list of this equipment is given in Table 4.9.0-2. The heaviest activity for all phases will be at the power block and gasifiers. Pile driving may be required for the air separation unit, CTs, and ST generators.

Table 4.9.0-1. Equipment and Noise Levels for the Site Preparation and Excavation Stage

Equipment	Maximum Noise Level at 50 ft (dBA)
Bulldozers	90
Graders	83
Backhoes	84
Front-end loaders	90
Dump trucks	89
Scraper pans	91
Sheepsfoot rollers	83
Dewatering pumps	78

Source: UE&C, 1992.

Table 4.9.0-2. Equipment and Noise Levels for the Foundation Preparation and Pouring Stage

Equipment	Maximum Noise Level at 50 ft (dBA)
Pile drivers	95
Concrete pouring/trucks	87
Cranes	86
Air compressors	89
Concrete pumps	84
Excavation equipment	90
Trucks	87

Source: UE&C, 1992.

Cranes, air compressors, welders, asphalt pavers, dump trucks, and delivery trucks will be required during the third stage for all construction phases. There will also be 12 to 30 rail deliveries of certain equipment and materials on an infrequent basis during the IGCC unit construction activities. The number of rail deliveries for construction purposes will be reduced to 6 to 12 for the CC and CT units. Noise levels produced during equipment installation and erection will be in the range of 78 to 89 dBA at 50 ft (UE&C, 1992), and diesel locomotives will produce a maximum of 97 dBA at 50 ft (UE&C, 1992). Table 4.9.0-3 lists this equipment and their respective noise levels.

The final stage, site cleanup and plant startup, will be approximately 10 dBA quieter than the other stages (BBN, 1977), except during the short periods of time when the steam lines are being cleaned. During steam line cleaning, high-pressure steam is blown through the steam piping between the HRSGs and the ST generators to remove scale or welding debris which could damage the ST blades. The steam is vented directly to the atmosphere through a temporary bypass line constructed specifically for that purpose. Cleaning of the steam lines will require approximately 3 to 10 blows of 1 to 15 minutes per blow over a 2- to 5-day time period. A significant peak sound pressure level at 50 ft of 131 dBA (UE&C, 1992) will be produced. The temporary steam line blow-out activity is predicted to produce a maximum instantaneous noise level of 80 to 83 dBA at the nearest residences. Construction noise mitigation for steam blow-out activities will involve publishing advance notices in the local newspapers of such scheduled events. The earthmoving equipment will be operated according to design specifications and only during daytime working hours.

Figure 4.9.0-1 shows the composite construction noise-level contours overlaid on the power block portion of the project site. The noise contours are based on time-integrated averaged noise data measured during the construction of several power plants (BBN, 1977). These data represent typical noise levels during construction. The site preparation and steel erection stages produce the highest levels of

Table 4.9.0-3. Equipment and Noise Levels for the Steel Erection and Equipment Installation Stage

Equipment	Maximum Noise Level at 50 ft (dBA)
Cranes	86
Air compressors	89
Welders	73
Delivery trucks	87
Diesel locomotives (12 to 30 infrequent rail deliveries)	97
Asphalt paver	89
Dump trucks	87

Source: UE&C, 1992.

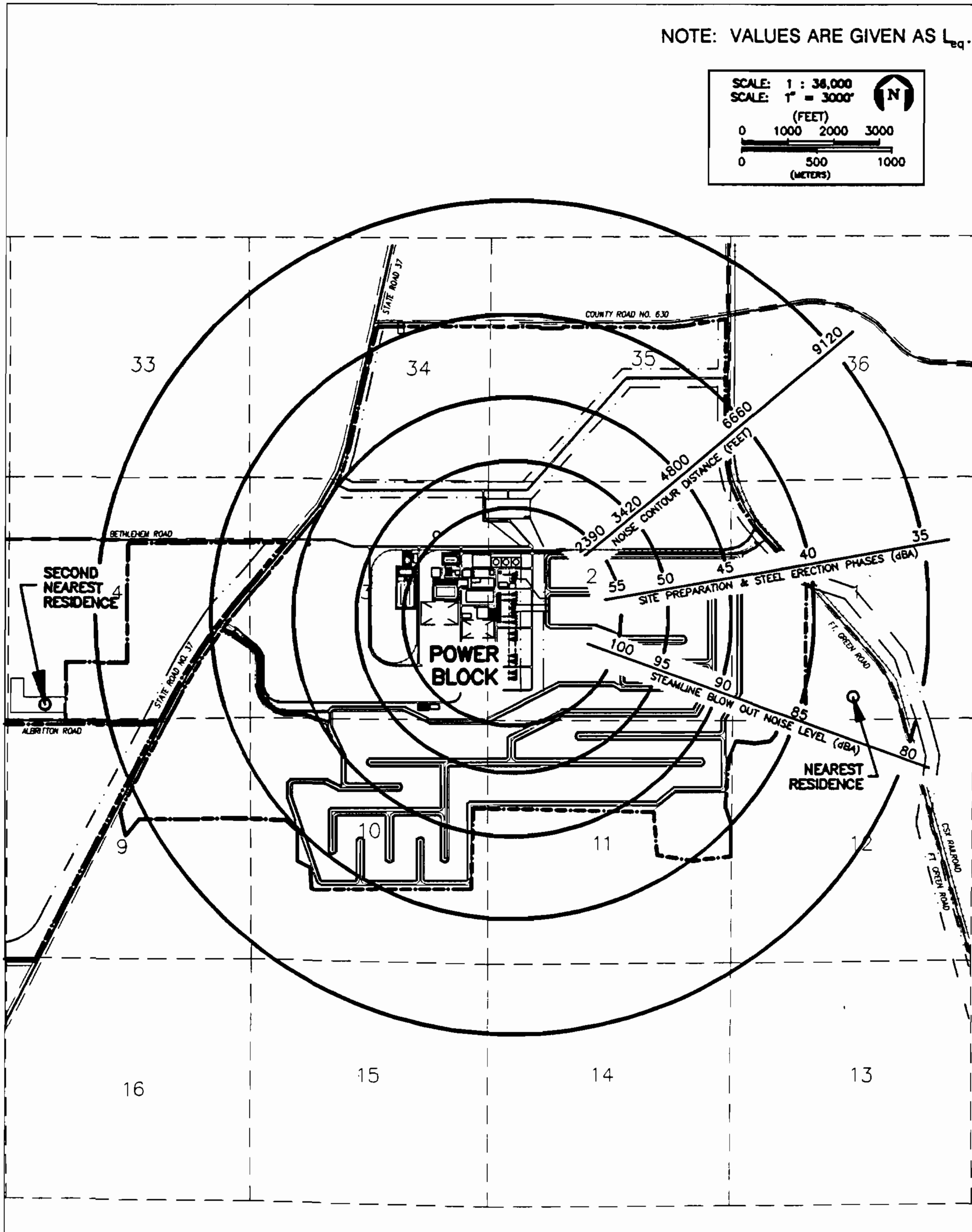

FIGURE 4.9.0-1.

COMPOSITE CONSTRUCTION NOISE-LEVEL CONTOURS

Sources: BBN, 1977. UEC, 1992. ECT, 1992.

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continuous daytime noise. However, due to the large separation between the plant site and the nearest residence, the construction noise levels will be reduced to approximately an equivalent noise level (L_{eq}) of 40 dBA. This level is significantly below the existing L_{eq} of 51 dBA measured near the residence. Consequently, since noise is not additive, normal construction activities at the plant site will have a minor and temporary impacts on the noise environment at residences around the plant.

Noise related to truck traffic could be significant during construction due to noise levels generated [91 dBA at 50 ft (EPA, 1971)] and frequency. However, such impacts will be temporary since it would be limited to the construction phase.

4.10 SPECIAL FEATURES

Construction of the Polk Power Station will involve no unusual products, raw material, garbage disposal services, and incinerator effluents and residues which will have an influence on the environment and ecological systems of the plant site and adjacent areas.

4.11 BENEFITS FROM CONSTRUCTION

The site preparation and construction of the Polk Power Station will create numerous economic benefits to the area. These benefits include increased construction employment and sales taxes levied on construction materials. A detailed description of these benefits is presented in Section 7.0 of this SCA.

4.12 VARIANCES

As part of the state site certification proceedings, two variances are sought from Chapter 16C-16.0051, F.A.C., FDNR Reclamation and Restoration Standards for the development and reclamation of the Polk Power Station site on mined and disturbed phosphate lands. Specifically, a variance from Chapter 16C-16.0051(5), F.A.C., Wetlands and Water Bodies, is needed for the construction of the proposed cooling reservoir and from Chapter 16C-16.0051(11), F.A.C., Time Schedule. Discussions of these variances are provided in Chapter 9.0 of this SCA and in the Conceptual Reclamation Plan Application submitted as a separate document to FDNR. No significant or adverse impacts will result from granting these variances.

No other construction related variances from applicable local, regional, state, or federal standards or guidelines are expected to be required as part of the state site certification proceedings.

REFERENCES

Bolt, Beranek, and Newman, Inc. (BBN). 1977. Power Plant Construction Noise Guide. Prepared for Empire State Electric Energy Research Corporation, New York, NY. Report No. 3321.

Bureau of Economic and Business Research (BEBR). 1991. 1991 Statistical Florida Abstract. College of Business Administration, University of Florida, University Press of Florida. Gainesville, FL.

Electric Power Research Institute (EPRI). 1982. Socioeconomic Impacts of Power Plants, Document EA-2228. Denver Research Institute, Denver, CO.

Lincks and Associates. 1992. Transportation Analysis Polk Power Station.

United Engineers & Constructors, Inc. (UE&C). 1992. Comment Letter to D.A. Cowdrick, Tampa Electric Company, from R.A. Rizzi, UE&C. May 6.

U.S. Environmental Protection Agency (EPA). 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. Prepared by Bolt, Beranek, and Newman, Inc. NTID Report No. 3001.

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CHAPTER 5.0
EFFECTS OF PLANT OPERATION

This chapter describes the operational interactions of the proposed Tampa Electric Company Polk Power Station and directly associated facilities on the environment on and in the vicinity of the site. The descriptions focus on the potential environmental interactions of the proposed project operations relative to applicable federal, state, and local regulatory requirements and standards. To the extent practicable, the potential impacts of the facility operations are quantified and systematically presented and proposed impact mitigation measures are described to provide reasonable assurance that applicable regulatory requirements and standards will be met during the project operations. In this chapter, appropriate references are provided to other chapters and sections of this SCA, particularly to Chapters 2.0 and 3.0 which present detailed information on the existing environmental conditions on the site and the proposed project facilities, systems, and operations.

5.1 EFFECTS OF THE OPERATIONS OF THE HEAT DISSIPATION SYSTEM

5.1.1 TEMPERATURE EFFECT ON RECEIVING BODY OF WATER

Continuous supply of cooling water at the rate of approximately 247,000 gpm (355.7 MGD) will be needed for cooling purposes for the two 220 MW CC units, the 260 MW IGCC unit, and certain other facilities at the proposed Polk Power Station. A 727-acre (water surface) cooling reservoir will be used as the cooling water supply and will also receive the warmed water discharge and dissipate heat energy during recirculation. The cooling reservoir is designed to have sufficient heat rejection capacity to continuously supply cool water to the power generating units for cooling purposes. The design features of the reservoir are described in Section 3.5.

As discussed previously in Section 3.5, the reservoir will be designed to optimize the plant operation and maximize water reuse; therefore, minimizing the consumptive uses of groundwater while maintaining water quality in the reservoir. To assess the water quality impacts from the cooling reservoir operations, a water quality model, in conjunction with a groundwater flow model, MODFLOW, was used to predict the long-term water quality in the reservoir considering various makeup, blowdown, and treatment scenarios. The modeling efforts indicated that the optimum design with the least hydrologic and water quality impacts, for both surface water and groundwater, would be a recirculating system having the following design and operating features:

- The reservoir will be maintained at a water level of approximately 136.0 ft-NGVD;
- The reservoir will receive and reuse treated water from the IWT system, sanitary treatment plant, oil/water separators, and R.O. units. The average quantity of the reused water will be approximately 887,600 gpd;
- The reservoir will be replenished by groundwater from the Floridan Aquifer at an average annual rate of 4.91 MGD (or approximately 5.0 MGD); and
- The reservoir will have continuous discharge of approximately 3.1 MGD to control the water quality in the reservoir and of offsite discharges.

The water level of the reservoir will be controlled by the operation of the makeup water supply from the Floridan aquifer. To optimize water quality conditions, a blowdown structure (i.e., Outfall 001) will be provided to prevent continuous accumulation of dissolved material in the reservoir (see Figure 3.5.1-2). As discussed in Section 3.5, the receiving water for discharges from the reservoir will be the reclaimed lake located along the eastern edge of the reservoir and within the project site.

To evaluate the potential temperature impacts of the cooling reservoir operation on the receiving water at Outfall 001, a thermal balance and thermal model were used to predict the monthly water temperatures of the reservoir discharges. The methodology of the thermal model is described in Peterson (1971) and the EPA publication (Tetra Tech, 1985). The model included the effects of short-wave solar radiation, long-wave atmospheric radiation, heat load from the power plant, reflected short-wave solar radiation, reflected long-wave atmospheric radiation, long-wave back radiation, conductive heat loss, and evaporative heat loss. The forced evaporation due to warmed water was computed according to Harbeck (1964). Various meteorological data, including air temperature, dew point temperature, relative humidity, and windspeed were used for the model inputs.

The water temperature of the reservoir was computed for two scenarios: (1) normal operating conditions, and (2) full load (worst case) conditions. The monthly temperatures at the water intake, the point of blowdown discharge, and within the reclaimed lake receiving water body are shown in Table 5.1.1-1 for average operating conditions. Monthly temperatures for full load conditions are shown in Table 5.1.1-2.

As shown in these tables, the results of the thermal analysis predict that under normal operating conditions the water temperature of the cooling reservoir blowdown will not be higher than receiving water by more than 3.0°F. The worst month of the year in term of thermal stress is December when the discharge temperature is 64.7°F, approximately 2.6°F above ambient water temperature. The highest discharge temperature will occur in August when the blowdown is 87.7°F, approximately 1.6°F above the ambient temperature. According to FDER water quality standards (Chapter 17.302, F.A.C.), the thermal discharge should not exceed 92°F and should not be more than 3°F higher than the ambient temperature of a receiving lake. Therefore, under normal operating conditions, the cooling reservoir discharge will meet these standards and will not have significant adverse impacts in the receiving water (i.e., the onsite reclaimed lake to the east of the cooling reservoir).

When the plant facilities are operating at full load during periods of extremely high power demand, the discharge temperature will be 66.2°F in December, approximately 4.1°F above receiving lake temperature which would exceed the FDER standards of a delta temperature of not more than 3°F. As shown in Table 5.1.1-2, this temperature standard is also predicted to be exceeded in January, February, and November under these full load operating conditions. The maximum blowdown

Table 5.1.1-1. Heat Budget Summary for the Proposed Tampa Electric Company Polk Power Station Cooling Pond–Average Load Conditions

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ambient air temperature	AF	61.2	62.7	66.0	71.4	76.8	80.6	81.6	82.0	80.5	74.7	66.8	62.3
Ambient air relative humidity	%	75.5	73.0	73.5	71.0	68.5	73.5	76.5	79.0	77.0	76.0	75.5	75.8
Ambient air water vapor pressure	mm Hg	10.4	10.6	12.0	13.9	16.1	19.5	21.0	22.0	20.4	16.6	12.7	10.9
Barometric pressure	mb	1,017	1,016	1,015	1,014	1,012	1,013	1,014	1,014	1,013	1,014	1,015	1,017
	mm Hg	782	781	780	780	778	779	780	780	779	779	781	782
Windspeed	mph	9.1	9.7	10.0	9.7	9.2	8.4	7.6	7.4	8.6	9.1	8.9	8.9
Cloud cover	%	53	47	48	47	46	58	63	61	60	47	46	52
Solar radiation, shortwave at surface	$Btu/ft^2/day$	1,210	1,447	1,754	1,994	2,205	2,124	1,976	1,828	1,672	1,480	1,317	1,110
Net shortwave solar radiation	$Btu/ft^2/day$	1,174	1,403	1,701	1,934	2,139	2,060	1,917	1,773	1,622	1,436	1,278	1,077
Net longwave atmospheric radiation	$Btu/ft^2/day$	2,348	2,359	2,472	2,639	2,817	3,070	3,168	3,195	3,106	2,795	2,503	2,380
Longwave back radiation	$Btu/ft^2/day$	2,986	3,039	3,154	3,291	3,424	3,542	3,576	3,581	3,501	3,321	3,118	2,991
Evaporative heat loss	$Btu/ft^2/day$	518	674	893	1,146	1,404	1,442	1,356	1,242	1,136	859	628	467
Conductive heat loss	$Btu/ft^2/day$	25	56	119	127	121	144	149	140	92	45	28	(7)
Discharge flow	cfs	550	550	550	550	550	550	550	550	550	550	550	550
Reservoir area	acres	727	727	727	727	727	727	727	727	727	727	727	727
Thermal exchange coefficient	$Btu/ft^2/day$	170	186	207	221	230	229	216	212	230	214	184	169
Relative humidity at pond surface	%	100	100	100	100	100	100	100	100	100	100	100	100
Vapor pressure (sat'd at pond surface)	mm Hg	19.9	21.1	24.1	28.3	32.9	37.6	39.9	40.2	36.5	29.7	23.6	20.4
Plant load factor	%	75	75	75	75	75	75	81	81	81	78	78	78
Heat load to cooling pond	$Btu/ft^2/day$	1,410	1,410	1,410	1,410	1,410	1,410	1,520	1,520	1,520	1,460	1,460	1,460
Natural water equilibrium temperature	AF	61.9	64.2	69.1	74.7	80.0	84.6	85.9	86.1	83.0	75.9	67.6	62.1
Thermal increase	AF	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Temperature at condenser intake	AF	63.8	65.7	70.2	75.6	80.8	85.4	87.2	87.4	84.1	77.0	69.3	64.3
Hot side temperature	AF	83.8	85.7	90.2	95.6	100.8	105.4	107.2	107.4	104.1	97.0	79.3	84.3
Blowdown temperature	**AF**	**64.2**	**66.0**	**70.5**	**75.9**	**81.1**	**85.7**	**87.5**	**87.7**	**84.3**	**77.3**	**69.7**	**64.7**
Delta-T (blowdown, ambient)	**AF**	**2.3**	**1.8**	**1.4**	**1.2**	**1.1**	**1.1**	**1.6**	**1.6**	**1.3**	**1.4**	**2.1**	**2.6**

Note: mm Hg = millimeters of mercury.
mb = millibar.
$Btu/ft^2/day$ = British thermal unit per square foot per day.

Source: ECT, 1992.

Table 5.1.1-2. Heat Budget Summary for the Proposed Tampa Electric Company Polk Power Station Cooling Pond--Full Load Conditions

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ambient air temperature	AF	61.2	62.7	66.0	71.4	76.8	80.6	81.6	82.0	80.5	74.7	66.8	62.3
Ambient air relative humidity	%	75.5	73.0	73.5	71.0	68.5	73.5	76.5	79.0	77.0	76.0	75.5	75.8
Ambient air water vapor pressure	mm Hg	10.4	10.6	12.0	13.9	16.1	19.5	21.0	22.0	20.4	16.6	12.7	10.9
Barometric pressure	mb	1,017	1,016	1,015	1,014	1,012	1,013	1,014	1,014	1,013	1,014	1,015	1,017
	mm Hg	782	781	780	780	778	779	780	780	779	779	781	782
Windspeed	mph	9.1	9.7	10.0	9.7	9.2	8.4	7.6	7.4	8.6	9.1	8.9	8.9
Cloud cover	%	53	47	48	47	46	58	63	61	60	47	46	52
Solar radiation, shortwave at surface	Btu/ft^2/day	1,210	1,447	1,754	1,994	2,205	2,124	1,976	1,828	1,672	1,480	1,317	1,110
Net shortwave solar radiation	Btu/ft^2/day	1,174	1,403	1,701	1,934	2,139	2,060	1,917	1,773	1,622	1,436	1,278	1,077
Net longwave atmospheric radiation	Btu/ft^2/day	2,348	2,359	2,472	2,639	2,817	3,070	3,168	3,195	3,106	2,795	2,503	2,380
Longwave back radiation	Btu/ft^2/day	2,986	3,039	3,154	3,291	3,424	3,542	3,576	3,581	3,501	3,321	3,118	2,991
Evaporative heat loss	Btu/ft^2/day	518	674	893	1,146	1,404	1,442	1,356	1,242	1,136	859	628	467
Conductive heat loss	Btu/ft^2/day	25	56	119	127	121	144	149	140	92	45	28	(7)
Discharge flow	cfs	550	550	550	550	550	550	550	550	550	550	550	550
Reservoir area	acres	727	727	727	727	727	727	727	727	727	727	727	727
Thermal exchange coefficient	Btu/ftc/day	180	196	216	230	239	237	222	218	236	223	193	177
Relative humidity at pond surface	%	100	100	100	100	100	100	100	100	100	100	100	100
Vapor pressure (sat'd at pond surface)	mm Hg	21.9	23.0	26.1	30.5	35.3	40.0	41.8	42.1	38.3	31.7	25.6	22.1
Plant load factor	%	100	100	100	100	100	100	100	100	100	100	100	100
Heat load to cooling pond	Btu/ft^2/day	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870
Natural water equilibrium temperature	AF	61.9	64.2	69.1	74.7	80.0	84.6	85.9	86.1	83.0	75.9	67.6	62.1
Thermal increase	AF	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Temperature at condenser intake	AF	65.3	67.0	71.3	76.6	81.7	86.4	88.0	88.3	84.8	78.0	70.5	65.7
Hot side temperature	AF	85.3	87.0	91.3	97.6	101.7	106.4	108.0	108.3	104.8	98.0	90.5	85.7
Blowdown temperature	**AF**	**65.9**	**67.5**	**71.7**	**77.0**	**82.1**	**86.7**	**88.4**	**88.7**	**85.2**	**78.4**	**71.0**	**66.2**
Delta-T (blowdown, ambient)	**AF**	**4.0**	**3.3**	**2.6**	**2.3**	**2.1**	**2.1**	**2.5**	**2.6**	**2.2**	**2.5**	**3.4**	**4.1**

Note: mm Hg = millimeters of mercury.
mb = millibar.
Btu/ft^2/day= British thermal unit per square foot per day.

Source: ECT, 1992.

temperature is predicted to be 88.7°F in August, approximately 2.6°F above receiving lake temperature. The thermal analysis assumes that the plant loads are 100 percent at all times during the year and for all units after full built-out. In reality, however, such full load conditions are unlikely to occur, and if they do, will only occur for a few days per year. Therefore, the results of the analysis are extremely conservative, especially considering the fact that the time of one cycle of cooling water recirculation through the reservoir is greater than 10 days, and the travel time of the cooling water to reach the point of discharge is greater than 9 days.

To assess the thermal impacts of the cooling water blowdown in the receiving lake under the worst-case conditions (long-term full load in December), a mixing zone analysis was conducted. The thermal mixing zone analysis used a conservative approach in that only the effects of heat exchange in the receiving water were considered, while turbulent mixing, a more effective mechanism of temperature reduction, is not considered in the analysis. Table 5.1.1-3 presents the results of the thermal mixing zone analysis which indicate that within an approximately 200-ft distance from the point of discharge, the temperature will be reduced to less than 3°F above the ambient temperature in the receiving water body. The receiving reclaimed lake is approximately 3,800 ft long and 900 ft wide, and this 200-ft radius mixing zone only represents approximately 1.8 percent of the total lake surface area.

As described in Section 3.5.1-1, in addition to the continuous blowdown structure, a 10-ft wide overflow weir will be provided at Outfall 001 to drain excessive rainfall during extreme storm events. The stormwater overflow structure is designed so that it will allow stormwater overflow only for storm events greater than 7.2 inches.

Although extreme storm events (i.e., 25-year, 24-hour) will create greater discharge, up to 8.2 cfs from the cooling reservoir than under the normal operating conditions, the onsite runoff into the reclaimed lake will significantly mix the reservoir blowdown as discussed in Section 3.8.4 and depicted in Figure 3.8.4-4. The maximum mixing ratio is estimated to be about 82:1 at the peak of the storm and is estimated to

Table 5.1.1-3. Thermal Mixing Zone Analysis

Distance (ft)	Temperature Difference (°F)	Water Temperature (°F)
0	4.10	66.2
50	3.99	66.1
100	3.68	65.8
200	2.67	64.8
300	1.56	63.7
400	0.73	62.8
500	0.28	62.4
1,000	0.00	62.1

Note: Blowdown rate = 3.1 MGD.
Heat exchange coefficient = 177 Btu/ft^2/day/°F.
Water depth = 15 ft.
Ambient water temperature = 62.1°F.
Temperature at POD = 66.2°F.

Source: ECT, 1992.

decrease to 1.8:1 after 300 hours (12.5 days) when the reservoir discharge predicted is dropped to 5.5 cfs. In addition to the mixing effects of the onsite runoff, the precipitation will also provide further cooling. Therefore, the increased warmed water discharge from the reservoir during extreme storm events may not create a greater mixing zone than under normal conditions. To quantify the size of the mixing zone during extreme storm events; however, an even more conservative approach than the one describe above was used. The analysis assumed the following:

- The cooling reservoir discharge is at a constant rate of 8.2 cfs, which is the peak discharge;
- The mixing flow (up to 90:1 mixing ratio) is ignored in the analysis;
- Turbulent mixing is ignored;
- Cooling effects of the precipitation is neglected; and
- Only the surface heat exchange is considered in the analysis.

The size of the mixing zone given the above conservative assumptions is calculated to be less than 250 ft from the point of discharge, and is estimated to represent approximately 2.9 percent of the total receiving reclaimed lake area.

Based on the results of the thermal and mixing zone analyses, the normal operation of the cooling reservoir will cause no adverse impacts in the receiving reclaimed lake. Only during full load and with extremely high water level in the reservoir will a mixing zone of less than 250 ft radius from point of discharge be expected. The location and size of this worst-case thermal mixing zone is shown in Figure 5.1.1-1. The cooling reservoir discharge will have no thermal impacts on the receiving water bodies, including Little Payne Creek which flows to Payne Creek and then to the Peace River.

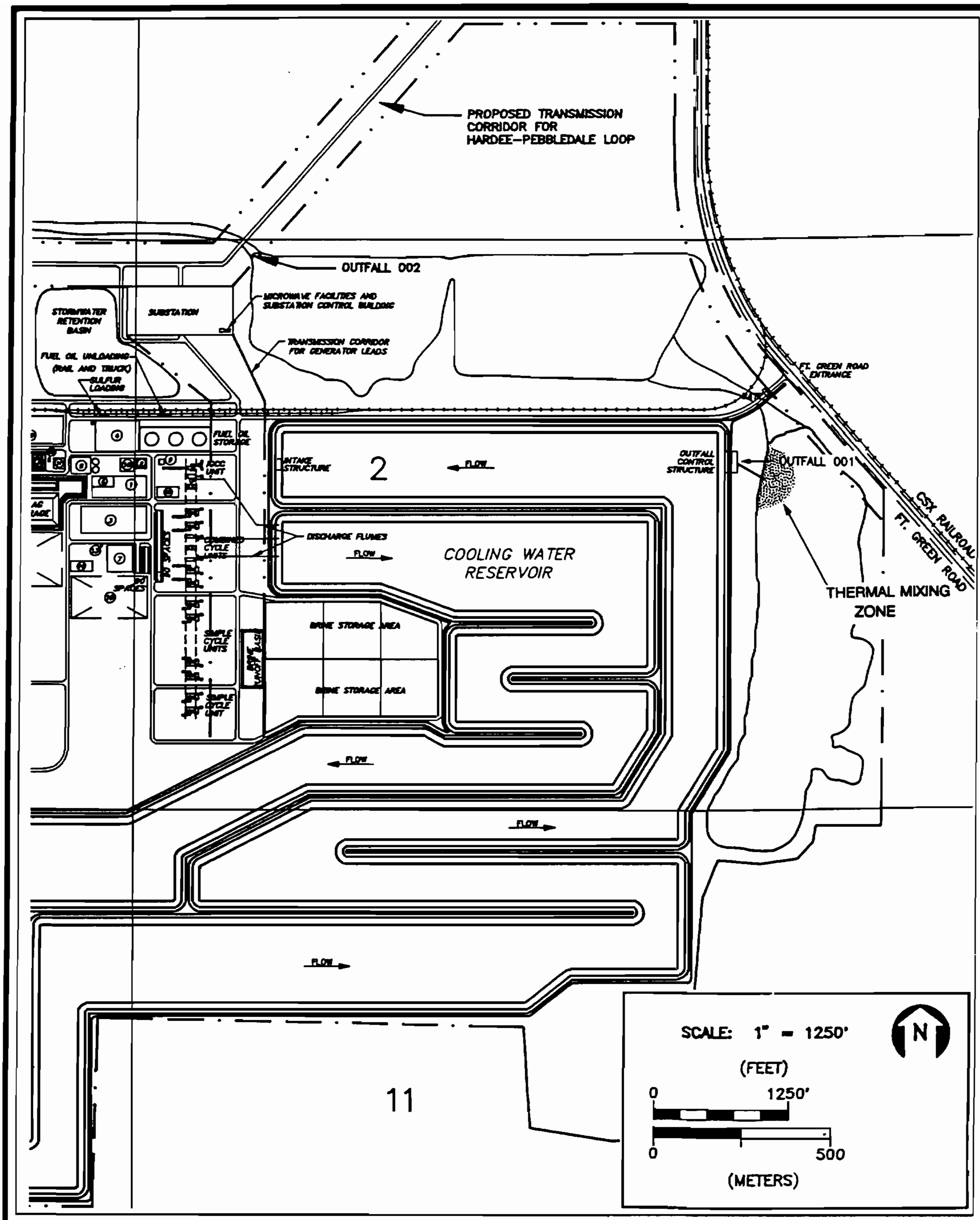

FIGURE 5.1.1-1.

THERMAL MIXING ZONE (WORSE CASE CONDITION - FULL LOAD AND MAXIMUM DISCHARGES)

Source: UEC, 1992; ECT, 1992.

TAMPA ELECTRIC
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POLK POWER STATION

5.1.2 EFFECTS ON AQUATIC LIFE

5.1.2.1 Thermal Impacts

The proposed Polk Power Station cooling reservoir will discharge into the northwestern corner of the reclaimed lake located within the project boundaries on the east side of the site. Water will then drain from the lake through a swale on the southern edge of the lake into the Little Payne Creek drainage system. The predicted maximum average reservoir temperature on the cold side at the condenser intake is estimated to be 88.3°F in August. The maximum worst case monthly discharge temperature (August) would be 88.7°F under plant full load conditions. At the point of discharge, these worst case discharge temperatures are within the acceptable water quality criteria for peninsular Florida streams. The thermal criteria for maximum discharge temperature in the project area is 92°F, while the predicted worst case discharge temperature is 88.7°F. Additionally, the maximum water temperature increase over ambient conditions at point of discharge is predicted to be 4.1°F which is less than the state standard of 5°F for receiving streams but slightly higher than the standard for receiving lakes (3°F above ambient). In less than 250 ft from the point of discharge into the reclaimed lake, the thermal plume will be reduced to less than 3°F above ambient temperature. Based on these factors, no significant thermal impacts are anticipated to aquatic life not only within plant site boundaries but downstream and offsite as well.

5.1.2.2 Impingement and Entrainment

Plant makeup water will be groundwater and waters from the cooling reservoir. Therefore, impingement and entrainment are not potential sources of impacts to aquatic organisms since natural surface waters will not be used.

5.1.2.3 Thermal Shock

Based on a natural water equilibrium temperature of 62.1°F in December and a maximum cooling reservoir discharge temperature of 66.2°F during winter, a maximum temperature differential of 4.1°F may occur. The greatest potential for thermal shock will be localized within 250 ft from the point of discharge (i.e., the mixing zone) during winter at the northwestern corner of the reclaimed lake on the site. The maximum summer temperature differential is estimated to be 2.6°F at the point of discharge. During summer, aquatic organisms will be acclimated to high temperatures and therefore, may be more tolerant to slight increases in ambient levels. At temperatures greater than their thermal preference, fish tend to avoid or move away from the heated waters (Talmage and Opresko, 1981). Because of the differences in thermal responses of different fish species, the seasonal changes in preference of species, and variation in temperatures across the mixing zone, fish will exhibit temporal and spatial variation near a thermal discharge. However, this very seldom results in a permanent loss of species from the local population.

Class III water quality standards for receiving streams will be met at the point of discharge (5°F limit in receiving streams), and the state standard for receiving lakes (3°F limit above receiving lake temperature) will be met beyond the mixing zone, an area of less than 250 ft from the point of discharge. Thus based on the worst cases modelled for this project, no impacts to aquatic organisms are anticipated outside the mixing zone.

5.1.3 BIOLOGICAL EFFECTS OF MODIFIED CIRCULATION

No water intake structures will be placed in any natural drainages located on or off the project site. Discharges from the cooling reservoir will enter the reclaimed lake on the eastern side of the property and eventually enter Little Payne Creek. As previously discussed, a mixing zone of less than 250 ft from the point of discharge at the northwestern corner of the reclaimed lake and the retention time in the lake will limit thermal impacts. When waters are discharged to Little Payne Creek, no temperature impacts to aquatic organisms are anticipated.

Cooling reservoir blowdown will be discharged at a rate of approximately 3.1 MGD. This relatively small amount will have two hydrological and ecological benefits to Little Payne Creek downstream of the site. First, the average volume of water entering the creek will be increased sightly over pre-mining conditions, which will help maintain water in the creek on a more permanent basis. Second, the peak flood levels will be reduced in exchange for a more constant flow throughout the year. These two benefits will serve to maintain aquatic habitats year round, thereby maintaining use of the system by aquatic organisms.

The increased volume and flow are not anticipated to be significant enough to cause scouring, bank erosion, or deposition of suspended solids in Little Payne Creek. Therefore, such negative effects on aquatic organisms are not anticipated from cooling reservoir discharges.

5.1.4 EFFECTS OF OFFSTREAM COOLING

The proposed project will use a 727-acre (water surface area) recirculating cooling reservoir as the heat rejection/dissipation system. Since cooling towers will not be used, significant fogging and drift impacts associated with cooling tower operations will not occur. The warm side temperature in the cooling reservoir is approximately 23.5°F above the equilibrium temperature under the full load worst-case conditions. Because of this warmer water temperature, slight fogging may occur during cool, humid, and no wind movement conditions, mostly during early mornings. However, the fogging will be noticeable only in a thin layer above the water surface, and strong updrafts carrying heavy vapors are not expected to occur. This thin layer of surface phenomena will be easily broken up even with slight wind movement. In addition, the reservoir surface is approximately 9 ft below the top of the surrounding berm; therefore, this thin layer of fog will be mostly confined within the immediate project area. Any fog escaping from the confining berm will be dispersed and is not expected to cause traffic hazards.

As discussed in Section 3.5.1, recycled wastewater to be used as supplemental makeup water will be treated prior to discharging into the reservoir. As a result, water in the cooling reservoir will meet surface water quality standards, and volatile substances will not be present in the water. Therefore, minor fogging will not have adverse health impacts. The discharges of treated stormwater runoff to the reservoir will have a fecal coliform concentration of no more than 200 counts per 100 milliliters (mpn/100 mL). With this loading rate, the long-term fecal coliform concentration will be less than 1 mpn/100 mL, even if the lowest decay rate found in literature was used for the calculation. Therefore, bacteria in the reservoir will not cause human health concerns.

5.1.5 MEASUREMENT PROGRAM

5.1.5.1 Groundwater

A groundwater monitoring program will be developed and implemented for the operation of the proposed Polk Power Station in accordance with applicable FDER regulatory requirements under Chapter 17-28, F.A.C. This plan is provided in Appendix 11.7.8.

5.1.5.2 Surface Water

For the proposed project operations, a surface water quality monitoring plan will be established to measure selected parameters in the cooling reservoir effluent at Outfall 001. The water discharge temperature of the blowdown as well as blowdown flow will be monitored on a weekly basis. A minimum of one grab sample will be taken daily for measurement of TSS, oil and grease, and pH. These effluent samples will be collected and analyzed in accordance with analytical methods approved under 40 CFR 136.

5.1.5.3 Biological

Due to lack of anticipated ecological impacts from cooling reservoir operation proposed for Polk Power Station, no biological monitoring is proposed.

5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.2.1 INDUSTRIAL WASTEWATER DISCHARGES

5.2.1.1 Surface Water Discharges

The Polk Power Station operation will result in the discharge to surface waters of the following:

- Cooling water reservoir blowdown,
- Stormwater associated with industrial activity, and
- Stormwater not associated with industrial activity.

In addition to the recirculating cooling water, the following wastewater streams will contribute to the cooling reservoir blowdown:

- IWT system effluent;
- Sanitary treatment system effluent;
- Stormwater runoff from the fuel oil storage area, substation, and CT/CC areas; and
- R.O. concentrate.

The water quality of these streams is presented in Table 3.5.1-1, and the projected water quality in the cooling reservoir is presented in Table 3.5.1-2.

The recirculating cooling water will be chlorinated prior to entering the condensers. The discharge of recirculating cooling water will contain a maximum concentration of 0.2 mg/L total residual chlorine.

As described in Section 3.5.4.3, the IWT system will treat a number of low-volume waste streams including:

- Non-chemical cleaning waste;
- Water treatment filter backwash;
- Demineralizer regeneration waste; and
- Boiler blowdown.

In addition, the IWT system will receive stormwater runoff associated with industrial activities from the following areas:

- Slag storage,
- IWT system sludge storage,
- Coal pile,
- Active brine storage,
- Sulfur/H_2SO_4 storage, and
- CG equipment area.

Stormwater runoff from the slag, IWT sludge, brine, and coal pile storage areas will be treated in basins to provide settling prior to their discharge to the IWT system for further treatment. The design criteria for these basins and storage areas are detailed in Section 3.1.1.8, 3.1.4.6, and 3.3.1.3. Any leachate from the brine storage area will be sent to the brine concentrator for treatment.

As described in Section 3.5.4.3, stormwater runoff from the fuel oil storage switchyard, and CT/CC areas will be treated by an oil/water separator prior to being discharged to the cooling reservoir. Stormwater runoff from the sulfur storage and CG equipment areas is discharged directly to the IWT system for treatment prior to discharge to the cooling reservoir.

All of the streams receiving treatment in the IWT system are described in Section 3.5.4.3. The treatment system will be designed to meet NSPS effluent guidelines, as appropriate, and other applicable standards prior to the discharge of this effluent to the cooling reservoir.

Sanitary wastewater will be treated in the activated sludge package unit, as described in Section 3.5.2. The system will provide a level of treatment which will comply with applicable standards under Chapter 17-600, F.A.C., prior to its discharge to the cooling reservoir. The sludge generated will be disposed of at an approved offsite facility.

The R.O. concentrate is an additional low-volume wastewater which is discharged to the cooling reservoir as described in Section 3.5.4.2.

The use of the cooling water reservoir maximizes the retention and recycling of these wastewater flows while providing further water quality treatment prior to the discharge to offsite surface water. Based on the anticipated plant and cooling water balance (see Section 3.5) and the reservoir inflow quality, the long-term reservoir water quality has been estimated. This long-term reservoir quality reflects the quality of discharges from the reservoir to the reclaimed lake on the site which eventually flows to Little Payne Creek. As shown in Table 3.5.1-2, the water quality of the reservoir complies with all applicable surface water quality standards. As discussed in Section 5.12, the discharges from the reclaimed lake and off the Polk Power Station site will also meet all applicable water quality standards. Therefore, surface water discharge of cooling reservoir water is not expected to adversely impact the water quality conditions of Little Payne Creek, or impair or interfere with any current or future beneficial use of these waters.

These results are considered conservative because they are based on chemical mass balances only and do not take into account any chemical precipitation, sedimentation or biological activity which may occur in the reservoir. These processes may result in a significant amount of removal of suspended and/or dissolved solids from the water, resulting in an even better water quality of discharges than that presented in Table 3.5.1-2.

In addition to the areas previously described, stormwater runoff from other areas on the plant site associated with industrial activity will be collected and treated in the stormwater management system described in Section 3.8. The system will discharge to the old mine cut lake located northeast of the power block area (Outfall 002).

Stormwater runoff not associated with industrial activity will be primarily generated in the portion of the site located west of SR 37. As described in Section 3.8.1, these wetland/wildlife corridor areas discharge stormwater runoff to unnamed tributaries of the South Prong Alafia River and to Payne Creek. Stormwater discharges from these areas will meet applicable water quality standards.

5.2.1.2 Groundwater Discharges

There will be no direct chemical or biocide discharges to groundwater, except for possible indirect discharges to groundwater which may occur due to accidental spills from chemical handling and storage areas. The proposed measures to prevent and manage such potential discharges are described in the facility's Preliminary SPCC Plan (Appendix 11.13.1), Preliminary RCRA Contingency Plan (Appendix 11.13.2), and in the Best Management Plan (Appendix 11.1.1).

The long-term water quality in the reservoir reflects the quality of seepage from the reservoir to shallow groundwater. As shown in Table 3.5.1-2, the seepage from the reservoir is expected to comply with applicable Florida primary and secondary drinking water standards (Chapter 17-550.310, F.A.C.) with the exception of iron and manganese, which are secondary drinking water standards. These standards apply to water which is delivered to the free-flowing outlet of the ultimate user of a public water system; however, they are generally used as groundwater quality standards in the State of Florida pursuant to Chapter 17-520.420, F.A.C. Because the quality of the reservoir water meets the primary maximum contaminant levels (MCLs) and because there are no shallow drinking water wells in the vicinity of the site, no significant impacts to human health are expected to occur as a result of the reservoir seepage to the shallow groundwater.

As shown in Table 3.5.1-2, the reservoir water quality does not meet the secondary MCLs for manganese and iron. The MCL for manganese is 0.05 mg/L, while the reservoir water concentration is predicted to be 0.081 mg/L. The MCL for iron is 0.3 mg/L, while the level in the reservoir water is predicted to be 0.959 mg/L.

Secondary drinking water MCLs are established to control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water (40 CFR 143.1). At considerably higher concentrations of these contaminants, health implications may also exist, as well as aesthetic degradation. Based on the data presented in Table 3.5.1-2, some aesthetic degradation of the shallow groundwater in the immediate site vicinity may be expected because the concentration of manganese and iron is above the ambient shallow groundwater concentrations.

The concentrations of these two parameters are relatively close to the secondary MCLs; therefore, no adverse impacts are expected from a human health perspective. The water seeping from the reservoir will receive a significant amount of mixing with water in the shallow aquifer. Because there are no drinking water wells in the vicinity of the site, no impacts to the aesthetic quality of drinking water supplies are expected. Any concentration of iron or manganese above the secondary standard is expected to remain localized near the cooling reservoir.

5.2.1.3 Biological Impacts

The cooling reservoir water quality was presented previously in Section 3.5.1. As shown in Table 3.5.1-2, all surface water quality parameters will meet state standards when discharged into the cooling reservoir, except for temperature during certain winter months and under extended periods of full load operation. The temperature of the discharge water will meet temperature standard within a mixing zone of less than 250 ft from the outfall. The water exiting the site at the southern edge of the lake will also meet all surface water quality standards.

Gaseous chlorine will be used as a biocide for cooling system protection and will be introduced in conformance with the allowable residual chlorine discharge requirements as specified in 40 CFR 423.15 (i.e., 0.2 mg/L for 2 hour daily intervals). Based on the anticipated travel time for the cooling water to reach the point of discharge (greater than 9 days), the mixing factors, and the natural decay, the level of total residual oxidants near the reservoir outfall should be negligible. If other biocides are used in the cooling reservoir and the recirculating system in the future, under similar conditions, they should also be undetectable when discharged as part of the reservoir outfall discharges.

The sanitary wastewater system and the potable and process water treatment 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 result in a toxicity issue. Chemical cleaning wastewater generated by the periodic cleaning of the heat recovery steam generator boilers will be collected and temporarily stored in a chemical cleaning wastewater or holding tank. A boiler cleaning contractor will transport the chemical cleaning waste offsite for treatment and disposal.

Based on the above factors, no biological impacts from the cooling reservoir discharges are anticipated outside the thermal mixing zone of the onsite reclaimed lake or in any offsite waters.

5.2.1.4 Biological Measurement Program

Because of the lack of any anticipated ecological impacts, no biological monitoring is proposed.

5.2.2 COOLING TOWER BLOWDOWN

Cooling towers will not be used as the heat dissipation system. Analysis concerning the feasibility of using cooling towers as an alternative is discussed in Chapter 8.0.

5.2.3 MEASUREMENT PROGRAMS

The physical and chemical monitoring program for the surface water in the project area is described in Section 5.1.5.

5.3 IMPACTS ON WATER SUPPLIES

5.3.1 SURFACE WATER

5.3.1.1 Surface Water Consumptive Impacts

The proposed project will not withdraw, divert, or consume surface water from natural water bodies for plant operation purposes. An annual average of approximately 5.0 MGD of makeup water will be withdrawn from the Floridan aquifer and discharged into the cooling reservoir to compensate for the evaporative losses.

To maintain water quality in the cooling reservoir, an approximately 3.1-MGD discharge from the reservoir will be needed. This reservoir discharge will be received by a reclaimed lake on the eastern edge of the site and then routed downstream to Little Payne Creek. Therefore, the proposed project will augment the base flow of the eventual receiving waters, i.e., Little Payne Creek, Payne Creek, and Peace River, and prevent extended dry periods as frequently observed in these watersheds. The stormwater management system will also suppress peak flow and provide base flow for South Prong Alafia River and Payne Creek watersheds as discussed in Section 3.8.4. In addition, the water level in the cooling reservoir will be at an elevation of approximately 136 ft-NGVD which is slightly higher than the surficial groundwater level; therefore, a net seepage (approximately 250,000 gpd) from the reservoir into the surficial aquifer will occur. This additional groundwater recharge will in turn recharge the streams in the area. Therefore, the proposed project will have no adverse hydrologic impacts.

5.3.1.2 Surface Water Quality Impacts

According to the water quality modeling for the cooling reservoir, the water in the reservoir will not violate any Class III surface water quality standards after long-term operation (see Table 3.5.1-2). Therefore, potential surface water quality impacts are not expected from the proposed cooling reservoir discharges for the Polk Power Station operations.

5.3.2 GROUNDWATER

5.3.2.1 Consumptive Use Impacts

The main consumptive groundwater use impact from the Tampa Electric Company Polk Power Station is the planned withdrawal of potable, process, and makeup water from the Floridan aquifer. Four production wells will be required (two wells installed in two stages) for full build-out of the power plant. Two 10-inch inside diameter wells each providing yields of 230 to 290 gpm will be installed prior to January 1995 and operate until January 1999. Prior to January 1999, two 24-inch outside diameter wells will be installed. The yields for each of these larger wells will range from approximately 1,750 to 2,900 gpm. These wells will be capable of obtaining substantially higher yields, and with assistance of two 10-inch wells, achieve the required production. If one of the large wells requires unscheduled well maintenance or is temporarily lost, the makeup into the reservoir will also be temporarily stopped. Thus, no additional backup wells will be required. The annual average and annual maximum withdrawal rates are approximately 6.6 MGD and 9.3 MGD, respectively. Of the 6.6 MGD average annual withdrawal, approximately 5.0 MGD will be for makeup water to the reservoir, approximately 1.6 MGD for industrial process service water uses, and 0.01 MGD for potable water uses.

Two production wells, within each of the two well field stages, will be spaced approximately 350 ft apart to allow a better efficiency for pumps and wells to operate within their designed ranges. Additionally, this will distribute and minimize the drawdown within the cone of depression.

A regional, three-dimensional, groundwater flow model (MODFLOW) was used to evaluate drawdown impacts at the Tampa Electric Company Polk Power Station site, onsite and at the property boundaries. The results of the groundwater model were compared to analytical, steady-state, leaky confined aquifer results with excellent agreement. Two different types of simulations were completed with the model. First, a transient 45-day simulation at the maximum average annual withdrawal rate, and second, a steady-state simulation at the average annual withdrawal rate. The results are shown in Figures 5.3.2-1 and 5.3.2-2, respectively. The modeled Floridan aquifer drawdown predictions for these and additional simulations including the future operations of the Hardee Power Station located approximately 4 miles south of the site are summarized in Table 5.3.2-1. From comparison of the modeled and analytical calculations and well field design, the projected Floridan aquifer drawdowns at the Tampa Electric Company Polk Power Station property boundary are expected to be approximately 5 ft. A detailed summary of the regional model including its application and results is provided in Appendix 11.7.7.

5.3.2.2 Recharge of Water Table Aquifer

Operation of the cooling reservoir will increase the amount of recharge the surficial aquifer receives. This results from the providing makeup from the Floridan aquifer to the cooling reservoir and increasing the hydraulic head in the reservoir. Water budgets calculated for full site build-out indicate that the cooling reservoir will provide approximately 500,000 gpd recharge to the surficial aquifer on an average annual basis. This indicates that groundwater mounding will occur around the reservoir for most of the year, but especially during the dry season when the water table is naturally depressed.

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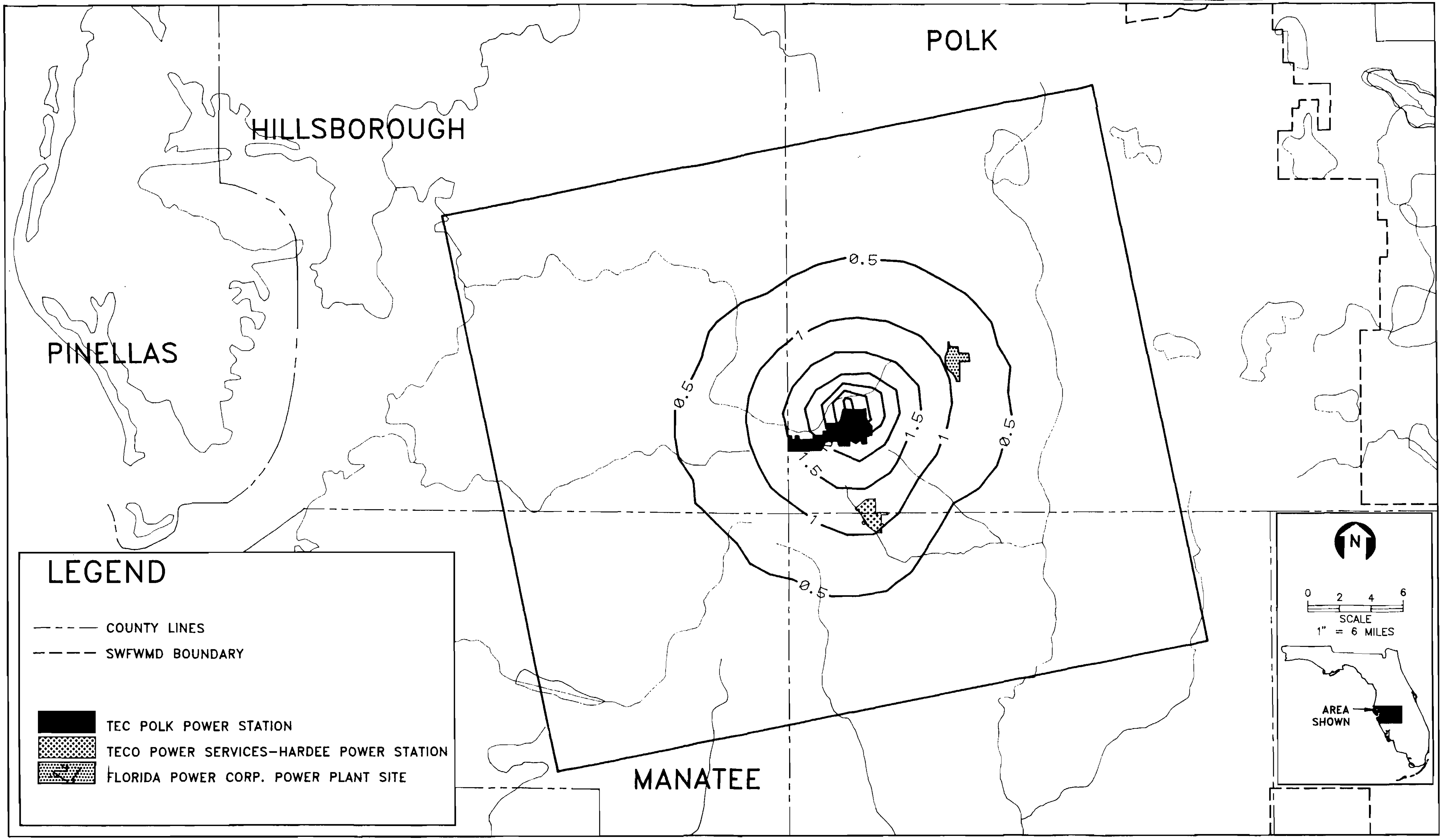

FIGURE 5.3.2-1.
POTENTIOMETRIC SURFACE FLORIDAN AQUIFER
TRANSIENT CONDITIONS
Source: ECT, 1992.

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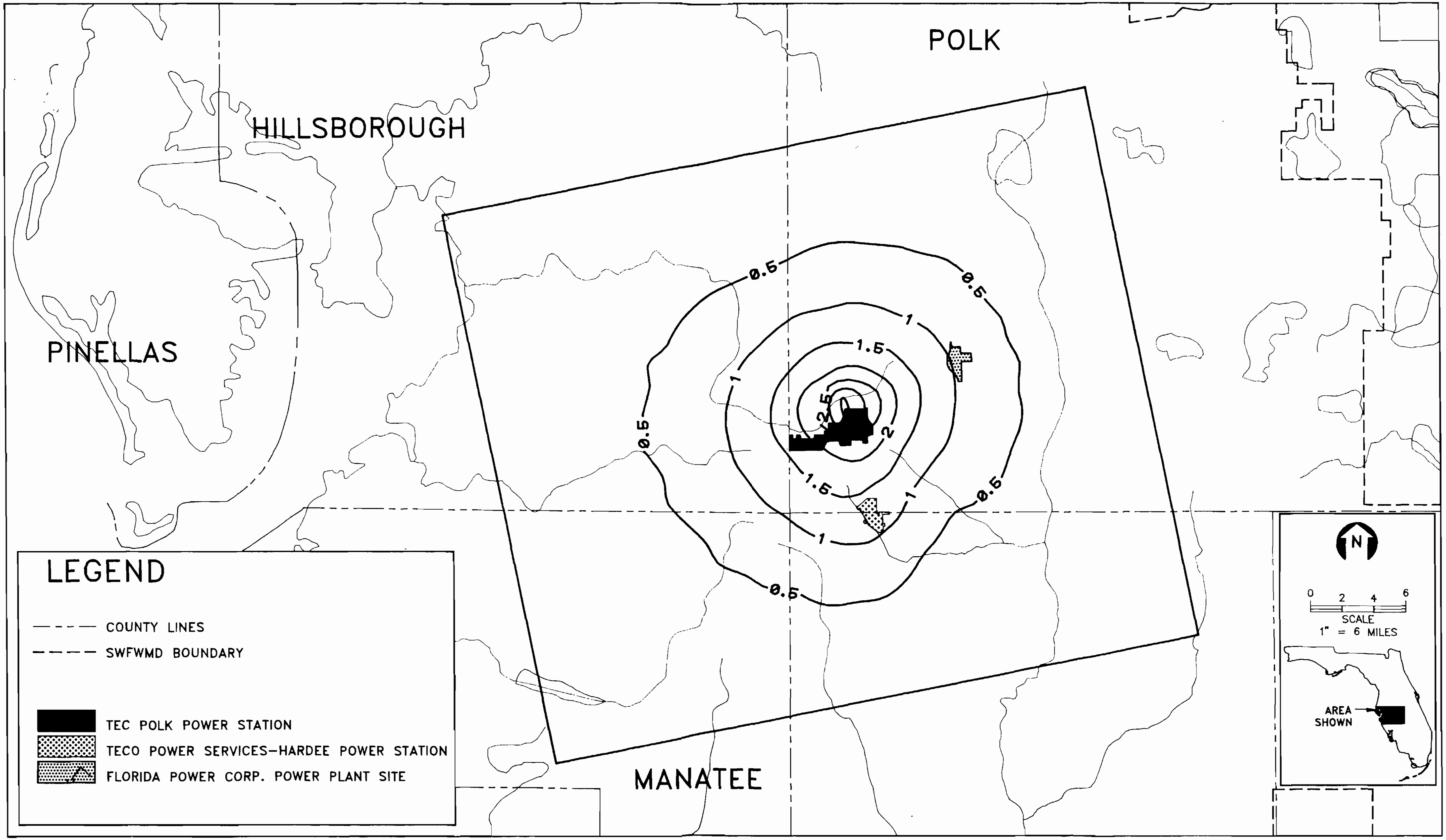

FIGURE 5.3.2-2.
POTENTIOMETRIC SURFACE FLORIDAN AQUIFER
STEADY-STATE CONDITIONS
Source: ECT, 1992.

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Table 5.3.2-1. Groundwater Numerical Model Simulated Pumpage and Drawdown Results

Condition Simulated	Simulated Pumpage	Tampa Electric Company Polk Power Station	Hardee Power Station
Simulated Pumpage (mgd)			
Transient (45 days)	Case 1	9.3	NA
Transient (45 days)	Case 2	9.3	8.64
Steady State	Case 1	6.6	NA
Steady State	Case 2	6.6	3.80
Model Calculated Drawdowns (ft)			
Transient (45 days)	Case 1	8.8	NA
Transient (45 days)	Case 2	10.3	8.6
Steady State	Case 1	6.7	NA
Steady State	Case 2	7.5	4.8

Note: NA = not applicable.

Source: ECT, 1992.

5.3.3 DRINKING WATER

The computer modeling efforts for the surficial and Floridan aquifer systems indicate there will be no adverse impacts to potable water supplies. There are no municipal wells within a 5-mile radius of the site. Most of the residential wells located primarily to the west of the site, along Bethlehem and Albritton Roads, use one of the two water-bearing units within the intermediate aquifer. Additionally, the modeling results indicate the drawdown impacts in this area will be approximately 2.5 ft or less in the Floridan aquifer. Anticipated drawdowns in the overlying intermediate aquifer system are expected to be minimal because of the confining unit that separates this system from the Floridan aquifer. Much of the surficial aquifer surrounding the Tampa Electric Company Polk Power Station site has been impacted by mining activities. Much of the land surrounding the site to the northeast, northwest, east, and south is presently clay settling ponds. Thus, the surficial aquifer is not used as a significant potable water source and is not expected to be adversely impacted from the Floridan aquifer withdrawals or the operation of the cooling reservoir.

5.3.4 LEACHATE AND RUNOFF

As described in Section 3.8.4, the onsite drainage system will collect runoff from areas where rainfall runoff has potentially contacted process materials. This collected runoff will be treated in the IWT system prior to discharging into the cooling water reservoir. The storage area for coal pile runoff, brine storage, slag storage, and wastewater treatment sludge storage will be lined with low-permeability materials; therefore, the potential groundwater contamination caused by leachate from these storage areas will be prevented.

The fuel oil storage area will be designed with a surrounding berm to contain any potential spills. Any spills will be appropriately managed and cleaned up to prevent groundwater contamination. A preliminary SPCC plan has been prepared for the proposed project and is provided in Appendix 11.13.1.

The stormwater runoff from other areas associated with industrial activity will be collected in detention basins for appropriate treatment prior to being discharged offsite. An NPDES permit will be filed for this offsite discharge, and a monitoring program has been developed to monitor the water quality of the stormwater discharge (see Appendix 11.1.1).

5.3.5 MEASUREMENT AND MONITORING PROGRAMS

A detailed summary of the regional model (MODFLOW) developed for these simulations including its development, application, and results is provided in Appendix 11.7.7. The regional model used information available from sources including SWFWMD, USGS, and the Florida Bureau of Geology. The results of the finite difference, numerical model were compared to analytical results to support the model's predictions.

The report summarizing the surficial aquifer model, including its development, application, and results is provided in Appendix 11.7.6. The surficial aquifer model used information on the surficial aquifer characteristics which were collected during the geohydrology monitoring and testing program at the Polk Power Station. The site-specific monitoring program is described in Section 2.3.2.

No additional groundwater measuring or monitoring programs will be needed during the site preparation and construction activities. However, a groundwater monitoring plan has been developed and will be implemented for the operation of the proposed project in accordance with applicable FDER regulatory requirements under Chapter 17-28, Part IIV, F.A.C. This plan is provided in Appendix 11.7.8.

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 SOLID WASTE/BY-PRODUCT

The impacts resulting from the onsite disposal of solid wastes, in addition to the potential surface water and groundwater impacts discussed previously in Section 5.3 and in Chapter 3.0, are limited to topographic and associated changes in runoff patterns in the immediate vicinity of the solid waste disposal areas. The by-product slag and IWT system sludge storage areas are located in the western portion of the main plant facilities site and will have pile heights of approximately 50 and 25 ft, respectively. These two areas will encompass approximately 7 acres at full build-out. The brine storage area, located in the eastern portion of the site adjacent to the cooling reservoir, will have a pile height of approximately 4 to 6 ft and will encompass approximately 40 acres at full build-out. The active cell of the brine storage area will be 0.12 acres; the remaining portion of the area at full build-out will be clay-capped and lined to prevent the generation of contaminated runoff and leachate. The net land requirement for the solid waste and slag management units will be approximately 47 acres. Runoff collection basins associated with these units will require approximately 4 acres of additional land. The land impacted by the construction of these units has previously been impacted by former phosphate mining activities.

The rainfall runoff which may come in contact with the solid wastes and by-product slag will be collected and treated in the IWT system, except for leachate from the active cell of brine storage area which will be routed to the inlet of the brine concentrator unit.

No impacts are expected to result from the runoff and leachate from the solid waste and slag storage areas, except for the need for additional area to store brine solids.

As noted in Sections 3.5.2 and 3.7.1, the following solid wastes produced by the power station are expected to be non-hazardous and disposed of offsite in a licensed solid waste landfill:

- Sanitary wastewater treatment sludge,
- Spent supply water treatment media, and
- Miscellaneous solid wastes (e.g., trash).

In Polk County, the North Central Landfill is located nearest the Polk Power Station site and has a capacity of 1,000 tpd. The solid wastes generated from the Polk Power Station are conservatively expected to consume less than 0.2 percent of the available capacity of this landfill. The useful life of the three landfills which currently operate in Polk County is projected until the year 2010; however, Polk County has proposed a solid waste processing plant which, if constructed, could extend the useful life of the Polk County landfills to the year 2030.

Reclamation of a significant portion of the solid wastes produced at the power station is expected. As discussed in Section 3.7, reclaimed solid wastes will include waste oil, worn gasifier refractory and refractory backup brick, spent sulfur recovery unit catalysts, and spent tail gas treating catalysts; these will be sold to the supply vendors or to other reclaimers. Because these wastes are expected to be reclaimed soon after their removal and replacement, the potential impacts associated with the onsite storage of these materials will be negligible.

Slag by-product is marketable as an abrasive, roofing material, industrial filler, synthetic aggregate for concrete, or road base material. In addition, sulfur and H_2SO_4 by-products are expected to be of marketable-grade quality. Benefits resulting from the sale of these by-products include:

- Increased revenue,
- Reduction in land requirement for onsite by-product storage,
- Reduction in consumption of natural resources where slag is used as a substitute,
- Reduced potential for fugitive dust generation, and
- Reduced potential for aesthetic impacts from by-product storage.

5.4.2 HAZARDOUS WASTES

Hazardous wastes (as defined under RCRA) will be generated primarily as a result of painting, degreasing, and other maintenance activities at the Polk Power Station.

These hazardous wastes will be managed onsite and transported offsite to a permitted waste disposal or recycle facility in accordance with local, state, and federal hazardous waste requirements for generators. The amount of hazardous waste will be minimized through the use of source reduction techniques, such as product substitution, and waste reduction techniques, such as recycling and waste segregation.

Wastes will be collected in designated containers located in satellite storage areas. When a container becomes full, it will be transferred to the central hazardous waste storage facility for temporary storage. Hazardous wastes will not be stored onsite longer than 90 days (or 180 days for small quantities); therefore, the facility will not require a storage facility permit. However, the storage facility will be designed and managed in accordance with applicable emergency prevention and preparedness measures specified in 40 CFR Part 264, Subparts C and D. Such measures include an available fire extinguisher, spill absorbent material, and spill containment features. Hazardous wastes will be stored in a manner to minimize the potential for an incident, and a preliminary RCRA contingency plan has been prepared to provide immediate response in the unlikely event of a fire, spill, or explosion involving hazardous wastes (see Appendix 11.13.2). As a result, any potential impacts associated with the onsite storage of hazardous waste are expected to be minimized through emergency prevention and response.

5.5 SANITARY AND OTHER WASTE DISCHARGES

5.5.1 DISCHARGE REGULATIONS

5.5.1.1 Federal Requirements

Federal regulations primarily address the discharge of pollutants to Waters of the United States through the NPDES permit program. Tampa Electric Company has applied for an NPDES permit for the proposed discharge from the cooling reservoir to Little Payne Creek (see Appendix 11.1.1). The proposed sanitary wastewater treatment system does not discharge directly to jurisdictional waters; however, a monitoring point will be established within the NPDES permit application to demonstrate compliance with applicable BOD, TSS, and other relevant standards.

5.5.1.2 State Requirements

State of Florida requirements include various FDER rules governing the design, operation, and performance of a sanitary wastewater treatment plant, including:

- Chapter 17-600, Domestic Wastewater Facilities--This chapter provides general technical guidance and design requirements for new wastewater treatment plants, siting criteria, operation and maintenance requirements, technology- and water quality-based effluent standards, disinfection requirements, and construction and permit requirements;
- Chapter 17-604, Collection Systems and Transmission Facilities--This rule provides minimum design, operation, and maintenance standards for domestic wastewater collection/transmission systems;
- Chapter 17-601, Domestic Wastewater Treatment Plant Monitoring--This chapter specifies the monitoring/reporting requirements and schedules for flow, carbonaceous BOD, and other parameters connected with the influent and effluent of the treatment plant;
- Chapter 17-602, Wastewater Plants Operator Certification--This chapter establishes a system for classification of domestic treatment plants and further specifies classes of certified operator which must serve as lead operators of these plants for minimum specified periods of time;

- Chapter 17-302, Surface Water Quality--The surface water quality standards for BOD, fecal coliform, residual chlorine, and other applicable parameters are specified in this chapter; and
- Chapter 17-701, Solid Waste Management Facilities--This chapter specifies the design and operating standards for landfills which receive solid wastes, including domestic wastewater residuals.

The domestic wastewater treatment plant will comply with these and other relevant state requirements. The effluent monitoring program will include the following parameters: carbonaceous BOD, TSS, pH, fecal coliform, residual chlorine, and flow. No monitoring of nutrients is proposed.

5.5.2 TREATMENT PLANT DISCHARGE

Sanitary wastewaters will be treated and discharged to the cooling reservoir for reuse in the cooling system. As described in Section 3.5, the sanitary wastewater treatment system is an aerobic package system. All effluent from this system will be filtered and chlorinated prior to discharge to the cooling reservoir. Parameter concentrations in the treatment plant effluent, prior to mixing in the reservoir, are expected to be in compliance with the following effluent standards:

- BOD, 20 mg/L;
- TSS, 20 mg/L'
- Total residual chlorine, 0.5 mg/L;
- Fecal coliform, <200 per 100 mL;
- pH, 6.0 to 8.5; and
- Flow rate, 10,400 gpd.

No adverse impacts to the cooling reservoir or offsite water quality are expected from sanitary wastewater discharges. Detectable amounts of residual chlorine and other constituents within the effluent will be rapidly mixed and dissipated upon entering the cooling reservoir.

5.6 AIR QUALITY IMPACTS

5.6.1 IMPACT ASSESSMENT

5.6.1.1 Introduction

Analyses were conducted to project the potential air quality impacts of emissions from Polk Power Station. These analyses are described in detail in the PSD permit application contained in Appendix 11.1.3. This section presents a summary of the approach used and the results obtained. The results demonstrate that the operation of Polk Power Station will not cause or contribute to a violation of any PSD increment or AAQS.

5.6.1.2 Regulatory Applicability and Overview of Impact Analyses

Under federal PSD review requirements, all major new or modified sources of air pollutants regulated under CAA must be reviewed and approved by EPA or by the state agency if PSD review authority has been delegated, as is the case in Florida. A *major stationary source* is defined as any 1 of 28 named source categories that has the potential to emit 100 tpy or more, or any other stationary source that 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.

Polk Power Station constitutes a major facility since it will have the potential to emit more than 250 tpy of at least one pollutant. Therefore, the facility must undergo PSD review. Furthermore, more than one pollutant is subject to review. Table 5.6.1-1 summarizes the facility's proposed annual emissions and compares the projected totals to the significant emission rate thresholds for PSD review.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified source. PSD review requirements are contained in Chapter 17-2.500, F.A.C., Prevention of Significant Deterioration. Major sources may be required to undergo the following reviews related to PSD for each pollutant emitted in significant amounts:

Table 5.6.1-1. Projected Emissions Compared to PSD Significance Rates

Pollutant	Projected Maximum Annual Emissions (tpy) IGCC*	+ CCs†	+ CTs**	= Total	Significance Rate (tpy)	Subject to PSD Review?
PM (TSP)	411	260	246	917	25	Yes
PM (PM_{10})	411	260	246	917	15	Yes
SO_2	2,543	720	654	3,917	40	Yes
NO_x	2,928	1,308	1,014	5,250	40	Yes
CO	456	1,092	978	2,526	100	Yes
O_3/VOC	46	180	168	394	40	Yes
Lead	0.15	0.28	0.17	0.6	0.6	Yes
H_2SO_4	241	80	72	393	7	Yes
Fluorides	0.92	0.17	0.10	1.2	3	No
Mercury	0.12	0.21	0.19	0.5	0.1	Yes
Beryllium	0.011	0.013	0.008	0.03	0.0004	Yes
Total reduced sulfur (including H_2S)	7.1	0	0	7.1	10	No
Reduced sulfur compounds (including H_2S)	7.1	0	0	7.1	10	No
Vinyl chloride	0	0	0	0	1	No
Asbestos	0	0	0	0	0.007	No

*IGCC emissions include the highest annual emissions estimates from the 7F CT (based on the larger of 100 percent CGCU or 50/50 CGCU/HGCU), plus related combustion emissions (e.g., thermal oxidizer), plus other associated process and fugitive emissions (PM, CO, VOC, and H_2S).
†CC emissions represent the totals for four stand-alone CTs in CC mode.
**CT emissions represent the totals for six stand-alone CTs in simple-cycle mode.

Source: ECT, 1992.

- Control technology review,
- Air quality analysis (monitoring),
- Source impact analysis,
- Source information, and
- Additional impact analyses.

The control technology review includes determination of BACT for each applicable pollutant. BACT emission limits cannot exceed applicable emission standards (e.g., NSPS). The air quality analysis (monitoring) portion of PSD review may require continuous ambient air monitoring data to be collected in the impact area of the proposed source. The source impact analysis requires demonstration of compliance with federal and state AAQS and allowable PSD increment limitations. Projected ambient impacts on designated nonattainment areas and federally promulgated Class I PSD areas must also be addressed, if applicable. Source information, including process design parameters and control equipment information, must be submitted to the reviewing agencies. Additional analyses of the proposed source's impact on soils, vegetation, and visibility, especially pertaining to Class I PSD areas, must be performed, as well as analysis of impacts due to growth in the area associated with the proposed source.

In addition to PSD review requirements, FDER has developed a strategy to control toxic emissions from stationary sources so that these emissions will not endanger public health. The strategy is based on comparing the predicted ambient impact of individual toxic air contaminants with an estimate of each chemical's ***no-threat level.*** A no-threat level is an ambient exposure level that is not likely to cause appreciable health risks.

Another air toxics assessment involves the estimation of cancer risk due to inhalation of emissions from a proposed facility. The metals arsenic, beryllium, cadmium, and chromium (hexavalent) are of primary interest in such an analysis since these constituents, which are emitted as a result of the combustion of most fossil fuels, are known or suspected carcinogens.

Polk Power Station will emit small quantities of pollutants addressed in FDER's air toxics review strategy. Therefore, an analysis of the facility's impacts compared to the no-threat levels applies. In addition, a conservative analysis of inhalation cancer risks was considered appropriate since Polk Power Station will emit trace metals that are known or suspected carcinogens. There is no regulatory standard or formal review requirement for this analysis, however.

5.6.1.3 Analytical Approach

Air Quality Models

Three air quality dispersion models were used in the analysis of impacts for Polk Power Station. These models were:

1. SCREEN;
2. ISC2 (both short- and long-term versions, ISCST2 and ISCLT2, respectively); and
3. MESOPUFF-II.

SCREEN is a simple model that calculates 1-hour average concentrations from a single source over a range of meteorological conditions. SCREEN was used to provide conservative estimates of impacts from combustion sources in order to select the worst-case operating configurations for each source.

The Industrial Source Complex (ISC2) models (EPA, 1992) were used for refined analyses. The ISC2 models are steady-state Gaussian plume models that can be used to assess air quality impacts from a wide variety of sources. They are capable of calculating concentrations for averaging times ranging from 1 hour to annual.

The MESOPUFF-II model (EPA, 1984) is a specialized model capable of accounting for several long-range transport and dispersion phenomena that are not addressed in conventional models such as ISC2. For this study, MESOPUFF-II was used for the specific purpose of estimating SO_2 impacts on the Chassahowitzka National Wilderness Area (NWA), a PSD Class I area.

Meteorological Data

Detailed meteorological data are needed for modeling with the ISC2 models. For this effort, meteorological data for input to these models were selected consistent with EPA (1986) guidance and FDER practice. For ISCST2, surface data from Tampa and mixing height data from Ruskin for the 5-year period 1982 through 1986 were employed. Surface data from the same 5-year period were processed into the format required for ISCLT2.

For MESOPUFF-II, a specialized set of meteorological data was required. Surface data from Tampa, Orlando, and Gainesville, along with upper air data from Ruskin and West Palm Beach for the year 1986 were used.

Emission Source Input Data

Emission parameters for Polk Power Station sources were based primarily on information provided by equipment vendors for the project. Some emission inputs were derived using EPA and other emission factors and facility design data.

For three pollutants (SO_2, NO_x, and PM), it was necessary to evaluate the impacts of other, offsite emission sources. These data were assembled primarily from information provided by FDER.

Background Concentrations

For the same three pollutants (i.e., SO_2, NO_x, and PM), it was also necessary to estimate background concentrations in the vicinity of the Polk Power Station site. For SO_2, the estimates were derived from onsite monitoring (see Section 2.3.7). The following background SO_2 concentrations were estimated based on the monitoring results:

- 5 $\mu g/m^3$ (annual average),
- 13 $\mu g/m^3$ (24-hour average), and
- 26 $\mu g/m^3$ (3-hour average).

For NO_x (actually NO_2), a background concentration of 10 $\mu g/m^3$ (annual average) was estimated conservatively based on monitoring data collected at the Archbold research site in 1988 (Hunter/ESE, 1989). The Archbold site is approximately 75 km southeast of the Polk Power Station site. Data from Archbold were used as opposed to data from NO_2 monitors operated by FDER, which are all located in urban areas and whose data would not be representative of rural southwest Polk County.

For PM (actually PM_{10}), background concentrations were estimated from data provided from the onsite monitoring program. For the annual averaging time, background PM_{10} was estimated to be 18.4 $\mu g/m^3$. For the 24-hour averaging time, a value of 45.4 $\mu g/m^3$ was estimated.

5.6.1.4 Summary of Air Quality Impacts: Criteria Pollutants

Maximum Facility Impacts and Significant Impact Areas

Criteria pollutant emissions from all Polk Power Station sources were modeled using the ISC2 models. ISCLT2 was used for annual and quarterly computations, while ISCST2 and 5 years of hourly meteorological data were used for all short-term computations. For SO_2, NO_x, CO, and lead, the Polk Power Station source inventory included the 7F CT (IGCC), the stand-alone CTs (both CC and simple-cycle), the auxiliary boiler, the tail gas treating unit thermal oxidizer, and the H_2SO_4 thermal oxidizer; for CO, fugitive sources were also included. For PM, materials handling and process vent sources were added to this list.

Table 5.6.1-2 summarizes the results of the maximum facility impact modeling runs for the criteria pollutants. As appropriate, the maximum impacts are compared to the modeling significance levels. Table 5.6.1-2 shows that SO_2, NO_x, and PM impacts were found to be significant for all averaging times. CO impacts were found to be

Table 5.6.1-2. Maximum Polk Power Station Criteria Pollutant Impacts

Pollutant	Averaging Time	Maximum Impact ($\mu g/m^3$)	Significance Level ($\mu g/m^3$)
SO_2	Annual	2.18	1.0
	24-hour	19.0	5.0
	3-hour	68.6	25.0
NO_x	Annual	2.26	1.0
PM	Annual	1.83	1.0
	24-hour	27.9	5.0
CO	8-hour	67.1	500
	1-hour	169.2	2,000
Lead	Quarterly	0.0014	NA*

*The AAQS for lead is 1.5 $\mu g/m^3$.

Source: ECT, 1992.

insignificant for both 1- and 8-hour averaging times. And while no significance level exists for lead, lead impacts were considered insignificant relative to the AAQS.

Illustrations of significant impact areas (SIAs) are provided in Figures 5.6.1-1 through 5.6.1-6. Figures 5.6.1-1, 5.6.1-2, and 5.6.1-3, respectively, present the annual, 24-hour, and 3-hour SIAs for SO_2. The annual SIA was found to have a maximum extent of approximately 8 km. The 24-hour SIA extended out to approximately 25 km, while the 3-hour SIA had a maximum extent of approximately 20 km.

Figure 5.6.1-4 presents the annual NO_x SIA. Its maximum extent was found to be approximately 6 km from the grid origin.

Figures 5.6.1-5 and 5.6.1-6, respectively, show the PM SIAs for annual and 24-hour averages. For the annual average, the maximum extent was only approximately 2 km, while for the 24-hour average it was approximately 11 km. Superimposed on the illustrations of PM SIAs is the portion of Hillsborough County that is classified as an air quality maintenance area for PM. As shown, the SIAs for Polk Power Station PM sources were found to fall well short of the maintenance area. Therefore, new source review with respect to maintenance areas (i.e., including provisions for nonattainment review) was not triggered.

Analyses for Ambient Air Quality Standards

Total potential SO_2, NO_x, and PM (PM_{10}) impacts within the Polk Power Station SIAs were determined for comparison with AAQS. This was accomplished by adding conservative estimates of background concentrations to modeled impacts due to Polk Power Station and other sources in the area. Table 5.6.1-3 summarizes the results of these analyses. As shown, all estimates of predicted total impacts were found to be less than the AAQS. Therefore, it was concluded that the operation of the Polk Power Station facility would not threaten compliance with any AAQS.

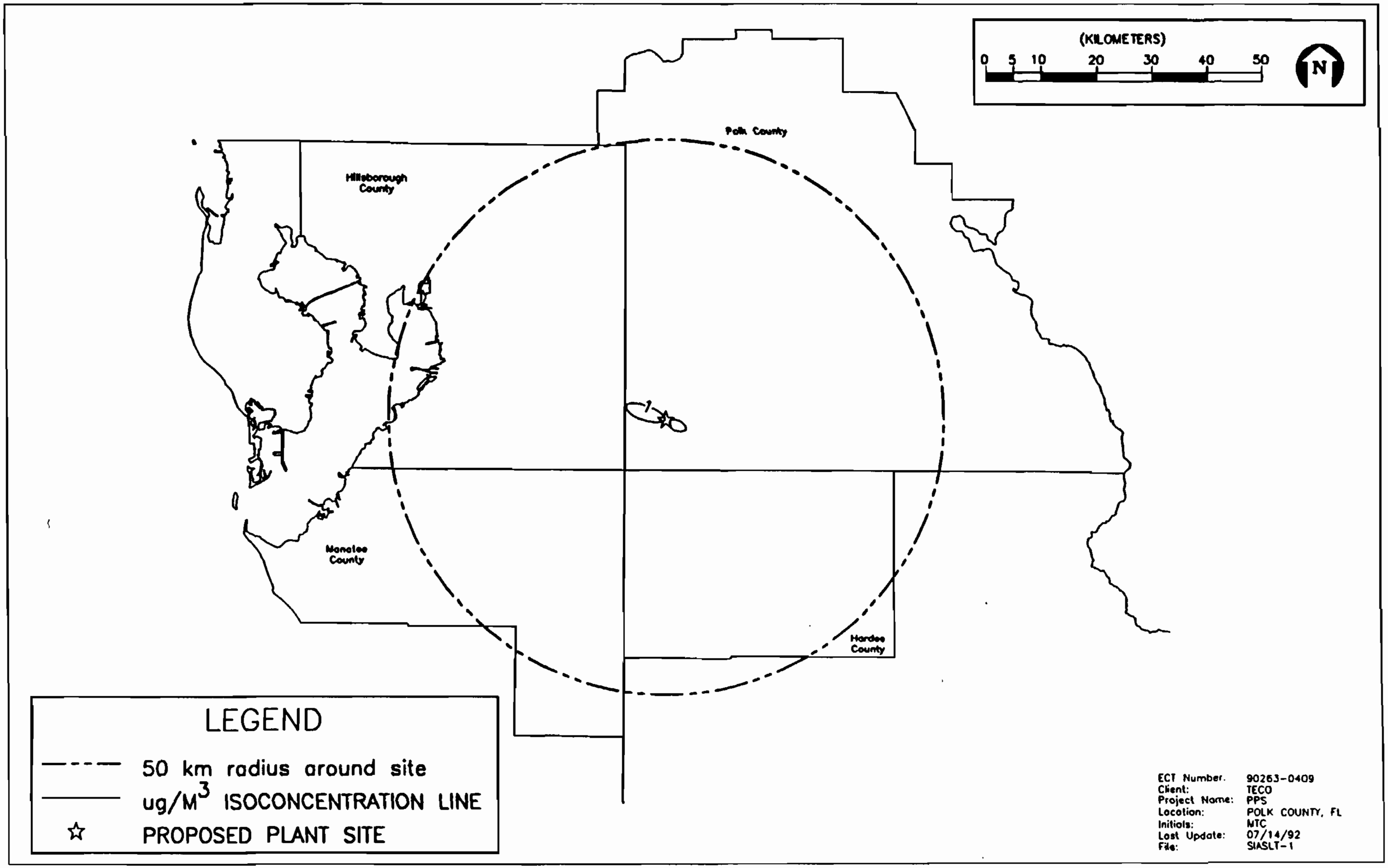

FIGURE 5.6.1-1.

ANNUAL SULFUR DIOXIDE SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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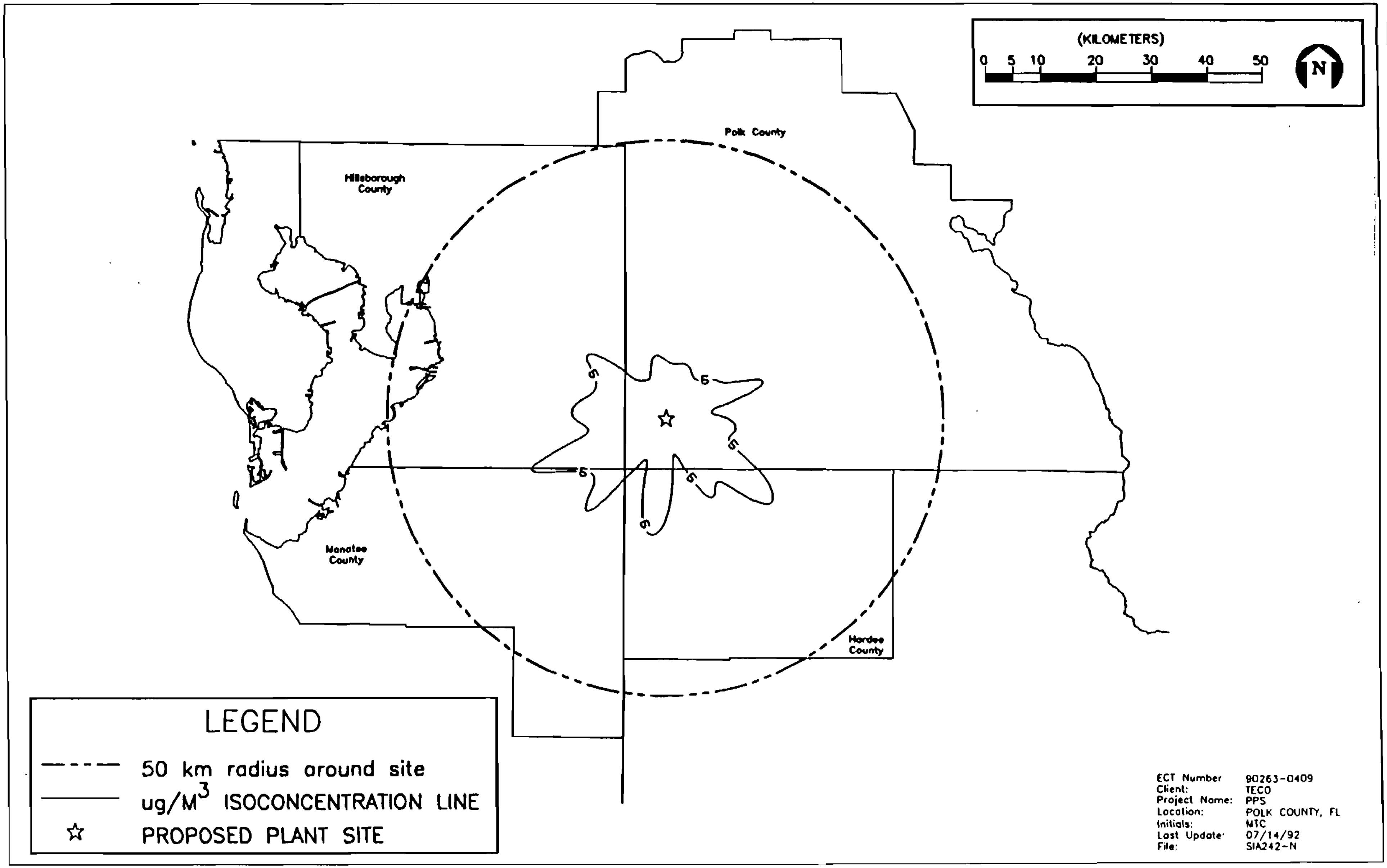

FIGURE 5.6.1-2.

24-HOUR SULFUR DIOXIDE SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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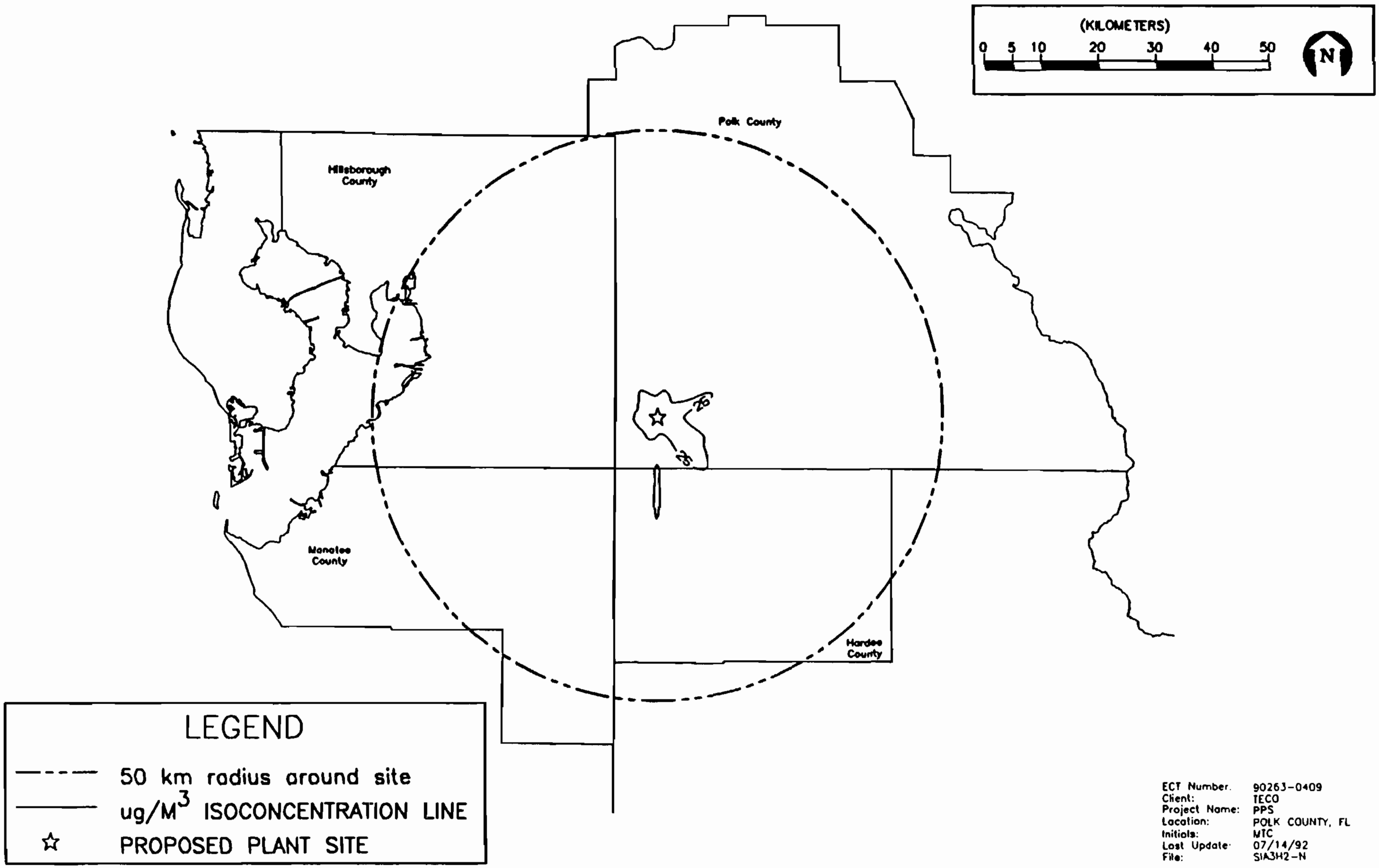
POLK POWER STATION



ECT Number.	90263-0409
Client:	TECO
Project Name:	PPS
Location:	POLK COUNTY, FL
Initials:	MTC
Last Update:	07/14/92
File:	SIA3H2-N

FIGURE 5.6.1-3.

3-HOUR SULFUR DIOXIDE SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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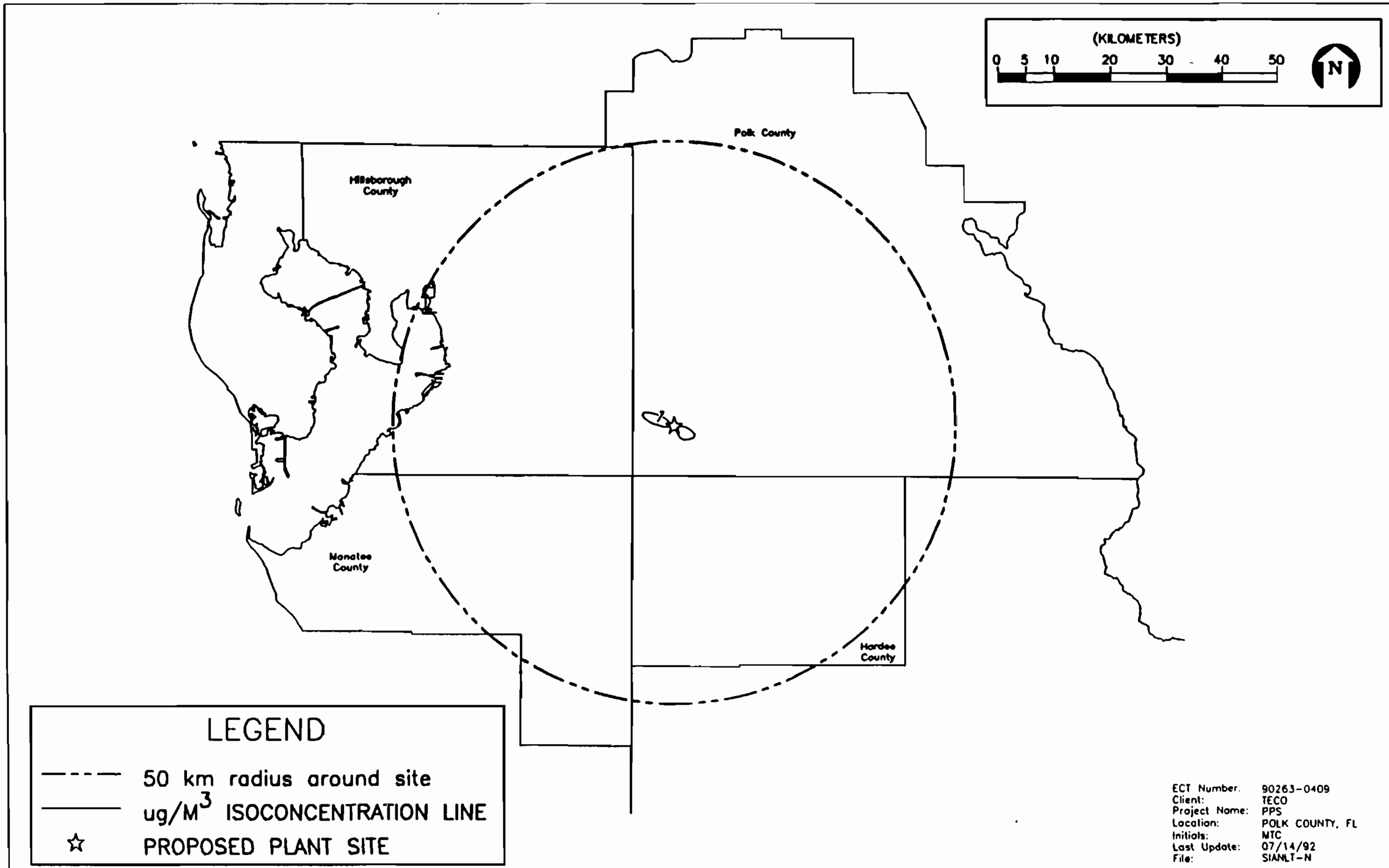

FIGURE 5.6.1-4.

ANNUAL NITROGEN OXIDES SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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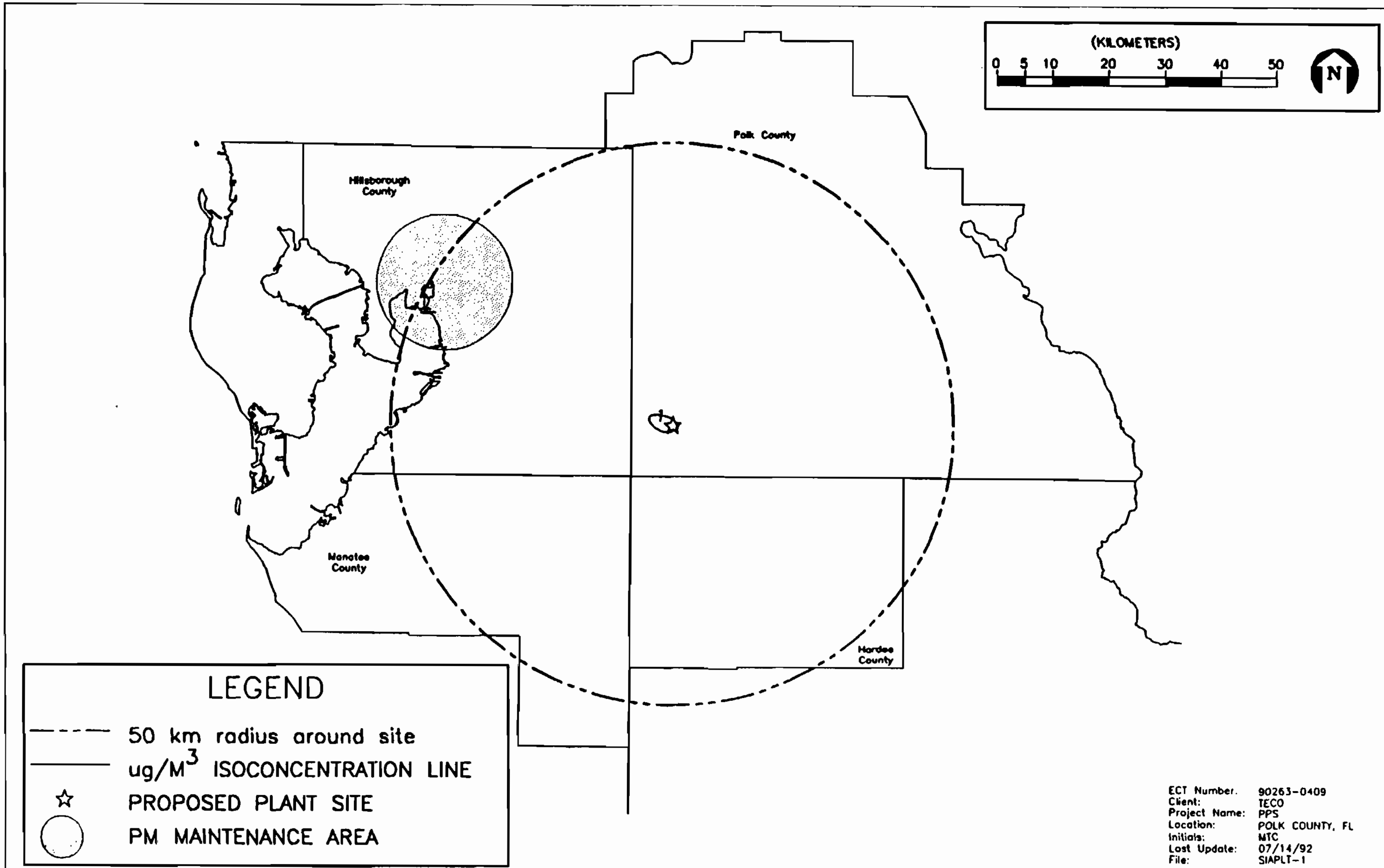

FIGURE 5.6.1-5.

ANNUAL PARTICULATE MATTER SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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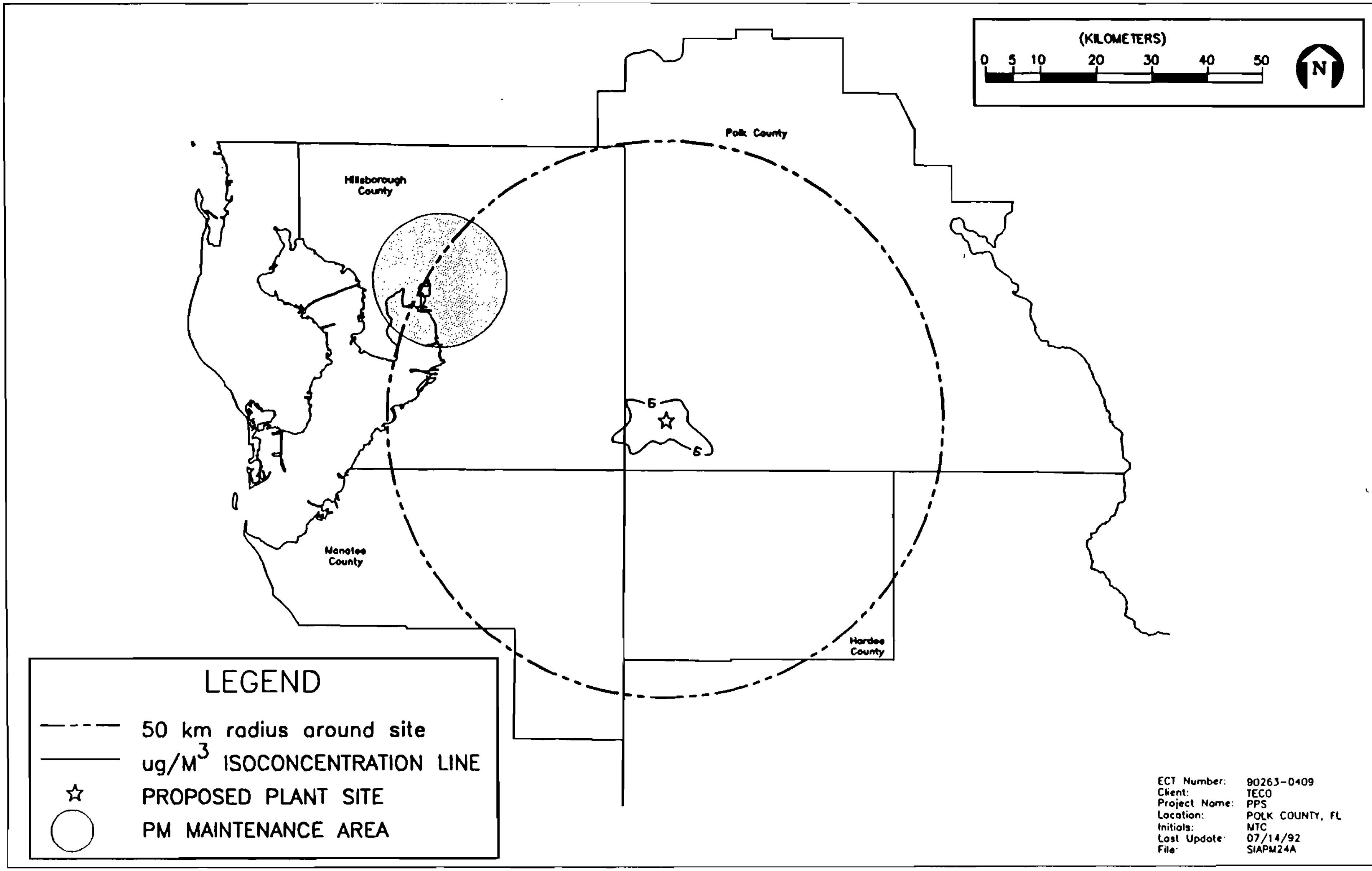

FIGURE 5.6.1-6.

24-HOUR PARTICULATE MATTER SIGNIFICANT IMPACT AREAS

Source: ECT, 1992.

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Table 5.6.1-3. Summary of Impact Analyses for AAQS

Pollutant	Averaging Time	Modeled Impact ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Projected Impact ($\mu g/m^3$)	AAQS ($\mu g/m^3$)
SO_2	Annual	30.4	5	35	60
	24-hour	162.7*	13	176	260
	3-hour	521.2*	26	547	1,300
NO_x	Annual	5.64	10	16	100
PM (PM_{10})	Annual	11.3	18.4	30	50
	24-hour	79.4*	45.4	125	150

*HSH modeled impact.

Source: ECT, 1992.

Analyses for Prevention of Significant Deterioration Class II Increments

Modeling analyses were carried out to determine maximum SO_2, NO_x, and PM (TSP) increment consumption within the Polk Power Station SIAs. Table 5.6.1-4 presents a summary of these analyses. All estimates of predicted impacts were less than the allowable Class II increments. Therefore, the operation of Polk Power Station will not cause significant deterioration of air quality in the project vicinity.

Analyses for Prevention of Significant Deterioration Class I Increments

Using very conservative modeling impacts and assumptions, air quality impacts with respect to PSD Class I increments were projected using the ISC2 and MESOPUFF-II models. Table 5.6.1-5 summarizes the final results of the impact analyses for PSD Class I increments. As shown, no exceedances were predicted. Given the conservative nature of the analyses, it can be concluded that operation of the Polk Power Station facility will not cause significant deterioration of air quality at the Chassahowitzka NWA.

5.6.1.5 Air Toxics Assessment

Maximum impacts due to Polk Power Station emission sources were determined for non-criteria pollutants using the ISC2 models. Table 5.6.1-6 summarizes the results and compares the maximum impacts to the no-threat levels. All maximum impacts were predicted to be below the no-threat levels, indicating that, with an adequate margin of safety, public health in the vicinity of Polk Power Station will not be jeopardized.

In addition to the no-threat level analysis, the potential impacts of the metals arsenic, beryllium, cadmium, and chromium (hexavalent) were of additional interest since they are known or suspected carcinogens and will be emitted in amounts that make them worthy of investigation. To evaluate the potential impacts of these emissions on human health, an inhalation cancer risk assessment was conducted. The assessment was used to estimate maximum individual risk (MIR) and total population risk (TPR). MIR is the estimated increase lifetime risk for an individual exposed to

Table 5.6.1-4. Summary of Impact Analyses for PSD Class II Increments

Pollutant	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	Annual	0.0*	20
	24-hour	27.8†	91
	3-hour	104.1†	512
NO_2	Annual	2.5	25
PM (TSP)	Annual	4.8	19
	24-hour	32.3†	37

*Increment consumption was negative over the entire receptor grid.
†HSH modeled impact.

Source: ECT, 1992.

Table 5.6.1-5. Summary of Impact Analyses for PSD Class I Increments

Pollutant	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)
SO_2	Annual	0.0*	2
	24-hour	5.0	5
	3-hour	11.5†	25
NO_2	Annual	0.2	2.5
PM (TSP)	Annual	1.3	5
	24-hour	5.9**	10

*Increment consumption was negative over the entire receptor grid.
†Impact due to Polk Power Station was not significant.
**HSH modeled impact.

Source: ECT, 1992.

Table 5.6.1-6. Summary of Worst-Case Estimates of Air Toxics Impacts Compared to FDER No-Threat Levels

Pollutant	Averaging Time	Maximum Impact ($\mu g/m^3$)	No-Threat Level ($\mu g/m^3$)
H_2SO_4	8-hour	3.76	10
	24-hour	1.64	2.4
Fluorides	1-hour	0.060	25
Mercury	8-hour	0.011	0.1
	24-hour	0.0048	0.024
Beryllium	Annual	0.00006	0.0004
Arsenic	Annual	0.00019	0.0002

Source: ECT, 1992.

the predicted highest annual average concentration. TPR is the estimated annual incidence of excess cancers for the entire affected population.

The highest estimate of MIR was calculated to be 1.9 x 10^{-6}. Figure 5.6.1-7 shows the areal distribution of MIR values of at least 1.0 x 10^{-6}. These values were predicted to occur primarily to the northwest of the site in areas of little or no population. TPR was conservatively estimated to be only 0.00027, meaning that the plant would theoretically cause an additional case of cancer only every 3,700 years.

5.6.1.6 Other Air Quality-Related Impacts

Impacts Due to Associated Growth

Construction of Polk Power Station will occur in phases. During the initial construction phase, an average of 400 workers will be employed for a 27-month construction period, with a 9-month peak of 600 construction workers. An average of 15 to 40 workers will be employed during other construction phases of the project. It is anticipated that most of these construction personnel will be drawn from Polk County and will commute to the job site from nearby cities, including Bartow, Winter Haven, and Lakeland. A portion of the work force will also commute from the Tampa metropolitan area. While not readily quantifiable, the temporary increase in vehicle-miles-traveled (VMT) in the area would be insignificant, as would any temporary increase in vehicular emissions.

The Polk Power Station will employ a total of 210 operational workers at project build-out. The operational workforce will also include annual contracted maintenance workers to be hired for periodic routine services ranging from 6 persons in 1997 to 100 at build-out in 2010. Again, it is expected that most of these persons will be drawn from the region. In 1990, the population of Lakeland was 70,576, while the population of Polk County was 405,382 persons. The workforce needed to operate the proposed plant therefore represents a small fraction of the population already present in the immediate area. Therefore, while some small increase in area VMT could result, the air quality implications in Polk County would be minimal.

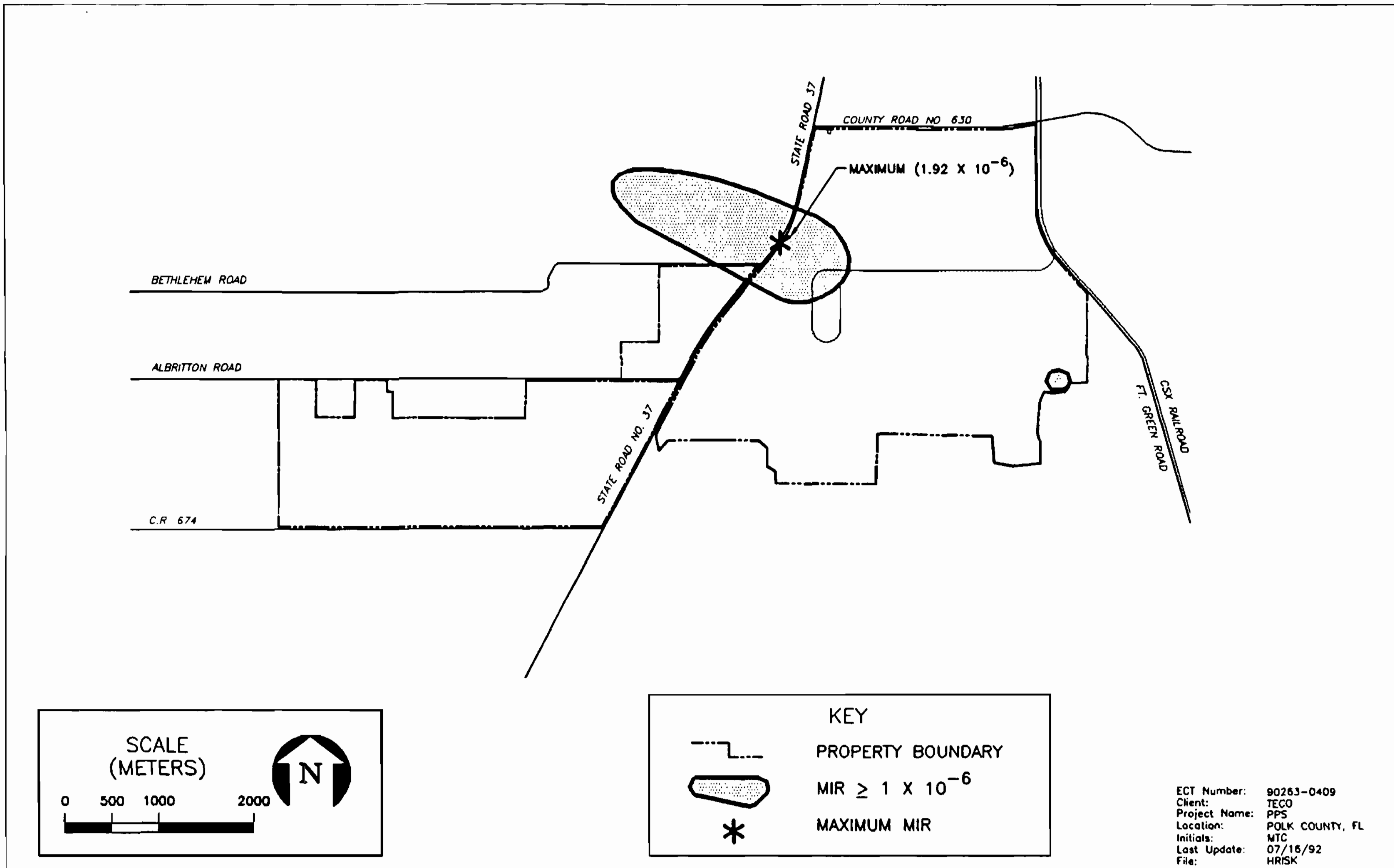

FIGURE 5.6.1-7.

AREAL DISTRIBUTION OF PREDICTED MAXIMUM INDIVIDUAL RISK

Source: ECT, 1992.

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Finally, a new industrial facility can sometimes generate growth in other industrial or commercial operations needed to support the new facility. Given the site's proximity to Bartow, Lakeland, and the Tampa metropolitan area, however, the existing commercial infrastructure should be more than adequate to provide any support services that the proposed facility might require. Therefore, no air quality impacts due to associated industrial/commercial growth would be expected. Furthermore, any significant industrial development resulting from the establishment of Polk Power Station would be independently subject to PSD and other environmental review requirements.

Impacts on Visibility and on Soils and Vegetation

No visibility impairment at the local level is expected due to the types and quantities of emissions projected from Polk Power Station sources. The opacity of combustion exhausts from the facility should be low. Emissions of primary particulates and sulfur oxides due to combustion will be low due to the predominant use of low-ash, low-sulfur fuels (syngas, natural gas, and distillate fuel oil) over the lifetime of the facility. While the facility will emit NO_x, the potential to impair visibility at the local level should be relatively low, given the very low expected exhaust opacity. The contribution of emissions of VOC to the potential for haze formation in the area is expected to be minimal. Materials handling and storage operations will be controlled so that fugitive dust potential will be minimized. In addition, the aesthetic character of lands within the boundaries of and adjacent to the Polk Power Station site are largely influenced by present and past mining operations. Because these lands have been previously disturbed by mining operations, the proposed project will not adversely affect aesthetic or visual qualities in the area.

Soil types have been mapped by the U.S. Department of Agriculture (USDA) in cooperation with the Polk County Soil Conservation Services (USDA, 1990). There are 20 different soil types on the Polk Power Station plant site. Most of the onsite or adjacent soils are either hydric soils which have thick organic layers and are slightly alkaline, or highly altered soils associated with mining activities. The Polk

Power Station plant site is situated primarily on Smyrna-Myakka, Arents-Water, and Ona soil types.

Gaseous emissions impacts on soils can cause both acid leaching of nutrients and direct impacts to vegetation. Impacts to vegetation are typically associated with direct uptake of toxins through the root zone. The potential for acid-leaching of nutrients in the alkaline organic soils which exist on the site is low. No impacts to nutrient levels in the highly altered, acidic soils of the mined areas are anticipated.

Sulfates and nitrates caused by SO_2 and NO_2 deposition on soil can have beneficial effects to soil if they are currently lacking. However, they can also increase acidity, affecting nutrient recycling and plant growth. The low emission levels and resulting ambient impacts for this project should not significantly cause increased acidity levels to the already acidic soils.

In summary, based upon the soils onsite, as well as the minimal emissions levels associated with plant operation, no impacts to soils are anticipated.

The majority of the Polk Power Station site has been or is in the process of being mined for phosphate. Consequently, most of the original flora on the site has been drastically altered. As a result of past and ongoing mining activities, only small, portions of relatively undisturbed terrestrial, wetland, and aquatic habitats still remain on the site. Major land uses and vegetation represented on the site consist of mined land, developed land (e.g., transmission lines, a pipeline, and a small industrial site), uplands (e.g., pasture, shrub and brushland, overgrown spoil, old fields, orange grove, mixed oak/pine woods, palmetto rangeland, pine flatwoods, and oak hammock), remaining wetlands (e.g., hardwood swamp and marsh), and open water systems (e.g., ditches, canals, mine ponds, and an intermittent stream). The 4,348-acre Polk Power Station site is a mine site in various stages of activity with relatively small, remnant areas of undisturbed, native vegetation.

Vegetation damage is described as impacts resulting in foliar damage. Less apparent vegetation injury is described as a reduction in growth and/or productivity without visible damage as well as changes in secondary metabolites such as tannin and phenolic compounds. Vegetation damage often results from acute exposure to pollution (i.e., relatively high doses over relatively short time periods). Injury is also associated with prolonged exposures of vegetation to relatively low doses of pollutants (chronic exposure). Acute damages, which have both functional and visible consequences, are usually manifested by internal physical damage to foliar tissues. Chronic injuries are typically more associated with changes in physiological processes.

In light of the previous discussion, the projected air quality impacts due to emission from Polk Power Station were evaluated as to their potential to impact vegetation in the area. The pollutants SO_2, NO_x, ozone, PM (including trace metals), CO, H_2SO_4, and fluorides and synergistic effects among gaseous pollutants were evaluated to the extent supported by the literature. Based on this assessment, it was concluded that emission from Polk Power Station will not result in impacts that will cause harm to vegetation.

<u>Other Potential Impacts on the Chassahowitzka National Wilderness Area</u>

The potential for Polk Power Station emissions to affect air quality-related values (AQRVs) at the Chassahowitzka NWA were also evaluated. The AQRVs of interest were visibility, soils, vegetation, and wildlife. Visibility impacts were predicted with the VISCREEN program (EPA, 1988). As a result of the low emissions from Polk Power Station and the distance of the plant from Chassahowitzka, it was predicted that the potential for visibility impairment is negligible.

Similarly, modeling of Polk Power Station emissions showed that the potential impacts at Chassahowitzka would be negligible. Given the ecology of Chassahowitzka and the negligible potential impacts, no detrimental effects on soils, vegetation, or wildlife in the wilderness area are expected.

5.6.2 MONITORING PROGRAMS

5.6.2.1 Post-Construction Ambient Air Quality Monitoring

Tampa Electric Company will provide up to two ambient air quality monitoring stations to collect post-construction ambient air quality monitoring data. The parameters to be monitored, the locations of the monitoring stations, and the operational dates of the stations will be determined at a later date.

5.6.2.2 Continuous Air Emissions Monitoring

The Polk Power Station project will be subject to 40 CFR 60, Subparts Y and GG. An initial performance test for opacity from coal processing, coal storage, and coal transfer and loading systems associated with the coal preparation process will be conducted pursuant to Subpart Y requirements. Continuous monitoring of fuel consumption and ratio of water to fuel being fired in the turbine will be conducted for the Polk Power Station CTs as required by Subpart GG. Monitoring of fuel sulfur and nitrogen content will also be performed pursuant to Subpart GG, §60.334(b). Initial performance testing of the CTs for NO_x and SO_2 emissions will be conducted as stipulated by Subpart GG, §60.335.

Initial and periodic performance testing of pollutants emitted by the Polk Power Station facility will be conducted pursuant to FDER requirements as specified in the SCA Approval Order. FDER test methods are specified in Chapter 17-2.700(6), F.A.C.

5.7 NOISE

Potential operational noise impacts were assessed for the three closest groups of residential receptors around the project site from both continuous and intermittent sources of noise resulting from the Polk Power Station project together with the existing sources. The NOISECALC noise model developed by the New York State Department of Public Service was the primary analytical tool employed in the assessment. Noise level input data were obtained from vendors, constructing engineers, and literature.

Figure 5.7.0-1 shows the locations of residential receptors assessed in the noise modeling. The receptors were located at the three groups of residences closest to the project site. The following list provides the distances in feet between each receptor and the power block center.

Receptor	Distance from Power Block Center (ft)	Number of Residences
1	22,250	53
2	10,125	45
3	8,250	1

Each of the locations will be shielded to some extent from lower elevation noise sources by existing features or features which will be developed as part of the project, including the approximately 200-ft wide vegetative buffer area which will be established along the public roadways (i.e., SR 37, CR 630, and Fort Green Road). In addition to its significant distance (i.e., over 4 miles) from the facilities, Receptor 1, southwest of the power block, will receive some shielding from the wetlands and uplands after reclamation. Currently, there are trees shielding Receptor 2 which is located west of the site. After reclamation, there will be wetlands and uplands which may provide some shielding. Receptor 3 located east of the plant, may receive some shielding from an orange grove between it and the plant. Unless, the vegetation is dense and wide enough, it will not attenuate the noise between the plant and the residences (Federal Highway Administration, 1980).

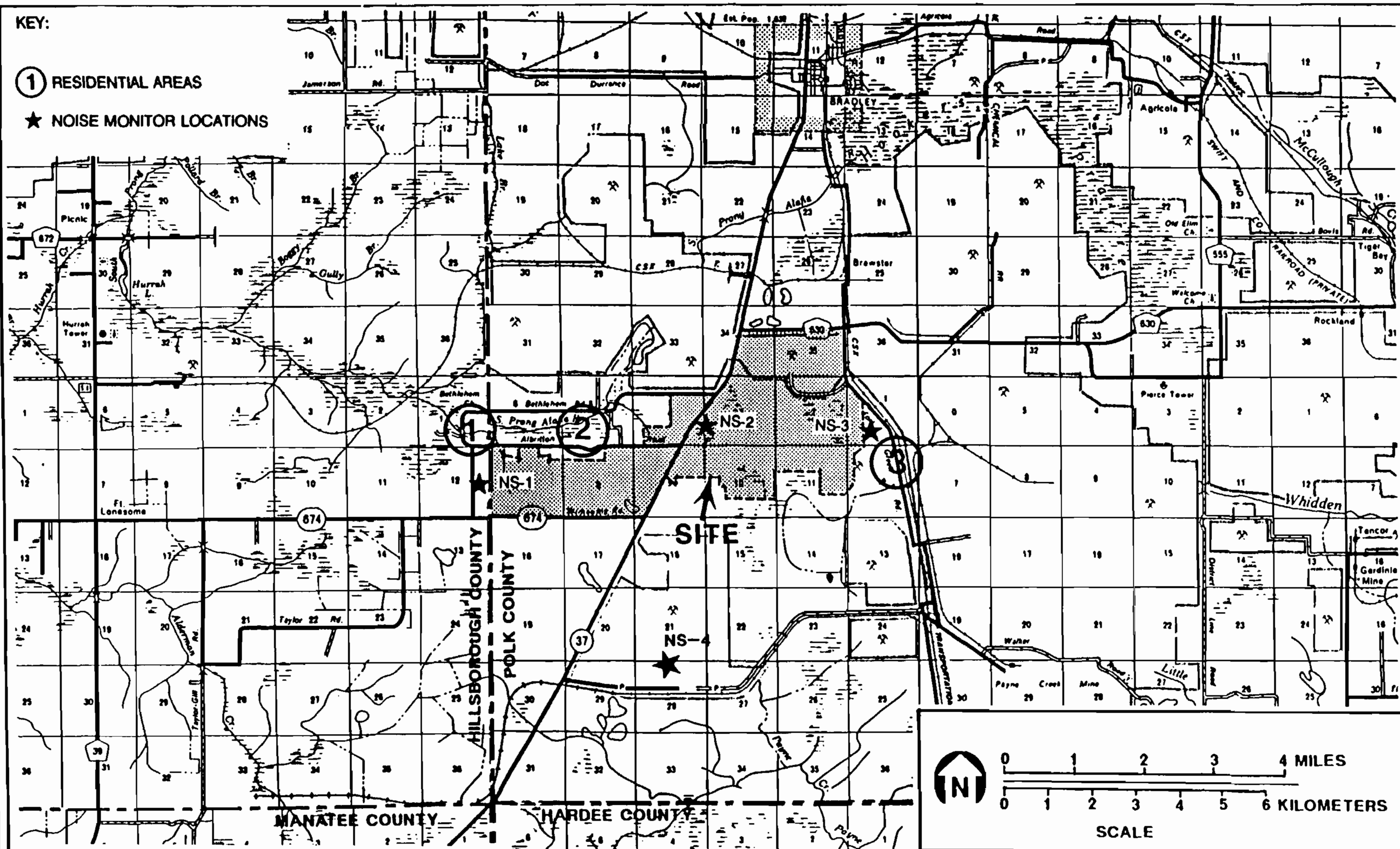

FIGURE 5.7.0-1.

LOCATIONS OF NOISE MODELING RECEPTORS

Source: FDOT Map, FL. ECT, 1992.

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Since the proposed vegetative buffer area surrounding the main plant site boundaries will take some time to mature after development of the project, a conservative approach was used for the noise analysis in that no credit was taken for vegetative noise attenuation in the modeling.

Table 5.7.0-1 presents the results of the noise modeling at each of the three receptor locations for three different timeframes in the overall project development and operation schedule (i.e., IGCC unit only, IGCC and CC units, and full build-out). In the analyses, flare stack and coal delivery train noise sources were modeled separately. For the IGCC unit only, the highest $L_{eq}(24)$ occurred at Receptor 2 west of the site. The highest $L_{eq}(24)$ of 51 dBA for other two development timeframes occurred at Receptor 2 and Receptor 3 located east of the site. Infrequent operation of the flare stack would temporarily increase noise levels to maximum instantaneous levels of 63, 77, and 75 dBA at Receptors 1, 2, and 3, respectively. The flare stack operations for full load trips are not expected to occur more than 24 hours per year. Project-related coal delivery trains on the CSX Railroad should not cause significant increases in the maximum noise levels at the residences but will increase the frequency of trains in the area. At Receptor 3, the residence closest to the railroad, the noise level produced by a train entering the site will be 54 dBA. Two trains per week will not significantly increase noise levels at any residence.

L_{dn} were computed for the plant based on the modeled levels. It was conservatively assumed that all plant activities will take place at any time of the day or night. [Calculation of the L_{dn} requires that a 10-dBA penalty be added to predicted noise levels between the hours of 10 p.m. and 7 a.m. to account for the increased awareness of people to nighttime noise levels. Thus, the L_{dn} is always higher than the 24-hour average level. A L_{dn} is essentially an $L_{eq}(24)$ value plus 10 dBA.]

The L_{dn} associated with plant operations were combined with the existing L_{dn} at the modeled receptor locations to show the total L_{dn} with the plant at full capacity. The existing L_{dn} include train, traffic, agricultural, and dragline noise. Table 5.7.0-2

Table 5.7.0-1. Noise Modeling Results

	Sound Level (dBA)				
Receptor	IGCC Unit Only $L_{eq}(24)$	IGCC and CC Units $L_{eq}(24)$	Full Build-Out $L_{eq}(24)$	Maximum Instantaneous Flare Stack Level	Maximum Instantaneous Coal Train Level
1	39	39	40	63	30
2	51	51	51	77	37
3	50	51	51	75	54

Source: ECT, 1992.

Table 5.7.0-2. Day/Night Noise Levels (dBA)

Receptor	Existing	Predicted Plant Noise	Combined Levels
1	57	46	57
2	61	58	63
3	59	58	62

Source: ECT, 1992.

presents the results of these calculations. The predicted L_{dn} were found to be slightly higher than the existing L_{dn} at Receptors 2 and 3. L_{dn} at Receptor 1 would be unaffected by the plant.

Tampa Electric Company will take into consideration noise mitigation measures as it evaluates equipment and prepares the detailed design of the plant. In addition to the proposed vegetative buffer, mitigative options may include silencers for the CT air intakes and require that vehicles on the plant site travel at slow speeds.

Projected noise levels from power plant operation will not affect wildlife resources. No sensitive wildlife communities (e.g., active eagle nests or wading bird rookeries) exist within 1 mile of the power block area. All wildlife onsite and in the region have been exposed to similar noise levels from phosphate mining for years.

In summary, the plant operation noise levels in the area surrounding the Polk Power Station site are generally not expected to increase significantly due to the project.

5.8 CHANGES TO NON-AQUATIC SPECIES POPULATIONS

5.8.1 IMPACTS

Vegetation and wildlife habitats situated on the Polk Power Station site have or will be modified by either phosphate mining or power plant construction. Habitats occurring onsite during power plant operation will be those left untouched during construction or those created either by mining reclamation or power plant development.

Potential adverse effects to local or regional terrestrial and wetland vegetation due to plant operation are commonly a result of air emissions and cooling system operation. As stated in Chapter 5.6, no significant impacts to either local or regional vegetation patterns are anticipated from the air emissions associated with power plant operation. Since water quality and temperature (after a short mixing zone) meet water quality standards and water levels will not be significantly increased or decreased in any offsite watercourse (i.e., flooding is not expected to occur outside of historic floodplains), no impacts to terrestrial or wetland vegetation are expected outside of the site boundaries.

Onsite, vegetation will become established along the littoral edges of the cooling reservoir and will vary in species composition and abundance depending on the water level fluctuations associated with surface water runoff, groundwater seepage, discharges, and rainfall. None of the remaining terrestrial or wetland communities within the property boundaries will be affected by plant operation. None of the listed plant species discussed in Section 2.3.6 will be impacted by plant operations.

The net effect of the reclamation/development plan will be to increase higher quality wildlife habitats over those that existed prior to mining. Wetland acreage will be increased over pre-mining conditions and, therefore, may result in an increase in wetland-dependent wildlife species onsite. No impacts to wildlife are anticipated as a result of using the cooling reservoir. As previously discussed, no impacts to wildlife from power plant air emissions are expected either locally or regionally. No listed species discussed in Section 2.3.6 should be affected by power plant operation.

5.8.2 MONITORING

It is not expected that monitoring of the site's non-aquatic species will be necessary. Biological resources of the site were found to be already affected by phosphate mining operations.

Monitoring of the site reclamation/development plan will extend into the operational phase of the project in accordance with FDNR reclamation requirements. This will include creation and restoration of wetlands and documentation of their success.

5.9 TRANSPORTATION AND OTHER PLANT OPERATION EFFECTS

As shown in Table 5.9.0-1 and Figure 5.9.0-1, the operational workforce is anticipated to include 50 persons in 1995 at the initial operation of the plant (i.e., nominal 150 MW) which will increase in 1996 to 130 total employees at the completion of the IGCC unit (i.e., nominal 260 MW), then gradually to a total of 210 (i.e., nominal 1,150 MW) at project build-out in 2010. This employment figure includes plant operators, internal maintenance personnel, and supervisory and administrative staff. The distribution of the operational workforce at build-out by work shift is shown in Table 5.9.0-2, which illustrates that approximately 60 percent of the workforce will be on the site between 7 a.m. and 3 p.m.

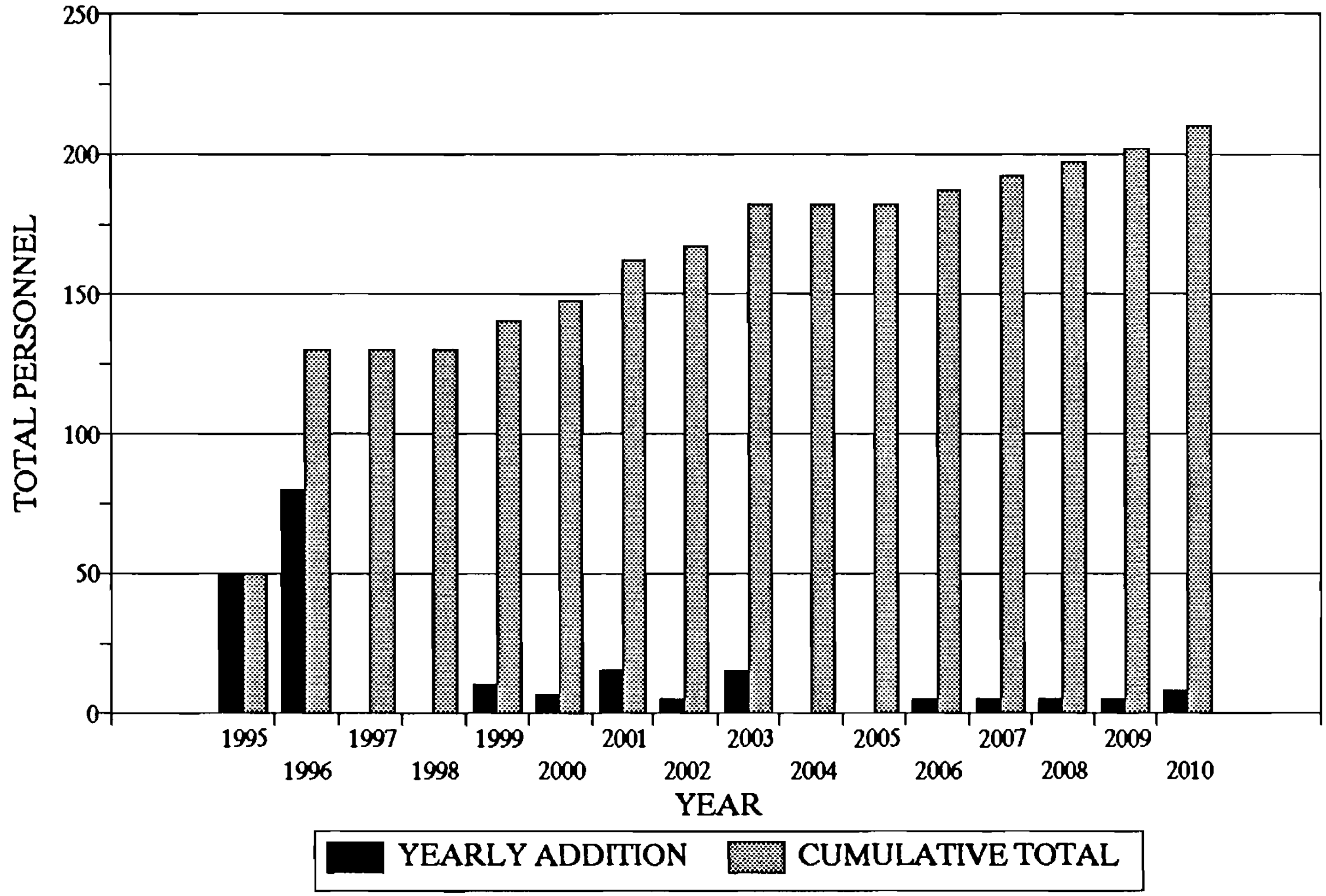
The majority of the operational workforce (e.g., plant workers) is anticipated to be drawn from the local labor pool in Mulberry, Bartow, Lakeland/Winter Haven, Plant City, and Tampa, with most of the senior plant management staff drawn from existing Tampa Electric Company operations in Hillsborough and Polk Counties. The geographic distribution of the operational workforce, as shown in Table 5.9.0-3, is anticipated to consist of the following: 60 percent from Polk County; 25 percent from Hillsborough County; 5 percent from Manatee County; 5 percent from Hardee County; and 5 percent from outside the region or state. Because the major regional population centers are within a 30-mile distance to the Polk Power Station, and based on typical commuting patterns of power plant employees (EPRI, 1982), it is estimated that 95 percent of the total operational workforce will commute from their existing residences. Only those recruited from outside the region or state, or the remaining 5 percent, are expected to permanently relocate to the region. At project build-out in 2010, this 5 percent represents 11 people. This number of potential relocations is not expected to create significant demands on regional housing, transportation facilities, or public services and facilities. In consideration of the relatively small number of relocations, the associated trips to and from the Polk Power Station site are not expected to create significant traffic impacts on the regional road networks.

Table 5.9.0-1. Operational Plant Personnel Requirements*

Year	Unit Additions	Total Nominal Station Capacity (MW)	Personnel Requirement Addition This Year	Personnel Requirement Cumulative Total
1995	One 150-MW CT	150	50	50
1996	Conversion of CT to 260-MW IGCC	260	80	130
1999	One 75-MW CT	335	10	140
2000	One 75-MW CT	410	7	147
2001	CC conversion of two 75-MW CTs	480	15	162
2002	One 75-MW CT	555	5	167
2003	One 220-MW CC	775	15	182
2006	One 75-MW CT	850	5	187
2007	One 75-MW CT	925	5	192
2008	One 75-MW CT	1,000	5	197
2009	One 75-MW CT	1,075	5	202
2010	One 75-MW CT	1,150	8	210

*The personnel requirements include plant operators, maintenance personnel, and supervisory and administrative staff.

Source: UE&C, 1992.



* The personnel requirements include Plant Operators, Maintenance Personnel, and Supervisory and Administrative Staff.

FIGURE 5.9.0-1.

TAMPA ELECTRIC COMPANY POLK POWER STATION PLANT PERSONNEL REQUIREMENTS

Source: UEC, 1992.

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Table 5.9.0-2. Estimated Distribution of Operational Workforce

County	1995	2010
Polk (60 percent)*	30	126
Hillsborough (25 percent)*	13	53
Hardee (5 percent)	2	10
Manatee (5 percent)	2	10
Outside region/state (5 percent)	3	11
TOTAL	**50**	**210**

*Rounded to the next whole position to establish worst-case relocation scenario.

Sources: UE&C, 1992.
ECT, 1992.

Table 5.9.0-3. Operational Workforce Labor Classifications at Build-Out

Shift	Skilled (Plant Operators)	Supervisory/ Professional	Adminis-trative/ Clerical	Total	Percent
First shift 7 a.m. to 3 p.m.	100	0	0	100	47.6
Second shift 3 p.m. to 11 p.m.	35	0	0	35	16.7
Third shift 11 p.m. to 7 a.m.	25	0	0	25	11.9
Management 7 a.m. to 4 p.m.	0	10	15	25	11.9
Maintenance 7 a.m. to 3 p.m.	20	5	0	25	11.9
TOTAL	**180**	**15**	**15**	**210**	**100.0**

Source: UE&C, 1992.

Based on existing operational traffic associated with a similar power plant, the trip generation rate for the Polk Power Station is expected to be approximately 2.35 trips per employee (Kimely-Horn, 1989).

The likely routes for operational employees commuting to the Polk Power Station are listed as follows according to community:

- From Bradley/Mulberry/Lakeland--South on SR 37 to Polk Power Station;
- From Bartow--West on SR 60 to SR 37 south to Polk Power Station, or south on CR 525 to CR 630 west to SR 37 south to Polk Power Station;
- From Fort Meade--West on CR 630 to SR 37 south to Polk Power Station;
- From Wauchula--North on U.S. Highway 17 to SR 62 west to CR 663/Fort Green Road north to CR 630 west to SR 37 south to Polk Power Station;
- From Plant City--South on SR 39 to SR 60 east to SR 37 south to Polk Power Station; and
- From Tampa/Brandon--East on SR 60 to SR 37 south to Polk Power Station, or east on SR 60 to CR 640 southeast to SR 37 south to Polk Power Station.

At the completion of the IGCC unit, a 130-person operational workforce is expected at the Polk Power Station. At project build-out in 2010, a daytime workforce (7 a.m. to 3 p.m.) of 125 persons, or approximately 60 percent of the total 210 operational employees, is anticipated. In consideration of the directional sources of employment, a distribution of 75 percent northbound and 25 percent southbound are assumed at a vehicle occupancy rate of 1.0. The daytime (7 a.m. to 3 p.m.) operational employee traffic volumes are estimated to be 221 daily northbound and 73 southbound daily trips at project build-out in 2010.

The projected operational workforce will also include those employees hired for contract maintenance on an annual basis. All of the contract maintenance workers are expected to commute from their existing residences, with no permanent relocation anticipated. The projected distribution of these annual contract maintenance workers ranges from 6 to 100 in 1997 to project build-out in 2010 as shown in Table 5.9.0-4. Based on previously stated assumptions regarding trip generation rate, vehicle occupancy rate, and directional distribution, and assuming that 100 percent of this workforce will be employed from 7 a.m. to 4 p.m., the additional traffic from contract maintenance workers ranges from 11 northbound and 3 southbound daily trips in 2001 to 176 northbound and 59 southbound daily trips in 2010.

As previously discussed in Section 3.3.2.1, two different means of delivering coal to the site, by truck or by rail, will be provided for the project. For purposes of identifying a worst-case scenario for vehicular traffic impacts, the following discussion assumes all coal to be delivered by truck.

Under this scenario, coal would be delivered via specially designed covered trucks. These specialized, bottom-dump trucks would operate from a coastal receiving facility at an estimated frequency of 80 to 100 trucks per day. The frequency of coal deliveries by truck is expected to remain constant from the completion of the IGCC unit in 1996 through the operational life of the plant. Based on the results of the detailed transportation analyses for the project, significant impacts on the a.m. and p.m. peak hour traffic volumes caused by the truck delivery of coal are not anticipated.

During the operation of the Polk Power Station, consumables will be delivered to the site, creating minimal additional traffic impacts. Consumable materials to be delivered include acid and caustic materials, boiler chemicals, lime, lubrication oils and greases, and miscellaneous gases. The distribution of these annual deliveries from project initiation in 1995 to build-out in 2010 is shown in Table 5.9.0-5, while the estimated constituent deliveries for the year 2010 and beyond is shown in Table 5.9.0-6. As these deliveries range from approximately four yearly deliveries in 1995 to approximately 50 annual deliveries in 2010, their additional traffic impacts will not be significant.

Table 5.9.0-4. Estimated Annual Contract Maintenance Personnel Requirements

Unit	Special Contract Maintenance Personnel in Year															
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
150-MW CT			6	6		10		6	6	11		6	6		10	
IGCC†				60		60		60		60		60		60		60
75-MW CT						5		7	5	7	5	7	5	7	5	7
75-MW CT							5	7	5	7	5	7	5	7	5	7
CC conversion					Included in preceding CT units											
75-MW CT									5		7		5		7	
220-MW CC										10		14		10		14
75-MW CT													5		7	
75-MW CT														5		7
75-MW CT															5	
75-MW CT																5
75-MW CT																
TOTAL ANNUAL			6	66		75	5	80	21	95	17	94	26	89	39	100

Note: The maintenance of the units could be staggered or combined based on plant operation requirements.

Source: UE&C, 1992.

Table 5.9.0-5. Annual Truck Deliveries for Consumables

Year	Number of Deliveries
1995	4
1996	10
1997	10
1998	10
1999	14
2000	18
2001	18
2002	22
2003	30
2004	30
2005	30
2006	34
2007	38
2008	42
2009	46
2010 and beyond	50

Note: Does not include waste or by-product offsite transfers.

Source: UE&C, 1992.

Table 5.9.0-6. Frequency of Truck Deliveries for Consumables for 2010 and Beyond

Material	Frequency
Acid	1 truck each month
Caustic	1 truck each month
Boiler chemicals	1 truck every 3 months
Lime	1 truck each month
Lube oil and grease	1 truck every 12 months
Miscellaneous gases	1 truck every 2 to 3 months
TOTAL ANNUAL	**50**

Source: UE&C, 1992.

Minimal traffic impacts to regional road networks are expected to result from fuel oil delivery trucks serving the Polk Power Station. Fuel oil is expected to be used as a backup fuel source for the CC and CT units used to meet peak or immediate demands and for the IGCC when operated in CC mode due to the unavailability of the CG plant. Table 5.9.0-7 provides estimated daily fuel oil truck deliveries based on worst-case fuel demands from project initiation in 1995 to project build-out in 2010. Based on the concurrent unavailability of natural gas and the gasifier, total daily fuel oil truck deliveries range from 7 in 1995 to 111 in 2010. The capability to deliver oil by rail would also significantly reduce the need for truck delivery.

A minimal amount of additional daily traffic will be generated by trucks transporting the by-products of the CG process, sulfur/H_2SO_4 and slag, offsite. Based on a 5-day workweek, approximately six 30-ton trucks will carry sulfur offsite daily, while nine 15-ton trucks will carry slag offsite. This converts to an additional 12 and 18 total daily operational trips, respectively, for sulfur and slag by-products.

The total projected operational daily vehicle trips are summarized on Table 5.9.0-8. These total predicted daily trips range from 322 in 1995 to 1,031 in 2010, and take into account operational and maintenance traffic, coal deliveries, and fuel oil truck and by-product truck deliveries. These total daily trips, when distributed over work shifts and for periodic delivery schedules, are not expected to lower the functional capacity of roadways to an unacceptable LOS or significantly impact a.m. and p.m. peak hour traffic volumes (see Appendix 11.6). Consumable delivery trip information was only available on an annual and not daily basis, and the range of these deliveries from initiation to build-out does not represent significant traffic impacts.

It is possible for vehicles accessing the Polk Power Station site to degrade the paving surfaces (e.g., by pot-holes) of those roadways closest to the Polk Power Station site. Two factors should minimize such potential degradation. First, heavy power plant components will be primarily delivered via rail. Second, access improvements, as appropriate, will be constructed in the initial project phase to facilitate construction

Table 5.9.0-7. Fuel Oil Consumption and Delivery Requirements*

Year	Unit Additions	Total Nominal Station Capacity (MW)	Daily Oil Consumption (gpd)		Number of Daily Truck Deliveries**			
					30-Day Replenishment		60-Day Replenishment	
			Maximum	Average	At Maximum Consumption	At Average Consumption	At Maximum Consumption	At Average Consumption
1995	One 150-MW CT	150	335,520.00	167,760.00	14	7	7	4
1996	CG conversion of one 150-MW CT	260	335,520.00	251,280.00	14	10	7	5
1999	One 75-MW CT	335	582,720.00	380,640.00	24	16	12	8
2000	One 75-MW CT	410	829,920.00	434,400.00	34	18	17	9
2001	CC conversion of two 75-MW CTs	480	819,290.40	591,798.00	33	24	17	12
2002	One 75-MW CT	555	1,066,490.40	721,158.00	43	29	22	15
2003	One 220-MW CT	775	1,550,260.80	1,061,676.00	62	43	31	22
2006	One 75-MW CT	850	1,797,460.80	1,115,436.00	72	45	36	23
2007	One 75-MW CT	925	2,044,660.80	1,191,876.00	82	48	41	24
2008	One 75-MW CT	1,000	2,291,860.80	1,321,236.00	92	53	46	27
2009	One 75-MW CT	1,075	2,539,060.80	1,374,996.00	101	55	51	28
2010	One 75-MW CT	1,150	2,786,260.80	1,451,436.00	111	58	56	29

Table 5.9.0-7. Fuel Oil Consumption and Delivery Requirements* (Continued, Page 2 of 2)

*Selective operations are based on shutting down one or more CT units at low loads during simple-cycle operation.
**Number of deliveries are calculated based on the following:

- Truck capacity: 8,000 gallons;
- Outages of natural gas and/or gasifier are 7 days; the plant will have at least 7 days' onsite oil storage;
- The oil trucks will replenish oil consumed over a 30- or 60-day period;
- Five days per week truck delivery; this means 22 days and 44 days delivery, respectively, for 30- and 60-day replenishment; and
- The truck deliveries are rounded off to the next whole number.

Source: UE&C, 1992.

Table 5.9.0-8. Combined Daily and Annual Operational Vehicle Trips

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Operational employment	50	130	130	130	140	147	162	167	182	182	182	187	192	197	202	210
Total daily trips[1]	118	305	305	305	329	346	381	393	428	428	428	440	451	463	475	494
Contract maintenance	0	0	6	66	0	75	5	80	21	95	17	94	26	89	39	100
Total daily trips[1]	0	0	14	155	0	176	12	188	49	223	40	221	61	209	92	235
Coal delivery trucks	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Total daily trips[2]	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
Fuel oil trucks[2]	7	7	7	7	12	17	17	22	31	31	31	36	41	46	51	56
Total daily trips[3]	14	14	14	14	24	34	34	44	62	62	62	72	82	92	102	112
By-product trucks[4]																
Sulfur/H_2SO_4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Total daily trips[3]	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Slag	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Total daily trips	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Total combined daily trips	**322**	**509**	**523**	**664**	**543**	**742**	**617**	**815**	**729**	**903**	**720**	**923**	**784**	**954**	**859**	**1,031**
Total annual consumable truck trips[5]	**8**	**20**	**20**	**20**	**28**	**36**	**36**	**44**	**44**	**44**	**44**	**68**	**76**	**84**	**92**	**100**

Note: [1] = trip generation rate of 2.35, vehicle occupancy rate of 1.0.
[2] = 60-day replenishment schedule for 7-day outage at maximum consumption.
[3] = Trip generation rate of 2.0.
[4] = by-product transport trips are assumed to remain constant.
[5] = daily trip information not available.

Sources: UE&C, 1992.
ECT, 1992.

worker and machinery access to the Polk Power Station site. These two factors will minimize such road impacts, especially at the project entrances on SR 37. Tampa Electric Company will repair and maintain these entrances as necessary.

Based on existing traffic volumes, LOS ratings, and functional capacities of roadway networks; the projected number of permanent employees; and expected trip generation rates, traffic associated with the operation of the Polk Power Station will not lower the functional capacity of adjacent road networks below the adopted county standard, or significantly impact a.m. and p.m. peak hour traffic volumes (see transportation analysis in Appendix 11.6).

5.10 ARCHAEOLOGICAL SITES

Based on the results of the Cultural Resources Assessment and a confirmation letter from FDHR (see Appendix 11.5), no significant archaeological sites are expected to be found at the Polk Power Station site. Therefore, no onsite, post-construction monitoring is planned or required. As previously described in Section 4.8, if encountered, the applicant will take appropriate measures to preserve or mitigate potential impacts to archaeological sites after review by a certified archaeologist and consultation with the FDHR.

5.11 RESOURCES COMMITTED

The major irreversible and irretrievable commitments of state and local resources due to operation of the proposed Polk Power Station are the use of land, and the consumption of water, coal, natural gas, and fuel oil.

The majority of the land areas used by the Polk Power Station have been or will be disturbed by phosphate mining activities and would have been reclaimed to pastureland with lakes developed in some mine cut areas.

The Polk Power Station project will use some of these lands for energy production. In addition, significant acreages on the site will be reclaimed to forested and non-forested wetland and upland areas and will develop as wildlife habitat/corridor areas.

Some groundwater 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 Polk Power Station.

Coal, natural gas, and fuel oil will be consumed as fuel for the proposed electric generating units. The amounts are described in Chapter 3.0. This is an irreversible and irretrievable commitment of energy resources for the production of energy for the State of Florida.

5.12 VARIANCES

A thermal mixing zone will be required for the discharge of water from the proposed cooling reservoir. The size of this mixing zone is described in Section 5.1.1.

REFERENCES

Electric Power Research Institute (EPRI). 1982. Socioeconomic Impacts of Power Plants. Document EA-2228. Denver Research Institute, Denver, CO.

Federal Highway Administration. 1980. Highway Traffic Noises.

Harbeck, G.E., Jr. 1964. Estimating Forced Evaporation from Cooling Ponds. Power Division, Proceedings of the American Society of Civil Engineers.

Hunter/ESE. 1989. Florida Acid Deposition Monitoring Program. 1988 Summary Report (Draft). Hunter/ESE No. 91126-0106-3170.

Kimely-Horn. 1989. Traffic Impact Analysis. Florida Power and Light Company, Martin County Expansion, Martin County, FL.

Peterson, W.D. 1971. The Capacity of Cooling Ponds to Dissipate Heat. Proceedings of the American Power Conference. Volume 33.

Talmage, S.S., and Opresko, D.M. 1981. Literature Review: Response of Fish to Thermal Discharges. EA-1840 Research Project 877, ORNL/EIS-193. EPRI.

Tetra Tech. 1985. Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling. Environmental Research Laboratory, Athens, GA.

U.S. Environmental Protection Agency (EPA). 1984. User's Guide to the MESOPUFF II Model and Related Processor Programs. Office of Research and Development. EPA-600/8-84-013. Research Triangle Park, NC.

U.S. Environmental Protection Agency (EPA). 1986. Guideline on Air Quality Models (Revised). Office of Air Quality Planning and Standards. EPA-450/2-78-027R. Research Triangle Park, NC.

U.S. Environmental Protection Agency (EPA). 1988. Workbook for Plume Visual Impact Screening and Analysis. Prepared by Systems Applications, Inc., PB89-151286. Research Triangle Park, NC.

U.S. Environmental Protection Agency (EPA). 1992. User's Guide for the Industrial Source Complex (ISC2) Dispersion Models. Volume I, User Instructions. Office of Air Quality Planning and Standards. EPA-450/4-92-008a. Research Triangle Park, NC.