4.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

This chapter provides descriptions of the proposed Polk 2-5 Conversion Project facilities, key components and systems of the Project operations, and the directly associated facilities to be installed at PPS. The descriptions include estimates of the expected character, quality, and quantity of discharges and emissions from the plant facilities and operations. In addition, proposed measures and systems to control and, as necessary, treat the expected emissions and discharges are described to provide reasonable assurance that the plant operations comply with applicable regulatory requirements and standards. The descriptions presented in this chapter are based on the currently available plans and engineering and design information for the Project.

4.1 BACKGROUND

The proposed Project will convert the existing Polk Units 2 through 5 from simple cycle operation to CC operation, increasing the nominal net capacity of the existing four units from 660 to 1,160 MW. Key directly associated facilities for the proposed Project include four HRSGs, an STG, a mechanical draft cooling tower, and a new transmission line and existing line upgrades (described in Chapter 9). After completion of the proposed Project, the new CC unit will be known as the Polk 2 Combined Cycle. The proposed Project will result in a total generating capacity of 1,420 MW (nominal net) at the PPS Site. Construction activities for the Project are scheduled to begin in February 2014; commercial operation is scheduled for January 2017. Tampa Electric is seeking an increase in the certified ultimate site capacity from 1,150 to 1,420 MW at the PPS Site and certification of the proposed Project and directly associated facilities within this PPSA proceeding.

The HRSGs will use waste heat from the existing Polk Units 2 through 5 CTGs to produce steam to be directed to a new STG, which will produce additional electrical power. The steam from the STG discharges to a condenser, which is cooled by the existing cooling reservoir via a new circulating water system. A new mechanical draft cooling tower will be used for cooling of the auxiliary equipment for the proposed Project, as well as for the auxiliary cooling systems for Polk Unit 1.

4.1.1 SITE SYNERGIES AND BENEFITS

Tampa Electric's selection of the PPS Site as the location for the Project will provide numerous synergies and benefits through the integration of the proposed Project with existing infrastructure and operations, while minimizing environmental, land use, and other impacts compared to development of a greenfield site. The existing PPS facilities that will provide design and operational synergies by the collocation of the Project at the Site include:

- Approximately 755-acre cooling reservoir with capacity to be used for condenser cooling for the Project.
- Four 230-kV transmission circuits currently serving the Site with capacity to handle the additional output of the Project with only an upgrade of a portion of one circuit of an existing Tampa Electric transmission line and one new offsite transmission line corridor. The onsite substation can be readily expanded to accommodate the needs of the Project.
- Existing paved roads with good access for trucks and other vehicle traffic.
- CSX railroad network adjacent to the Site with an existing onsite rail spur to provide for large equipment deliveries.
- Existing onsite FGT natural gas pipeline to provide primary fuel for the Project.
- Existing administration building, control room, warehouse, maintenance shop, and other facilities that, with minor modifications, can serve the Project.
- Sufficient open space adjacent to existing facilities for the new Project equipment and facilities.

Further, collocating the Project at the PPS Site will allow Tampa Electric to effectively take advantage of the extensive experience of its existing plant personnel in combustion turbine and steam generation technologies during the construction and operation of the Project. Tampa Electric also has established relationships with many local specialty contractors and other skilled service providers to support the operation and maintenance of the existing units that can be efficiently used to support the new Project operations.

4.1.2 OVERVIEW OF MAJOR PLANT FACILITIES AND SYSTEMS

The proposed Polk 2-5 Conversion Project will be a four-on-one CC unit with a nominal rating of 1,160 MW at 59°F. Table 4.1.2-1 presents the conceptual site design conditions for the PPS Site.

Table 4.1.2-1. Conceptual Design Conditions for the PPS Site

Condition	Value or Range	Reference
Maximum temperature Coincident relative humidity	102°F 33 percent	NCDC
Minimum temperature Coincident relative humidity	19°F 58 percent	NCDC
Average temperature Coincident relative humidity	72°F 80 percent	NCDC
Wind loading	Basic wind speed: 145 mph	Florida Building Code, 2010
	Windborne debris region, importance factor (Iw): 1.15, Exposure C	
Seismic zone	Seismic use group/seismic design Category III A, site classification (stiff soil): D,Sds=0.089g, Sd1=0.056g	Florida Building Code does not consider seismic loads for building codes; seismic design criteria in accordance with ASCE 7-98
Site elevation	Average 143 ft above mean sea level	Site arrangement drawing
Location	Outdoors, corrosive environment	Site arrangement drawing

Note: NCDC = National Climatic Data Center.
ASCE = American Society of Civil Engineers.

Source: Black & Veatch, 2012.

Tampa Electric will use state-of-the-art CC power generation technologies for the proposed Project. HRSG and STG technologies were also used for the existing Polk Unit 1 IGCC plant; however, improvements in these technologies have occurred over the past 20 years, which will be incorporated into the design of this Project to enhance the plant generating and environmental performance. Figure 4.1.2-1 provides a conceptual block flow diagram for the proposed Project.

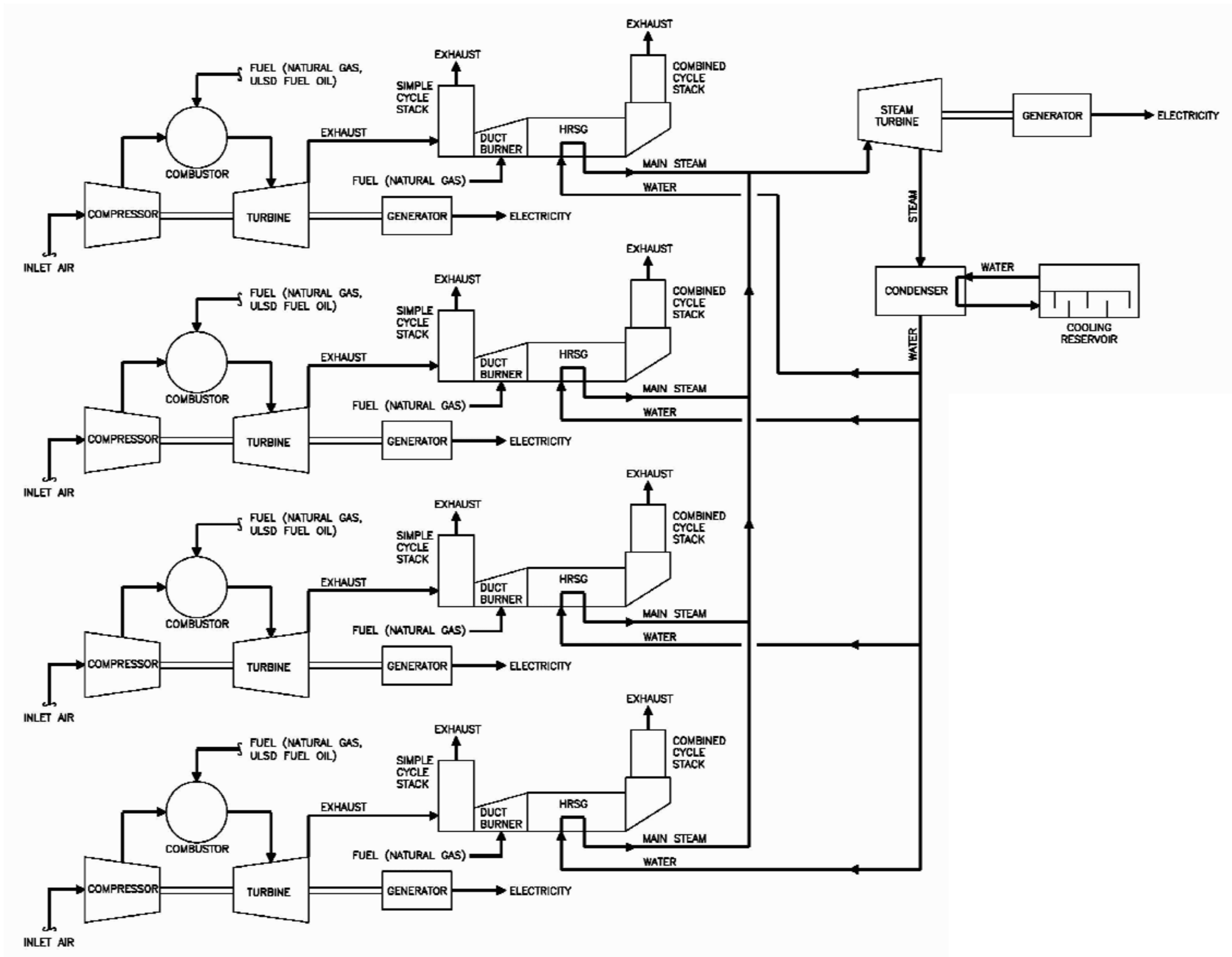

FIGURE 4.1.2-1.
CONCEPTUAL PROCESS FLOW DIAGRAM

Source: Black & Veatch, 2012.

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Major facilities for the proposed Project will include:

- Four existing CTGs.
- Four new HRSGs with natural gas-fired duct burners.
- One new STG.
- New six-cell mechanical draft cooling tower.
- New standby diesel generator.
- New expanded circulating water intake and discharge structures from/to cooling reservoir.
- Various new associated transformers, pumps, and water and chemical storage tanks.

The new unit will be designed for cycling load operation. The STG will be selected in combination with the HRSGs to provide a reasonable design throttle pressure to ensure satisfactory cycling operation. The HRSGs will be designed with natural gas-fired duct burners for peaking power operation. Evaporative coolers will be installed on the CTGs to increase warm weather power generation by increasing CTG inlet air density. The Project will be designed to allow the CTGs to operate in simple cycle mode with the STG out of service or to meet peak power demands by providing a means for the CTG exhaust gas to bypass the HRSG and flow directly to the atmosphere using a diverter damper stack in combination with the existing simple cycle stack.

The HRSGs will be installed outdoors and will convert waste heat from the CTG exhausts to steam for use in driving the STG. The HRSGs will be natural circulation, three-pressure, reheat units with supplemental duct firing to maximize unit output. Cycle operating pressure will be a nominal 2,400 pounds per square inch, gauge (psig). SCR systems for NO_x control will be included within the HRSGs. The HRSGs will discharge through metal exhaust stacks. Stack dampers will be included to minimize heat loss during shutdowns. Two 100-percent capacity condensate pumps and one 100-percent capacity boiler feedwater pump per HRSG will be included.

The STG will be a tandem-compound, single reheat, condensing turbine operating at 3,600 revolutions per minute. Turbine suppliers' standard auxiliary equipment includes a lubricating oil system; hydraulic oil system; and supervisory, monitoring, and control systems. A surface condenser will be provided for condensing steam from the turbine exhaust and will use the existing cooling water reservoir for cooling. The condenser will be designed for full steam flow bypass around the

STG. A single synchronous generator will be directly coupled to the STG. Generator suppliers' standard auxiliary equipment will include supervisory, monitoring, and control systems and static excitation systems. The STG will be provided with enclosures as required for outdoor installation.

A six-cell, mechanical draft, counterflow cooling tower will be used by the Project for cooling of auxiliary equipment from the new CC plant as well as the existing Polk Unit 1 auxiliaries. The cooling tower will be of fiberglass construction and installed on a reinforced concrete basin. The cooling tower will include a pump intake structure housing two 100-percent capacity new Unit 1 auxiliary cooling water pumps and two 100-percent capacity new CC auxiliary cooling water pumps for the proposed Project. An auxiliary cooling water chemical feed system will be included. Makeup water to the cooling tower will primarily be provided from the onsite reclaimed water treatment facilities and the existing onsite wells. The cooling tower will be equipped with drift eliminators with a design drift rate of 0.0005 percent. The cooling tower will be approximately 1,270 ft from the nearest PPS property line.

The Project will be designed for control through a plant distributed control and information system. The control screens for this system will be located in the exiting main plant control room. A new control system for control of the STG will also be included.

Following the conversion, each CTG unit (existing Units 2 through 5) will continue to use natural gas from the existing onsite natural gas supply system as the startup and primary fuel and ULSD fuel oil as backup.

The proposed Project will be integrated into the existing PPS operations and designed to minimize the use of water and maximize the recycling/reuse of water. For the Project, the existing cooling reservoir will be used for condenser cooling purposes, similar to existing Unit 1 operations. As previously mentioned, a new mechanical draft cooling tower will be constructed to provide cooling for the Project auxiliary systems. Unit 1 auxiliary cooling systems will be modified to also use the new cooling tower instead of the cooling reservoir.

The majority of water required for Project operations will be needed to replace water lost due to evaporation from the cooling reservoir and the new cooling tower. Currently, all water for existing PPS operations is provided by groundwater withdrawals from the Floridan aquifer through onsite wells. To minimize the need for additional groundwater withdrawals at the PPS Site, Tampa Electric is currently developing a water treatment plant on the PPS Site to accommodate the use of reclaimed water from the City of Lakeland to supply a portion of the makeup water for the cooling reservoir and new cooling tower. Groundwater will continue to be used to supply the higher quality process water needs (e.g., boiler makeup, potable water) of the existing facilities and proposed Project.

Process water used throughout the Project and PPS will concentrate impurities due to evaporation or contact with materials and chemicals. To maintain acceptable water quality in these processes, wastewater (e.g., blowdown) streams from these processes or systems will be removed, appropriately treated, and disposed.

The proposed Project area will use the existing onsite drainage system with minor modifications to manage and control stormwater runoff and minimize erosion and sedimentation impacts during construction and operation. Stormwater and wash water from plant areas associated with industrial activity will be collected and routed to the existing PPS stormwater treatment system prior to discharge to the cooling reservoir. These onsite drainage facilities have been designed in accordance with the requirements of FDEP, SWFWMD, and Polk County.

4.2 SITE LAYOUT

The originally certified PPS Site consisted of approximately 4,348 acres in southwest Polk County. Prior to development of PPS, the Site consisted primarily of previously mined phosphate lands that have subsequently been reclaimed and released under applicable FDEP and Polk County reclamation requirements. The portion of the Site containing the existing PPS power plant facilities is unmined land except for the approximately 755-acre cooling reservoir, which was developed in a previously mined area. As discussed in Sections 1.2.1 and 3.1, Tampa Electric has recently donated the approximately 1,511-acre portion of the Site on the west side of SR 37 to the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida for use as a wildlife management/recreation area. As part of this PPSA proceeding, Tampa Electric is requesting that the existing certification for the PPS Site be amended to remove this western portion from the certified Site area, and the new certified PPS Site will consist of the approximately 2,837-acre portion of the PPS Site east of SR 37.

Figure 4.2.0-1 presents the overall layout of the existing facilities (shown in red) and new facilities for the Polk 2-5 Conversion Project (shown in purple) on the

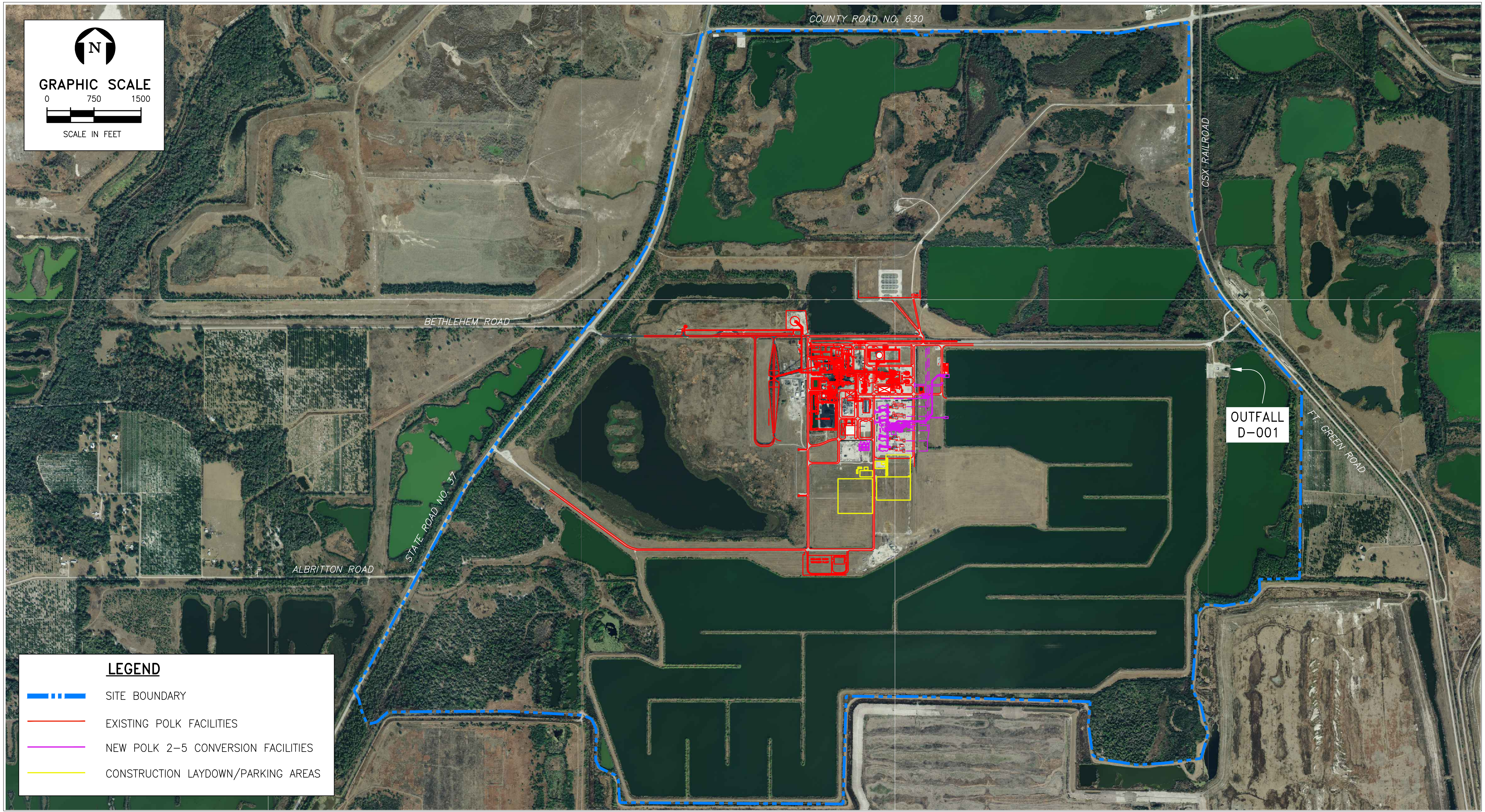

FIGURE 4.2.0-1.

OVERALL SITE LAYOUT ON PPS SITE

Sources: 2011 Dept. of Revenue Aerials; Black & Veatch, 2012; Tampa Electric, 2012; ECT, 2012.

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Site on a recent aerial photograph. As shown in this figure, the proposed Project facilities will be located adjacent to the existing Polk Units 2 through 5 facilities.

Figure 4.2.0-2 provides a layout of the existing and proposed facilities for the Project, and Figure 4.2.0-3 presents the similar detailed facility layout on a recent (i.e., 2011) aerial photograph. As shown in these figures, the new HRSGs and STG will be constructed immediately west of and between existing Units 2 through 5. Figure 4.2.0-4 provides a detailed site arrangement for the proposed Project facilities, including a facilities legend. The new mechanical draft cooling tower will be located west of the new generating facilities. Construction laydown and parking areas will be temporarily provided in the previously cleared and used upland areas south and west of the proposed Project facilities.

Figure 4.2.0-5 presents a conceptual rendering of the proposed Project with the existing facilities on the Site. Table 4.2.0-1 provides the approximate dimensions of the major buildings and facilities for the proposed Project. As shown in this table, the tallest new structures will be the HRSG structures with main upper platform levels at approximately 110 ft above ground level and the main exhaust stacks for the HRSGs at 130 ft in height. These new structure heights are lower than some of the existing structures associated with Polk Unit 1 (i.e., HRSG exhaust stack and gasifier).

Table 4.2.0-1. Project Building and Structure Dimensions

Building/Structure	Height (ft)	Length (ft)	Width (ft)
HRSG (each)	110	135	55
STG	75	150	50
Cooling tower	51	145	97
HRSG stacks	130	19*	

*Length dimension represents structure diameter.

Sources: Black & Veatch, 2012.

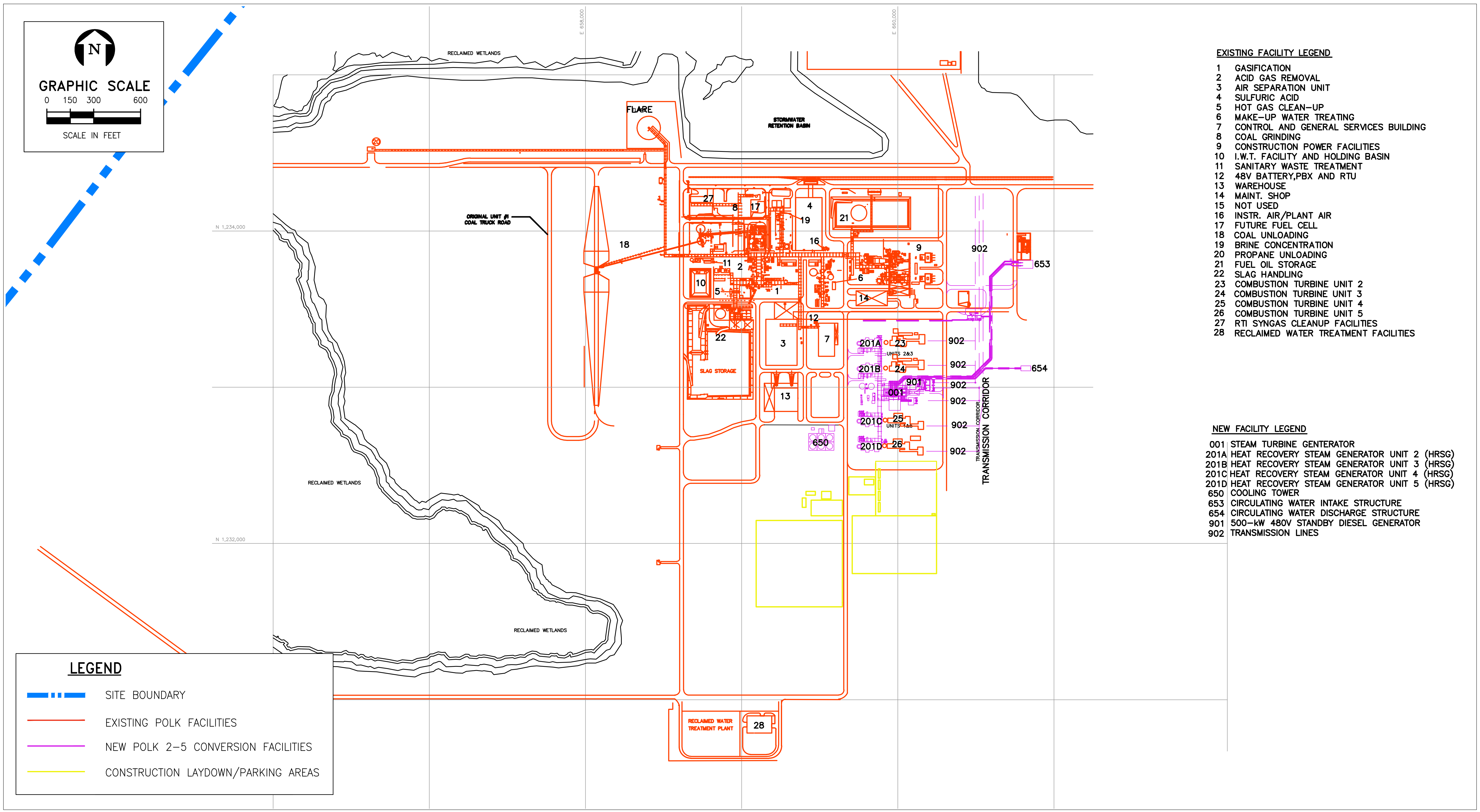

FIGURE 4.2.0-2.

LAYOUT OF EXISTING AND PROPOSED POLK 2-5 CONVERSION FACILITIES

Sources: Black & Veatch, 2012; Tampa Electric, 2012; ECT, 2012.

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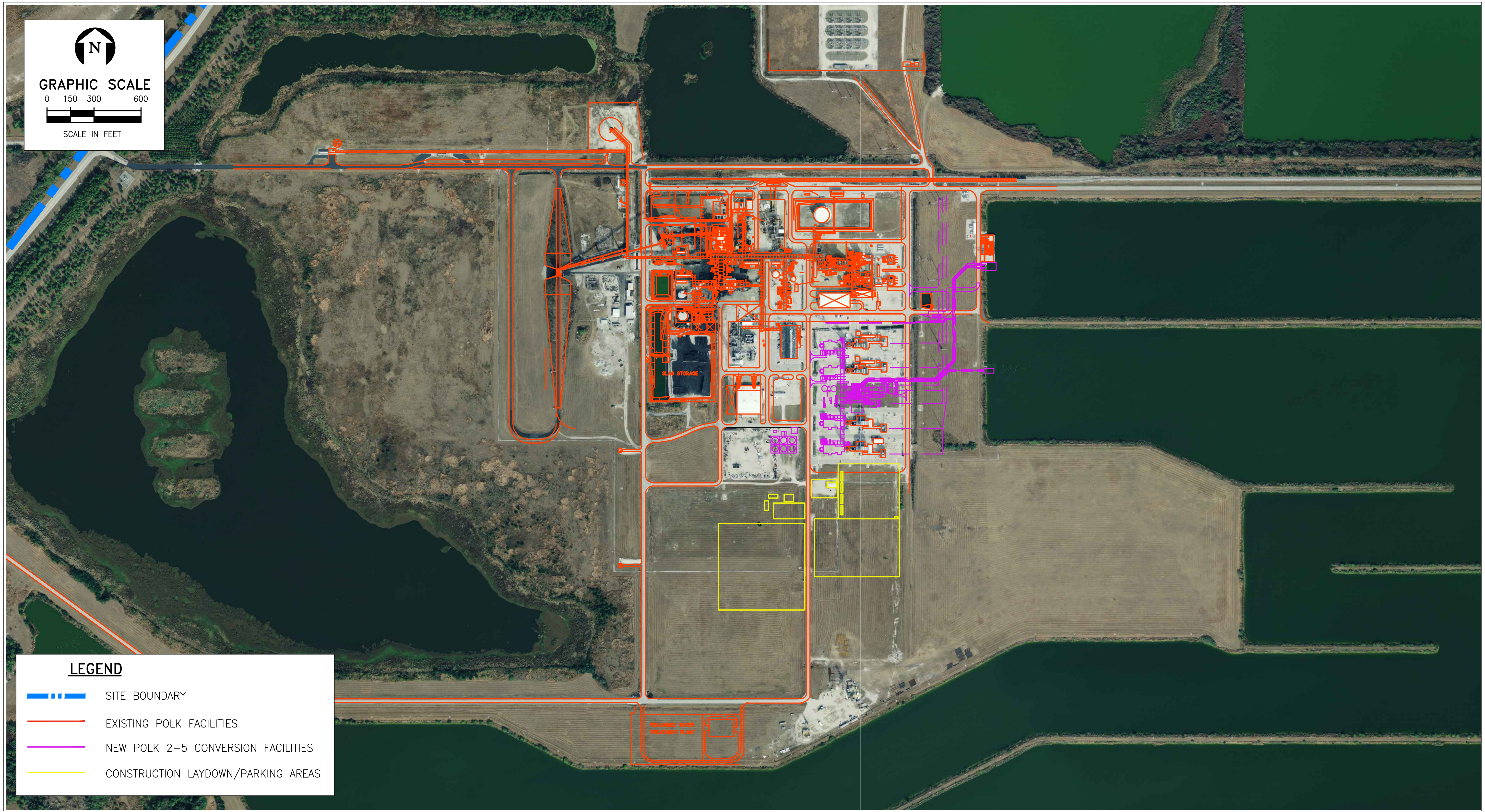

FIGURE 4.2.0-3.

LAYOUT OF EXISTING AND PROPOSED POLK 2-5 CONVERSION FACILITIES ON AERAIL PHOTOGRAPH

Sources: 2011 Dept. of Revenue Aerials; Black & Veatch, 2012; Tampa Electric, 2012; ECT, 2012.

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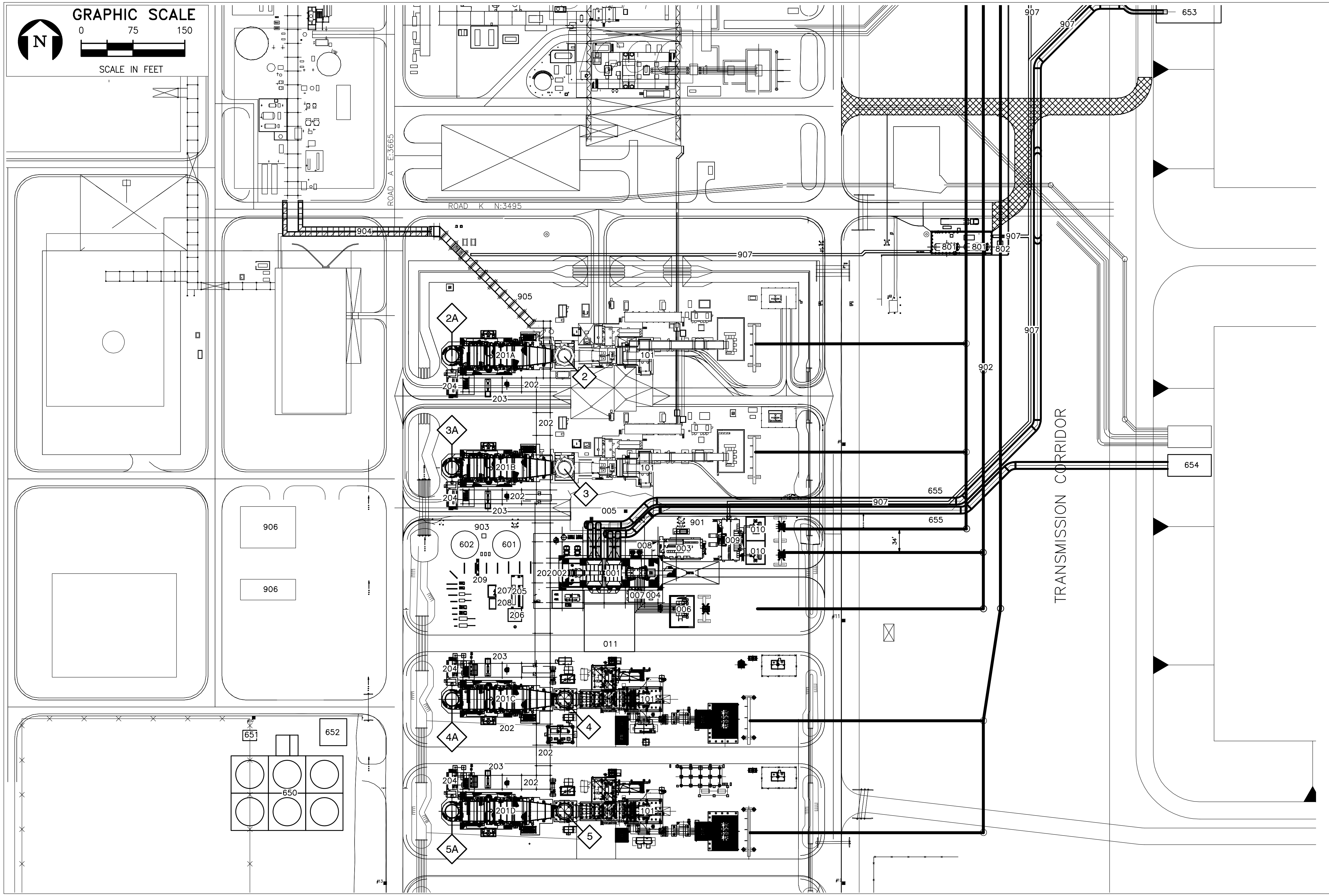

LEGEND

2A EMISSION POINT

NEW FACILITY LEGEND

001 STEAM TURBINE GENERATOR
002 STEAM TURBINE AREA STRUCTURE
003 STEAM TURBINE ELECTRICAL EQUIPMENT ENCLOSURE
004 STG EXCITATION TRANSFORMER
005 CONCRETE MAINTENANCE PAD (EXISTING)
006 STG STEP–UP TRANSFORMER
007 STG EXCITATION COMPARTMENT
008 CONDENSATE PUMPS
009 COMBINED CYCLE SWITCHGEAR ENCLOSURE
010 STATION SERVICE TRANSFORMER
011 STG AREA CONCRETE MAINTENANCE PAD
101A COMBUSTION TURBINE GENERATOR UNIT 2 (EXISTING)
101B COMBUSTION TURBINE GENERATOR UNIT 3 (EXISTING)
101C COMBUSTION TURBINE GENERATOR UNIT 4 (EXISTING)
101D COMBUSTION TURBINE GENERATOR UNIT 5 (EXISTING)
201A HEAT RECOVERY STEAM GENERATOR UNIT 2 (HRSG)
201B HEAT RECOVERY STEAM GENERATOR UNIT 3 (HRSG)
201C HEAT RECOVERY STEAM GENERATOR UNIT 4 (HRSG)
201D HEAT RECOVERY STEAM GENERATOR UNIT 5 (HRSG)
202 UTILITY PACK
203 BOILER FEED PUMPS
204 HRSG ELECTRICAL ENCLOSURE
205 CHEMICAL FEED EQUIPMENT (W/ SUN SHADE)
206 AMINE STORAGE TANK
207 WASTEWATER COLLECTION SUMP
208 OILY WASTE SUMP
209 WALK–OVER PLATFORM
601 DEMINERALIZED WATER STORAGE TANK
602 DEMINERALIZED WATER STORAGE TANK (FUTURE)
650 COOLING TOWER
651 COOLING TOWER ELECTRICAL EQUIPMENT ENCLOSURE
652 AUX COOLING CHEMICAL FEED (W/ SUN SHADE)
653 CIRCULATING WATER INTAKE STRUCTURE
654 CIRCULATING WATER DISCHARGE STRUCTURE
655 CIRCULATING WATER PIPE
657 INTAKE STRUCTURE ELECTRICAL EQUIPMENT ENCLOSURE
801 AMMONIA STORAGE TANKS & FORWARDING PUMPS
802 AMMONIA AREA ELECTRICAL EQUIPMENT ENCLOSURE
901 500–kW 480V STANDBY DIESEL GENERATOR
902 TRANSMISSION LINES
903 ST AREA FIRE WATER VALVE HOUSE
904 UTILITY TRENCH
905 UTILITY RACK (EXISTING)
906 TRAILER / STRUCTURE (EXISTING)
907 UTILITY TRENCH

FIGURE 4.2.0-4.

DETAILED SITE ARRANGEMENT FOR POLK 2-5 CONVERSION PROJECT

Source: Black & Veatch, 2012; Tampa Electric, 2012; ECT, 2012.

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FIGURE 4.2.0-5.
CONCEPTUAL RENDERING OF PROPOSED POLK 2-5 CONVERSION PROJECT FACILITIES

Source: Black & Veatch, 2012.

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4.3 FUEL

Key factors in Tampa Electric's decision to select the CC technology to meet its future power needs were fuel costs and use of proven technology. Use of natural gas will enable Tampa Electric to take full advantage of competitive fuel pricing and availability opportunities and transportation options in the future marketplace to provide low-cost, reliable electricity to its customers. Natural gas delivery will be unchanged via the existing pipeline on the Site to Units 2 through 5. The proposed Project will also be designed for operation on ULSD fuel oil as a backup fuel. ULSD fuel oil will also be fired in the new emergency generator diesel engine.

4.3.1 FUEL QUALITY AND QUANTITY

4.3.1.1 Natural Gas

The Project will fire natural gas in the CTGs and HRSG duct burners as the primary fuel. The existing natural gas supply line to PPS from the FGT pipeline system has adequate capacity to provide the additional natural gas requirements for the Project. Table 4.3.1-1 presents the typical composition of FGT pipeline system natural gas in Florida.

The hourly natural gas fuel consumption rates will depend on plant load, ambient conditions, and whether supplemental firing is used. Table 4.3.1-2 provides indicative estimates of total average fuel consumption rates for the four Unit 2 CC units.

Tampa Electric has determined that conversion of the existing simple cycle CTGs to CC operation is the most efficient use of technology and site facilities for additional power generation at PPS.

Table 4.3.1-1. Typical Natural Gas Composition

Gas Composition	Mole Percent Component (by volume)
Pentane	<0.1
Propane	0.3
I-butane	0.1
N-butane	0.1
Nitrogen	0.3
Methane	96.8
CO_2	0.8
Ethane	1.6
Other characteristics	
Heat content (HHV)	1,020 Btu/ft^3
Sulfur content	2.0 gr/100 dscf*

Note: Btu/ft^3 = British thermal unit per cubic foot.
gr/100 dscf = grain per 100 dry standard cubic feet.
HHV = higher heating value.

*FDEP-recommended value.

Sources: Tampa Electric, 2012.
ECT, 2012.

Table 4.3.1-2. Indicative Hourly Natural Gas Fuel Consumption Rates

Description of Operating Mode	MMBtu/hr (HHV)
59°F ambient, natural gas fuel, supplemental firing *off*, evaporative coolers *off*, full load.	7,094
59°F ambient, natural gas fuel, supplemental firing *on*, evaporative coolers *on*, full load.	8,113

Note: MMBtu/hr = million British thermal units per hour.
HHV = higher heating value.

Source: Black & Veatch, 2012.

4.3.1.2 ULSD Fuel Oil

ULSD fuel oil will be used as backup fuel for the CTGs and the only fuel for the new emergency generator. Table 4.3.1-3 presents the typical composition of ULSD fuel oil. The ULSD fuel oil will have a maximum sulfur content of 0.0015 percent by weight.

Table 4.3.1-3. Typical ULSD Fuel Oil Composition

Component	Maximum
Carbon residue on 10-percent bottoms	0.25 weight percent
Water and sediment	0.50 percent volume
Vanadium	1.5 ppm
Calcium	4.0 ppm
Sulfur	0.0015 weight percent
Ash	100 ppm
Lead	1.0 ppm
Heat content (HHV) (minimum)	130,000 Btu/gal

Note: Btu/gal = British thermal unit per gallon.
HHV = higher heating value.
ppm = part per million.

Source: ECT, 2012.

The quantity of ULSD fuel oil used for Project operations will depend on the number of hours permitted per year. Routine testing of the emergency generator will be conducted for a maximum of 100 hours per year (hr/yr).

4.3.2 FUEL DELIVERY, HANDLING, AND STORAGE

Natural gas and fuel oil are currently delivered to the PPS Site. Facilities required to support the Polk 2-5 Conversion Project include natural gas piping modifications/extensions at the existing CTG units to the new HRSG duct burners and fuel oil piping modifications/extensions to the existing Units 4 and 5 CTGs. The existing FGT natural gas supply line to PPS has the capacity to provide the additional natural gas requirements for the Project. ULSD fuel oil will continue to be delivered to the Site by trucks.

4.3.2.1 Natural Gas Operational/Startup Fuel

The current PPS facilities include a natural gas supply pipeline from the FGT system adjacent to the Site along Fort Green Road that provides fuel to the existing Units 2 through 5. This existing pipeline interconnection has adequate capacity to supply to the proposed Project operational and startup fuel requirements. Modifications to the existing natural gas supply facilities required for the Project will involve the onsite extension of the pipeline to the new HRSG duct burners for supplemental firing.

4.3.2.2 ULSD Backup Fuel Oil

As discussed in Section 4.3.1.2, ULSD fuel oil will be used as fuel for the new emergency generator, as well as backup fuel for the CTGs. The ULSD fuel oil will be delivered to the PPS Site via tanker trucks and unloaded and stored in day tanks near the emergency equipment. The day storage tanks will be located within appropriately designed containment areas with manually controlled drains routed to an oil-water separator.

The backup fuel oil for the CTGs will be stored in the existing aboveground bulk storage tank located in an existing secondary containment area.

4.4 AIR EMISSIONS AND CONTROLS

The proposed Polk 2-5 Conversion Project qualifies as a major modification to an existing major source and, therefore, is subject to PSD NSR. Subject to regulatory approval, emissions controls for NO_x will be the use of CTG dry low-NO_x burners and SCR when firing natural gas and dry low-NO_x burners, SCR, and water injection when firing ULSD fuel oil. Control of other pollutants will be by good combustion control and use of low-sulfur, low-ash fuels and high-efficiency drift eliminators on the cooling tower. The anticipated air emissions and proposed control technologies are fully described and presented in the PSD permit application included in Appendix 10.2.5 of this SCA and summarized in the following subsections.

4.4.1 AIR EMISSIONS TYPES AND SOURCES

The main Project emissions sources are the CTG and HRSG units. Combustion emissions from these units include gaseous and particulate components. The mechanical draft cooling tower will emit particulates from dissolved solids contained in water drift. Combustion emissions will also result from the occasional operation of the emergency diesel generator.

Table 4.4.1-1 presents the annual potential emissions for the proposed Project compared to the PSD significant emissions rates, which are thresholds for PSD review. If a project is located at an existing major source, then PSD review is required for any pollutant with emissions that are greater than the listed PSD significant emissions rate for that pollutant. PSD review requires a determination of best available control technology (BACT), an ambient air quality impact analysis, and an additional impact analysis as provided in the PSD application.

Table 4.4.1-1. PSD Applicability

Pollutant	Potential Emissions (tpy)	PSD Significant Emissions Rate (tpy)	PSD Review Required?
CO	935.0	100	Yes
NO_x	744.9	40	Yes
SO_2	192.3	40	Yes
PM	188.3	25	Yes
PM_{10}	309.0	15	Yes
$PM_{2.5}$	308.6	10	Yes
VOC	137.6	40	Yes
Lead	0.018	0.6	No
Fluorides	Negligible	3	No
H_2SO_4 mist	42.5	7	Yes
Hydrogen sulfide	Negligible	10	No
Total reduced sulfur	Negligible	10	No
Reduced sulfur compounds	Negligible	10	No
Municipal waste combustor—organics	Not applicable	3.5×10^{-6}	No
Municipal waste combustor—metals	Not applicable	15	No
Municipal waste combustor—acid gases	Not applicable	40	No
Municipal solid waste landfills (NMOC)	Not applicable	50	
Mercury	0.0032	0.1	No
Greenhouse gas (as CO_2e)	4,307,862	75,000	Yes

Note: Emissions rate calculations are provided in the PSD application.
CO_2e = carbon dioxide equivalent.
NMOC = nonmethane organic compound.
tpy = ton per year.

Source: Black & Veatch, 2012.

4.4.1.1 CTG/HRSG Units

Air pollutants will be emitted from the CTG/HRSG units when firing natural gas or ULSD fuel oil. Air emissions are the result of the combustion process and impurities in the fuel. Fuel combustion generally results in the emissions of NO_x, CO, SO_2, VOC, PM/PM_{10}/$PM_{2.5}$, H_2SO_4 mist, and small amounts of HAPs. During combustion, two primary types of NO_x emissions are formed: fuel NO_x and thermal NO_x. Fuel NO_x emissions are formed through the oxidation of a portion of the nitrogen contained in the fuel. Thermal NO_x emissions are generated through the oxidation of a portion of the nitrogen contained in the combustion air. SO_2 and H_2SO_4 mist emissions result from conversion of sulfur in the fuel and are minimized by the low sulfur content in the fuels proposed for the Project.

Potential annual emissions rates for the Project following conversion to CC mode operation were developed by evaluating three annual emissions profiles. The annual emissions profiles reflect operation of the four CTGs at baseload operation in CC mode of operation for both fuel types at International Organization for Standardization conditions of 59°F and 60-percent relative humidity. The annual emissions profiles also included the potential emissions resulting from the addition of ULSD fuel oil-firing to CTGs 4 and 5, consideration of emissions occurring during startup and shutdown events, and emissions resulting from the use of evaporative cooling and duct burner firing. The PSD application presents the basis for the emissions rates and potential annual emissions.

4.4.1.2 Cooling Tower

The proposed Project will include one six-cell mechanical draft cooling tower to dissipate heat from the Project auxiliary equipment. In addition, the auxiliary cooling system for Unit 1, which currently uses the cooling reservoir for heat dissipation, will be modified to use the new cooling tower. The tower will be operated at three to five cycles of concentration to minimize scaling. Blowdown from the tower will be directed to the cooling water reservoir. Makeup water to replace losses due to evaporation from the cooling tower will primarily be supplied from treated reclaimed water from the City of Lakeland.

PM/PM_{10}/$PM_{2.5}$ emissions occur from the cooling tower as a result of water being entrained in the air stream. Wet, or evaporative, cooling towers rely on the latent heat of water evaporation to exchange heat between the process and the air passing through the cooling tower. Because of direct contact between the cooling water and ambient air, a small portion of the recirculating cooling water is entrained in the air stream and discharged from the cooling tower as drift droplets. These water droplets contain the same concentration of dissolved solids as found in the recirculating cooling water. Large water droplets quickly settle out of the cooling tower exhaust stream and deposit near the tower. The remaining smaller water droplets may evaporate prior to being deposited in the area surrounding the cooling tower. These evaporated droplets represent potential $PM/PM_{10}/PM_{2.5}$ emissions because of the fine $PM/PM_{10}/PM_{2.5}$ formed by crystallization of the dissolved solids contained in the droplet.

The PM in the drift is primarily composed of the same substances as the tower water. The magnitude of the drift loss is influenced by the number and size of droplets produced within the tower (which are determined by the tower fill design), tower design, the air and water patterns, and design of the drift eliminators. Tampa Electric will use the most effective method of reducing the amount of drift from cooling towers by installing high-efficiency drift eliminators that will limit the drift loss rate to 0.0005 percent of the recirculating cooling water. Drift eliminators are designed to remove as many droplets as feasible before leaving the tower.

Controlled cooling tower annual PM, PM_{10}, and $PM_{2.5}$ emissions are estimated to be 0.35, 0.31, and 0.0021 ton per hour (tpy), respectively. Detailed emissions rate calculations are provided in the PSD permit application.

4.4.1.3 Emergency Diesel Generator

An emergency generator will be provided to supply power to essential service motor control centers during an interruption of electrical power supply to the Project. The 500-kilowatt emergency generator will fire ULSD fuel oil and will include advanced combustion modifications, including retard timing, to minimize NO_x emissions. Excluding operation during emergency conditions, the emergency generator will be operated for a maximum of 100 hr/yr for routine testing and maintenance. These controls, given the short and infrequent nature of operation, are considered BACT for this source.

4.4.2 AIR EMISSIONS CONTROLS

Project design will incorporate state-of-the-art CC technology and air quality emissions controls. The high thermal efficiency of the Project will reduce emissions per unit of output by producing each megawatt-hour of electricity with less fuel compared to conventional fossil-fuel power generation facilities. The use of natural gas, ULSD fuel oil, and good combustion controls will also minimize emissions of SO_2, H_2SO_4 mist, $PM/PM_{10}/PM_{2.5}$, and other fuel-bound contaminants. Combustion controls (dry low-NO_x burners, water injection) will minimize the formation of NO_x and the formation of CO and VOCs by combustor design. Further NO_x reduction will be achieved by use of an SCR system. The combination of these techniques for the Project has been proposed to represent BACT, considering economic, energy, and environmental impacts. The following subsection summarizes the air pollution control technology and BACT analysis, which is fully presented in the PSD permit application.

Table 4.4.2-1 presents a summary of Project air emissions controls. The use of low-sulfur, low-ash natural gas and fuel oil, along with highly efficient combustion, will also limit $PM/PM_{10}/PM_{2.5}$ emissions from the CTG/HRSG units. The CTG/HRSG units will be equipped with an SCR system to abate NO_x emissions. CO and VOC emissions from the CTG/HRSG units 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 emissions rates.

Table 4.4.2-1. Summary of Project Air Emissions Controls

	Pollutant	Control Method
CTG/HRSG Units	CO and VOC	Good combustion practice
	NO_x	Dry low-NO_x burners, SCR, water injection
	SO_2, H_2SO_4 mist	Pipeline-quality, low-sulfur natural gas; ULSD fuel oil
	$PM/PM_{10}/PM_{2.5}$	Good combustion practice
Cooling Tower	$PM/PM_{10}/PM_{2.5}$	High-efficiency drift eliminators
Emergency diesel engine	SO_2, H_2SO_4 mist	Exclusive use of ULSD fuel oil
	$PM/PM_{10}/PM_{2.5}$	Good combustion practice
	NO_x	Combustion controls
	CO and VOC	Good combustion practice

Sources: Black & Veatch, 2012.
Tampa Electric, 2012.
ECT, 2012.

The emergency diesel generator will combust ULSD fuel oil and (excluding emergencies) and will only operate for up to 100 hr/yr for routine testing and maintenance under normal operating circumstances. Finally, the use of high-efficiency drift eliminators to reduce recirculating water drift losses will control $PM/PM_{10}/PM_{2.5}$ emissions from the cooling tower. These air emissions control systems will result in relatively low emissions for the Project ancillary emissions units.

4.4.3 BEST AVAILABLE CONTROL TECHNOLOGY

The PSD air permitting regulations require detailed consideration of alternative means of emissions control on a pollutant-by-pollutant basis. The purpose of this control technology review process is to determine BACT. As defined by Rule 62-210.200(40) F.A.C., BACT represents an emissions 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 emissions limitations must be no less stringent than any applicable new source performance standards (NSPS) (40 CFR 60), National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 61 and 63), and state emissions standards (Chapter 62-296, F.A.C., Stationary Sources-Emissions Standards).

The Project is subject to BACT review for $PM/PM_{10}/PM_{2.5}$, SO_2, CO, VOC, NO_x, and H_2SO_4. A complete BACT evaluation is contained in the PSD permit application in Appendix 10.2.5 of this SCA. An abbreviated discussion of the BACT analysis is provided in the following subsections. As indicated in the PSD application, Project air emissions controls will fully comply with all applicable state and federal regulations. Specific design concepts are summarized as follows:

- Application of BACT for all affected pollutants and emissions sources.
- Use of low-sulfur fuels.
- Use of SCR to reduce NO_x emissions.
- Use of efficient combustion to minimize emissions of pollutants associated with incomplete combustion.

The Project's CC technology is among the most efficient processes available to generate electrical power. On a total power production basis, air emissions are minimized by using technology that produces the most power for each unit of fuel consumed at near complete combustion.

4.4.3.1 Methodology

As described in the PSD permit application, BACT analyses were performed in accordance with the EPA top-down method. A top-down BACT analysis involves the following steps for each pollutant:

- Identify all potential control technologies.
- Eliminate technically infeasible control options.
- Rank the remaining control technologies by control effectiveness.
- Evaluate the control technologies, starting with the most effective for:
    - Economic impacts.
    - Energy impacts.
    - Environmental impacts.
- Select BACT.

The top-down process ranks all available control technologies in descending order of control effectiveness. The PSD applicant first examines the most stringent or "top" alternative. That alternative is established as BACT unless the applicant demonstrates, and the permitting authority in its informed judgment agrees, that technical considerations or energy, environmental, or economic impacts justify a conclusion that the most stringent technology is not achievable in that particular case. Available control options are those air pollution control technologies or techniques with a practical potential for application to the emissions unit and the regulated pollutant under evaluation.

Evaluation of process alternatives that would involve completely redefining the design of the proposed process are not required to be considered in a BACT analysis. Control technology analyses using the five-step top-down BACT method were prepared for combustion products and products of incomplete combustion, respectively.

4.4.3.2 Summary of BACT Determinations

Proposed BACT emissions limitations for the Project emissions units are summarized in the following paragraphs.

NO_x

Dry low-NO_x combustor technology was previously installed on the existing simple cycle Units 2 through 5 to reduce NO_x emissions by inhibiting thermal NO_x

formation by premixing fuel and air prior to combustion to reduce flame temperatures. The General Electric (GE) PG7241FA dry low-NO_x CTG achieves NO_x emissions of 9.0 parts per million by volume dry (ppmvd) corrected to 15-percent oxygen when firing natural gas. To reduce emissions of NO_x when firing ULSD fuel oil, water is premixed with the fuel oil and air prior to combustion to reduce flame temperatures. When firing ULSD fuel oil, the GE PG7241FA simple cycle CTGs achieve NO_x emissions of 42.0 ppmvd corrected to 15-percent oxygen.

To further reduce emissions of NO_x during CC mode operations, a postcombustion SCR system will be installed within the HRSGs. The SCR system is designed for reduction of flue gas NO_x emissions to 2.0 ppmvd at 15-percent oxygen when operating with natural gas fuel and 8.0 ppmvd at 15-percent oxygen when operating with ULSD fuel oil.

Ammonia will be required for use in the SCR. Vaporized ammonia is injected into the CTG exhaust gases prior to passage through the catalyst bed, which is installed in the HRSG. The onsite ammonia system will include unloading facilities, anhydrous ammonia storage tanks, forwarding system, and vaporizing facilities. Anhydrous ammonia will be used and delivered to the site by tanker trucks that include integral unloading pumps. The anhydrous ammonia (99-percent solution) will be stored as a liquid in two nominal 22,000-gallon tanks each large enough for one full tanker truck delivery. The liquid ammonia will be vaporized at the storage tanks, forwarded to the HRSGs, and injected upstream of the catalyst.

CO and VOCs

The CTG will use good combustion control to minimize CO and VOC emissions. Proposed CO and VOC emissions rates are consistent with those recently established as BACT for similar CC projects.

SO_2, H_2SO_4 Mist, and PM/PM_{10}/$PM_{2.5}$

Clean-burning fuels (i.e., natural gas and ULSD fuel oil) having low PM, sulfur, and trace contaminant contents are proposed as BACT. PM emissions will also be emitted from the mechanical draft cooling tower in the form of drift. Cooling tower drift will be controlled through the use of high-efficiency mist eliminators designed to limit drift to 0.0005 percent of the auxiliary cooling water flow rate of the cooling tower.

4.4.4 DESIGN DATA FOR CONTROL EQUIPMENT

Control of air emissions from the Project will be accomplished by the use of clean fuels, good combustion controls, and SCR control technology. Section 4.3 of this SCA provides process descriptions, fuel specifications, and emissions rates.

4.4.5 DESIGN PHILOSOPHY

Air emissions controls planned for the Project have been designed to fully comply with applicable state and federal regulations and minimize emissions by using efficient generating and pollution prevention technologies.

CC plants can be expected to achieve fuel conversion rates on the order of 7,000 British thermal units per kilowatt-hours (Btu/kWh), as opposed to values in the 9,000- to 10,000-Btu/kWh range for more conventional generating plants. This is an improvement of approximately 30 percent. Thus, by maximizing the megawatt output per unit of fuel consumed, the air pollutant emissions per megawatt output are minimized. Pollution prevention is incorporated in the design by the use of clean fuels, efficient combustion technology, and postcombustion control. Natural gas will be used as the primary fuel, with ULSD fuel oil used as a backup fuel for the CTGs and as the sole fuel for the emergency generator diesel engine. Dry low-NO_x combustion and water injection technologies will minimize NO_x emissions during the CTG combustion process, while ensuring that CO and VOC emissions are within accepted limits. SCR will be installed postcombustion to further reduce NO_x emissions.

Air emissions control technologies planned for the Project reflect the application of BACT for each affected pollutant and emissions source. The proposed BACT limitations are well below applicable state and federal emissions standards (e.g., NSPS).

4.5 PLANT WATER USE

The primary water uses for the Project will include steam cycle makeup, cooling reservoir makeup, condenser and auxiliary cooling water, NO_x injection water, cooling tower makeup, and plant drains. The proposed Project water systems will be designed to:

- Maximize water reuse and recycling.
- Maximize the use of reclaimed water.
- Minimize groundwater withdrawals.

- Minimize water consumption.
- Manage the water quality within the plant systems and in any potential offsite surface water and groundwater discharges.

Figure 4.5.0-1 presents the overall water balance diagrams for PPS, including the proposed Project, under annual average conditions based on anticipated load plant operations and normal meteorological conditions (i.e., long-term average rainfall and temperatures). Figure 4.5.0-2 presents the overall water balance under peak monthly daily makeup conditions based on anticipated plant operations during the hottest month of the year (i.e., normally July). The Project water use plans and systems will be integrated with the existing PPS water systems to the extent possible to maximize wastewater recycling/reuse and minimize consumptive use.

The existing cooling water reservoir will be used for heat dissipation/condenser water cooling and fire water supply purposes for the Project and existing Unit 1. As shown in Figures 4.5.0-1 and 4.5.0-2, the largest water use will be makeup water to the reservoir to replace water lost through evaporation in the cooling process. The total cooling reservoir makeup water needs from all sources for the proposed Project and Unit 1 operations will be approximately 9.4 MGD on an annual average basis and approximately 11.6 MGD on a peak month daily basis.

Currently, cooling reservoir makeup water for Unit 1 operations is primarily provided by groundwater withdrawn from onsite wells. Other sources of the reservoir makeup water include direct rainfall, groundwater seepage, treated runoff from plant areas associated with industrial activities, and certain treated process wastewaters. To minimize the use of groundwater for the proposed Project as well as for Unit 1, Tampa Electric is currently implementing the reclaimed water project to treat and use reclaimed water, to the extent available, as makeup water for the cooling reservoir and new cooling tower at PPS. As shown in Figure 4.5.0-1, for the proposed Project, treated reclaimed water will supply approximately 3.7 MGD of the annual average cooling reservoir makeup water needs, and groundwater will supply approximately 2.1 MGD of the needs.

As shown in Figures 4.5.0-1 and 4.5.0-2, in addition to evaporation from the reservoir, the second-largest water use will be makeup water to replace water lost through evaporation in the new mechanical draft cooling tower and blowdown to manage water quality in the cooling system. The cooling tower will be used to dissipate heat from the proposed Project CTG and STG auxiliaries in addition to Unit 1 auxiliary equipment, which currently use the cooling reservoir for heat

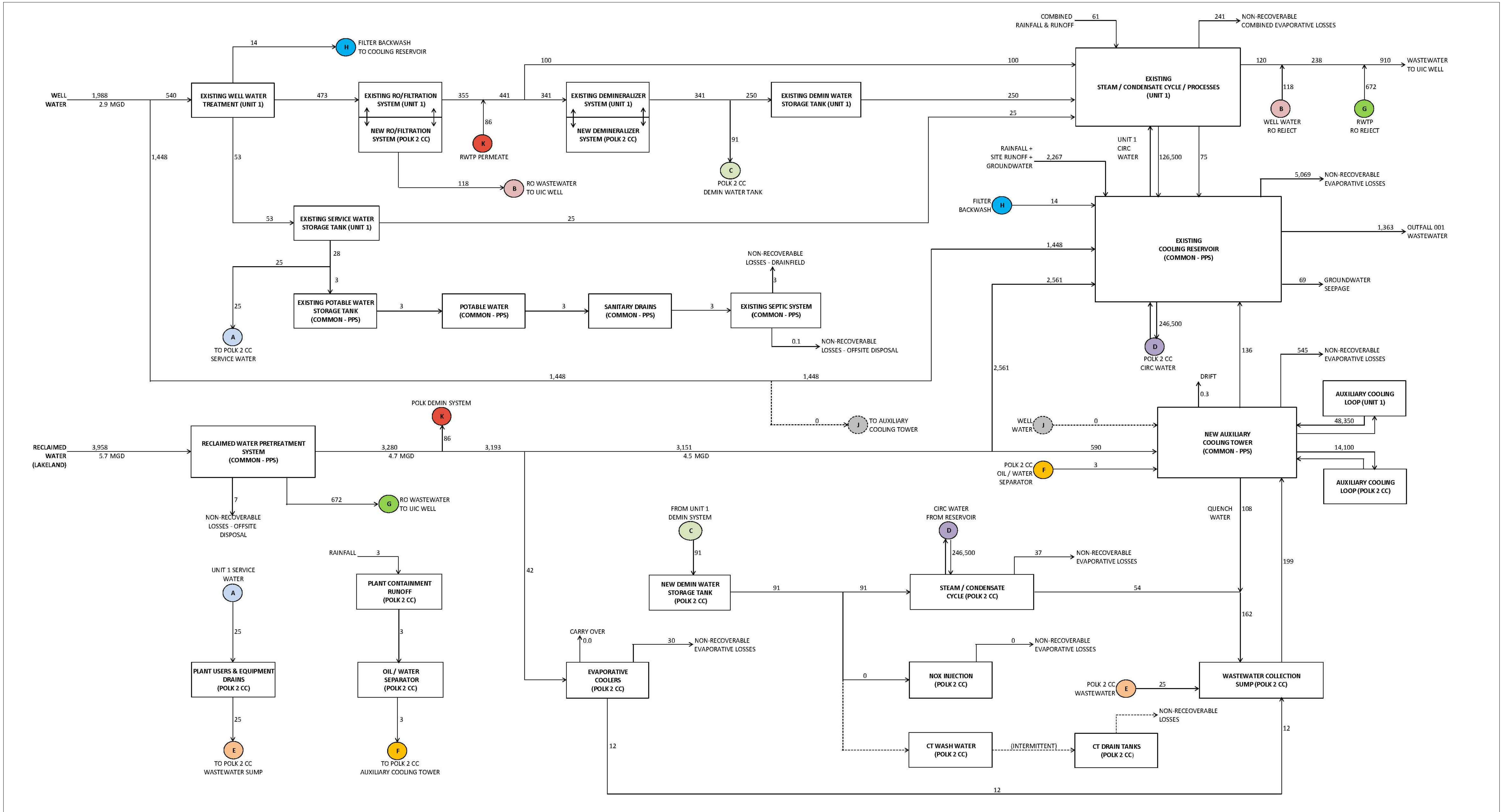

FIGURE 4.5.0-1.

WATER MASS BALANCE FOR
ANNUAL AVERAGE CONDITIONS

Source: Black & Veatch, 2012; ECT, 2012.

NOTES:

1. FLOWS ARE IN GALLONS PER MINUTE.
2. FLOWS ARE BASED ON ANNUAL AVERAGE WATER USE.
3. DASHED LINES REPRESENT INTERMITTENT FLOWS.

HEAT BALANCE CASE	AVERAGE	CASE 1
DUCT FIRING	OFF	
COMBUSTION TURBINE NOX INJECTION	OFF	
COMBUSTION TURBINE EVAP COOLER	ON	
COMBUSTION TURBINE FUEL	NATURAL GAS	
AMBIENT TEMP (F) / REL HUMIDITY	73	76%
TURBINE CONFIGURATION	4 X 100%	
POLK 2 CC CYCLE MAKEUP RATE	2%	

TOTAL PLANT LAKELAND RWTP RECLAIMED WATER COMSUMPTION	5.7 MGD
TOTAL PLANT WELL WATER CONSUMPTION	2.9 MGD
TOTAL PLANT WASTEWATER DISCHARGE TO OUTFALL	2.0 MGD
TOTAL PLANT WASTEWATER DISCHARGE TO UIC WELL	1.3 MGD
AUXILIARY COOLING TOWER EVAPORATION RATE	545 GPM
AUXILIARY COOLING TOWER CYCLES OF CONCENTRATION	5 COC
AUXILIARY COOLING TOWER DRIFT (% OF CW RATE)	0.0005%
COOLING RESERVOIR EVAPORATION RATE	5,069 GPM

TECO
TAMPA ELECTRIC

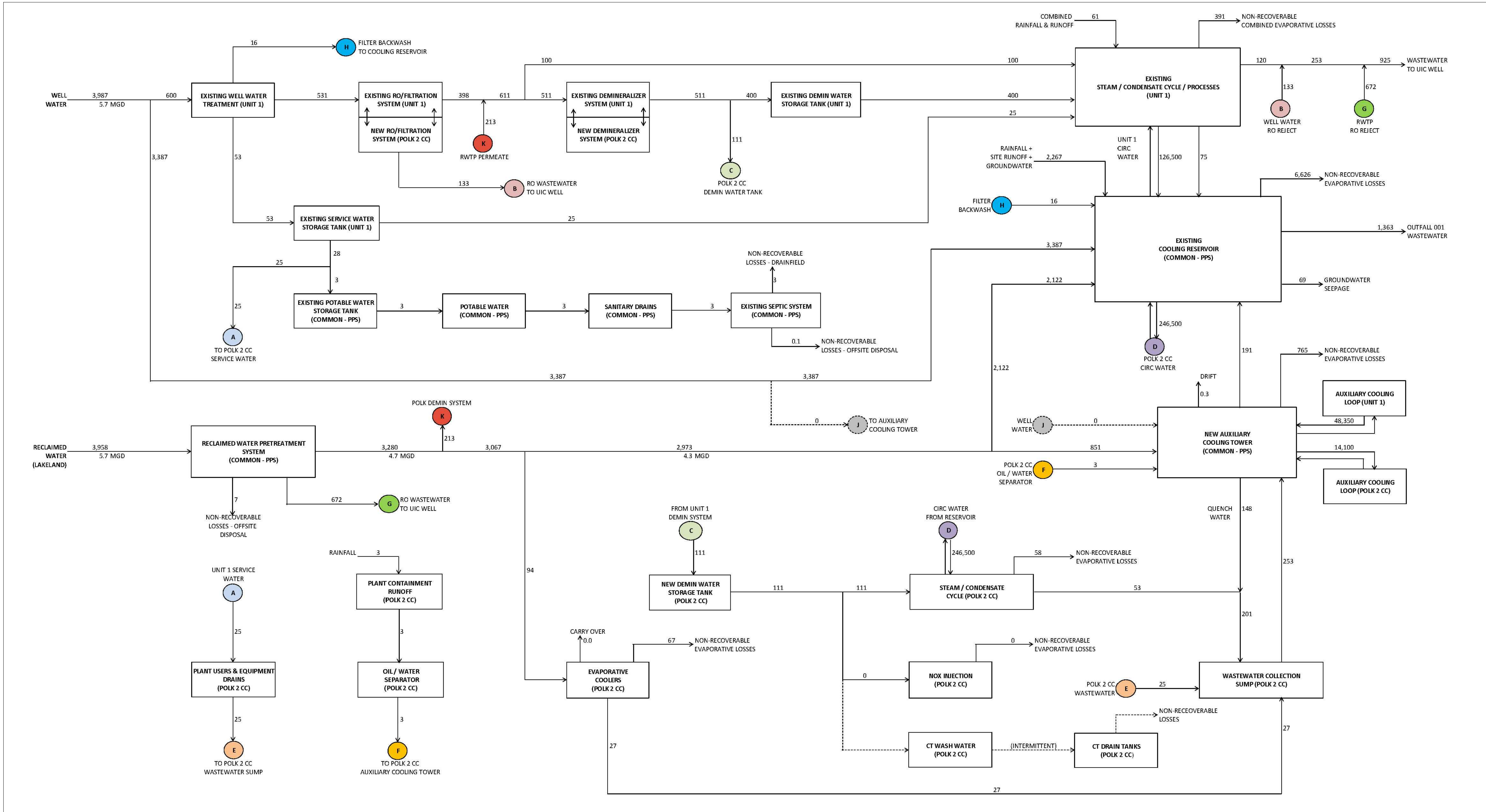

FIGURE 4.5.0-2.

WATER MASS BALANCE
FOR PEAK MONTH DAILY CONDITIONS

Source: Black & Veatch, 2012; ECT, 2012.

NOTES:

1. FLOWS ARE IN GALLONS PER MINUTE.
2. FLOWS ARE BASED ON PEAK MONTH WATER USE.
3. DASHED LINES REPRESENT INTERMITTENT FLOWS.

HEAT BALANCE CASE	PEAK CASE 2	TOTAL PLANT LAKELAND RWTP RECLAIMED WATER COMSUMPTION	5.7 MGD
DUCT FIRING	ON	TOTAL PLANT WELL WATER CONSUMPTION	5.7 MGD
COMBUSTION TURBINE NOX INJECTION	OFF	TOTAL PLANT WASTEWATER DISCHARGE TO OUTFALL	2.0 MGD
COMBUSTION TURBINE EVAP COOLER	ON	TOTAL PLANT WASTEWATER DISCHARGE TO UIC WELL	1.3 MGD
COMBUSTION TURBINE FUEL	NATURAL GAS	AUXILIARY COOLING TOWER EVAPORATION RATE	765 GPM
AMBIENT TEMP (F) / REL HUMIDITY	90 57%	AUXILIARY COOLING TOWER CYCLES OF CONCENTRATION	5 COC
TURBINE CONFIGURATION	4 X 100%	AUXILIARY COOLING TOWER DRIFT (% OF CW RATE)	0.0005%
POLK 2 CC CYCLE MAKEUP RATE	2%	COOLING RESERVOIR EVAPORATION RATE	6,626 GPM

TECO
TAMPA ELECTRIC

dissipation. Makeup water for the cooling tower will be supplied primarily by treated reclaimed water. Some groundwater will also be used for cooling tower makeup, as needed, to supplement treated reclaimed water or during unanticipated events, such as interruption in the reclaimed water supply or unavailability of the reclaimed water treatment facilities. As shown in Figures 4.5.0-1 and 4.5.0-2, cooling tower makeup water requirements, depending on cycles of concentration, will be approximately 0.9 MGD on an annual average basis and approximately 1.2 MGD on a peak month daily basis. Also, based on the proposed water use plan, blowdown from the new cooling tower will be discharged to the cooling reservoir as supplemental makeup water.

The current COCs and NPDES permit for PPS allow for offsite blowdown discharges from the cooling reservoir to manage water quality conditions and operating water levels in the reservoir.

As shown in Figures 4.5.0-1 and 4.5.0-2, in addition to cooling makeup water needs, the proposed Project and Unit 1 will require the use of groundwater for plant processes and systems requiring higher quality water, such as steam cycle HRSG makeup, plant service water, and potable water. Some treated reclaimed water will also be used to meet process water needs. Wastewaters from the proposed and existing operations will be appropriately treated and reused within the PPS process water systems, to the extent possible, to minimize groundwater use. Groundwater for these uses will be supplied by withdrawals from the Floridan aquifer through the four existing onsite wells. As shown in Figures 4.5.0-1 and 4.5.0-2, under normal operating conditions, the total groundwater withdrawals required to supply the process water needs for Unit 1 and the proposed Project will be approximately 2.9 MGD on an annual average basis and approximately 5.7 MGD on a peak month daily basis.

Under the current COC XXVI.A.14 from SWFWMD for PPS, Tampa Electric is authorized to withdraw from the Upper Floridan aquifer the amounts of water, subject to the additional provisions of COC XXVI.A.27, presented in Table 4.5.0-1.

Table 4.5.0-1. Authorized Groundwater Withdrawals Under COC XXVI.A.14

	Annual Average (MGD)	Peak Month (MGD)
Polk Unit 1	5.24	7.4
PPS buildout	6.4	9.22

Source: ECT, 2012.

In the COCs, PPS buildout is considered to be the development of additional generating units to reach the 1,150-MW nominal net ultimate site capacity. Appendix 10.6.1 of this SCA provides a copy of the current COCs for PPS.

Tampa Electric's authorized groundwater withdrawals under SWFWMD COC XXVI.A.14 are also subject to the provisions of COC XXVI.A.27. This COC limits withdrawals for Unit 1 and buildout to the amounts shown in Table 4.5.0-2 until Tampa Electric satisfies other specific provisions in the COC.

Table 4.5.0-2. Authorized Groundwater Withdrawal Limits Under COC XXVI.A.27

	Annual Average (MGD)	Peak Month (MGD)
Polk Unit 1	3.14	5.8
PPS buildout	4.3	7.6

Source: ECT, 2012.

Prior to withdrawals in excess of these amounts, Tampa Electric must conduct a detailed study of the technical and economic feasibility of treating and reusing 2.1 MGD for the Unit 1 operations or 1.6 MGD for buildout operation of the cooling reservoir blowdown discharges. In addition, the study must address the feasibility of reuse of treated wastewater from publicly owned sewage treatment facilities and other sources. The study would be submitted to SWFWMD, and the SWFWMD Governing Board would determine whether or not the treatment and use of these wastewaters is economically feasible. If the Governing Board determines that treatment of the blowdown is economically infeasible, the authorized withdrawals for Polk Unit 1 and full buildout would be those amounts shown in Table 4.5.0-1. If the Governing Board determines treatment of the blowdown is economically feasible, the authorized withdrawals would be limited to those amounts shown in Table 4.5.0-2.

For Polk Unit 1 and the subsequent additions of Units 2 through 5, Tampa Electric did not prepare the feasibility study to potentially obtain SWFWMD approval of withdrawal amounts beyond those authorized under COC XXVI.A.27. Therefore, the currently authorized withdrawal amounts for PPS are 3.14 MGD on an annual average basis and 5.8 MGD on a peak monthly basis for Polk Unit 1 and 4.3 MGD on an annual average and 7.6 MGD on a peak month daily basis for PPS buildout.

The addition of the proposed Project will increase the total nominal net generating capacity at PPS to approximately 1,420 MW. This is approximately 23 percent higher than the currently certified nominal net ultimate site capacity of 1,150 MW, which was considered to be buildout of PPS for the groundwater withdrawal allocations in the current SWFWMD COCs.

As shown in Figures 4.5.0-1 and 4.5.0-2, the projected total groundwater withdrawals for PPS with the proposed Polk 2-5 Conversion Project will be approximately 2.9 MGD on an annual average basis and approximately 5.7 MGD on a peak month daily basis. These amounts are less than the currently authorized groundwater withdrawal amounts of 4.3 MGD on an annual average basis and 7.6 MGD on a peak month daily basis for PPS buildout under COC XXVI.A.27. Tampa Electric will be able to achieve these lower proposed withdrawal amounts primarily by the treatment and use of approximately 5.7 MGD of reclaimed water from the City of Lakeland under a partnership with SWFWMD and the City. The treated reclaimed water will primarily be used to supply the makeup water needs of the new cooling tower, a significant portion of the makeup water needs of the cooling reservoir, and a small portion of the PPS process water needs. Other aspects of Tampa Electric’s proposed water use plan with the proposed Project to minimize the use of groundwater include the reuse of certain treated wastewaters and stormwater and cooling tower blowdown for cooling reservoir makeup water.

The proposed water use plan and amounts in Figures 4.5.0-1 and 4.5.0-2 reflect the groundwater needed to supply the water requirements of the units under normal operating conditions (i.e., continuous availability of reclaimed water at suitable quality and quantities from the City of Lakeland, long-term annual average rainfall conditions, and expected suitable water quality conditions in the reservoir with use of the treated reclaimed water as makeup). The higher authorized groundwater withdrawal amounts of 4.3 MGD on an annual average basis and 7.6 MGD on a peak month daily basis are required by Tampa Electric to reliably and safely operate the power plant and associated cooling reservoir and cooling tower at PPS during unanticipated events or conditions and emergencies, as well as during extended periods of extremely low rainfall.

For example, in the event of an interruption in the availability of reclaimed water from the City of Lakeland, additional groundwater from the existing onsite wells may be required for cooling tower makeup and to maintain reliable operating water levels in the cooling reservoir. It is anticipated that any such interruptions will be relatively short in duration. Based on the authorized withdrawal amounts, Tampa Electric will be able to provide, as may be periodically needed, additional groundwater makeup to the cooling tower and reservoir to maintain reliable water level conditions during short-term reclaimed water interruptions. In the unlikely event that an interruption in the reclaimed water supply lasts for an extended period, Tampa Electric will require authorization to withdraw, on a standby basis, sufficient groundwater to supply up to the full makeup water needs for the cooling tower and cooling reservoir, in addition to the process water needs. Under such standby events, the total groundwater withdrawals will be up to approximately 10.4 MGD on a peak daily basis.

Other unanticipated events that may require that additional groundwater be supplied to the cooling reservoir would be the unavailability of the reclaimed water treatment facilities or the deep well injection system for disposal of the RO reject wastewater from the treatment process. Under such events or upsets, poorer quality, untreated reclaimed water or the reject wastewater will need to be discharged to the reservoir to maintain power plant operations. Again, it is anticipated that such events would be of relatively short duration. However, the discharge of this poorer quality water to the reservoir will require the ability to supplement the makeup to the reservoir with higher quality groundwater to maintain suitable water quality conditions in the reservoir. The use of additional groundwater for reservoir makeup may, in all likelihood, be required for a longer duration than just the period of the system’s unavailability in order to restore suitable water quality conditions in the reservoir. The authorized groundwater use amounts are needed to provide Tampa Electric the ability and flexibility to reliably and safely operate the PPS and minimize potential adverse environmental impacts to onsite and offsite water resources.

Table 4.5.0-3 presents the estimated water quality of the reclaimed water supply from the City of Lakeland and the groundwater supply from the existing onsite wells, as well as the existing quality of water in the cooling reservoir. The table also presents the projected quality of the cooling tower blowdown and the cooling reservoir discharge at Outfall D-001.

4.5.1 HEAT DISSIPATION SYSTEM

4.5.1.1 System Design

The heat dissipation system will consist of the existing cooling water reservoir and a new mechanical draft cooling tower. Both the cooling reservoir and cooling tower are described in this subsection. Cooling water from the reservoir will be used for condensing and cooling the STG exhaust for both Unit 1 and the proposed Project STGs. For the proposed Project, the auxiliary equipment will use the new cooling tower to dissipate the heat. In addition, the auxiliary cooling system for existing Polk Unit 1 will be modified to remove all auxiliary cooling loads from the cooling reservoir and place that load on the new cooling tower. This will reduce heat load to the cooling reservoir and keep the reservoir temperature within an acceptable range. The proposed cooling system will be designed to meet the following objectives:

- The cooling system will have the capacity to reject a maximum of 2,686 million British thermal units per hour (MMBtu/hr) of thermal energy from the Project on a continuous basis.
- The cooling system will be able to supply cooling water to Unit 1 and proposed Project condenser with water temperature less than 97ºF under worst-case conditions (100-percent load factor on the hottest day) and less than 92ºF under most other conditions.
- The turbine backpressure will not exceed supplier requirements.

The proposed cooling system, compared with alternatives, will have the least environmental impacts, considering surface water hydrology and quality, groundwater hydrology and quality, water consumption, and ecological impacts.

Table 4.5.0-3. Water Quality of Source Water and Projected Water Quality of Key Process Water Streams into and Discharge from Cooling Reservoir

Parameter	Unit	Raw Water from Onsite Wells*	Projected Treated Reclaimed Water†	Projected Cooling Tower Blowdown to Cooling Reservoir	Cooling Reservoir Water Analysis 03/14/12	Unit 1 Process Blowdown to Cooling Reservoir‡	Projected Cooling Reservoir Discharge at Outfall D-001
Aluminum	mg/L	0.01	5.13E-06	0.002	0.286	0.499	0.038
Antimony	mg/L	0.0004	***9.23E-06***	0.0001	0.00176	0.006	0.0008
Arsenic	mg/L	0.0006	9.15E-06	0.0002	0.00687	0.22	0.0126
Barium	mg/L	0.027	8.65E-05	0.005	0.0125	0.347	0.047
Beryllium	mg/L	0.000072	***2.05E-06***	0	0.00004	0.00004	0.00008
Boron	mg/L	0.018	0.71	3.32	2.18	1.37	1.74
Cadmium	mg/L	0.000097	***8.21E-07***	0	0.0001	0.001	0.00016
Calcium	mg/L	52	4.28	29.5	77.2	67.7	68
Chromium, total	mg/L	0.00042	0.00017	0.0009	0.00765	0.01	0.001
Copper	mg/L	0.0011	***7.67E-05***	0.0006	0.00142	0.044	0.0037
Iron	mg/L	0.13	0.04	0.21	0.0283	0.76	0.27
Lead	mg/L	0.00019	***3.28E-07***	0.0001	0.000202	0.0008	0.0002
Magnesium	mg/L	17	1.38	9.5	40	29.2	22.4
Manganese	mg/L	0.0026	0.00135	0.0068	0.00361	1.55	0.09
Mercury	mg/L	2.0E-07	***2.56E-06***	0	0.00005	9.27E-06	6.63E-06
Molybdenum	mg/L	0.001	0.00005	0.0004	0.0109	0.01	0.0014
Nickel	mg/L	0.00021	0.00019	0.0009	0.0212	0.0247	0.002
Potassium	mg/L	0.8	7.28	34	2.92	1.32	18
Selenium	mg/L	0.0004	1.05E-05	0.0001	0.00347	0.005	0.0007
Silver	mg/L	0.00009	***5.13E-07***	0	0.00002	0.0002	0.0001
Sodium	mg/L	9.47	32.31	152.1	98.7	9.2	84.9
Strontium	mg/L	0.002	0.018	0.085	2.43	0.05	0.047
Thallium	mg/L	0.0005	3.72E-06	0.0001	0.000126	0.001	0.0006
Vanadium	mg/L	0.0025	5.13E-05	0.0007	0.0119	0.04	0.005
Zinc	mg/L	0.0037	4.67E-04	0.0029	0.01	0.1	0.01
Chloride	mg/L	10	62.62	293.2	125	29	156.5
Sulfate	mg/L	65	4.44	32.6	229	46	80.3
Nitrate	mg/L	0.1	0.02	0.1	0.01	2.51	0.28
Ammonia-nitrogen	mg/L	0.21	—	—	0.01	—	—
Silica	mg/L	7.5	0.6	4	2.53	1.3	7.9
TDS	mg/L	306	107	552	626	123	650
Conductivity	µmhos/cm	423	187	947	1040	205	999
Total M-alkalinity	mg/L	160	2	41	177	0.1	172
Total hardness	ppm as $CaCO_3$	200	13.3	99	358	289	262
pH	s.u.	7.0 to 7.7	4.0 to 5.0	7.0 to 9.0	6 to 9	7.0 to 9.0	7.0 to 9.0
TSS	mg/L	—	0	<0.1	8	1	<1
Temperature	°F	75	40 to 90	85 to 95	65 to 93	65 to 93	85 to 94

Note: — = not modeled.
°F = degree Fahrenheit.
µmhos/cm = micromhos per centimeter.
$CaCO_3$ = calcium carbonate.
mg/L = milligram per liter.
ppm = part per million.
s.u. = standard unit.
TSS = total suspended solid.
Bold italics indicates minimum detection limit.

*Well water analysis taken from SCA Table 4.5-3.
†Treated reclaimed water projected RO permeate calculated from known AECOM schematic recovery rates.
‡Heavy metals (except mercury) provided by August 28, 2012, sampling data. All remaining constituents from weighted average of blended Unit 1 process streams.

Source: Black & Veatch, 2012.

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

- Heat-rejection system consisting of a 755-acre (water surface area at 136 ft-NGVD) recirculating cooling reservoir and a six-cell mechanical draft cooling tower of fiberglass construction.
- Flow rates of the reservoir recirculating cooling water of approximately 126,500 gpm for Unit 1 and approximately 246,500 gpm for the proposed Project.
- Flow rate of the cooling tower recirculating water of approximately 62,450 gpm.
- Maximum temperature rise across the condenser of approximately 21ºF.
- Maximum recycling/reuse of process wastewaters.
- Treated reclaimed wastewater provided to the reservoir and auxiliary cooling tower to compensate for the net evaporation losses to minimize groundwater use.

Cooling Reservoir

The layout of the cooling reservoir that was installed with Polk Unit 1 is shown in Figure 4.2.0-1. This reservoir will be used for the proposed Project condenser cooling as well. The reservoir is a below-grade basin constructed in phosphate mine cuts and overburden spoil piles. Materials from the mine cuts were used to construct low-profile perimeter berms surrounding the reservoir when Unit 1 was constructed. As shown in the figure, to maximize the heat dissipation efficiency of the cooling reservoir, interior berms were 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 maximum depth of the reservoir is at an elevation of approximately 120 ft-NGVD. The top of the perimeter berm has a width of 25 ft and is at approximately 145 ft-NGVD in elevation.

The slopes on both sides of the interior and exterior berms are four-to-one (4-ft horizontal to 1-ft vertical). The berms have been grassed to prevent erosion. The size of the reservoir is approximately 755 acres of water surface when the water elevation is at 136 ft-NGVD, the designed operating level elevation. Figure 4.5.1-1 shows a typical cross-section of the reservoir.

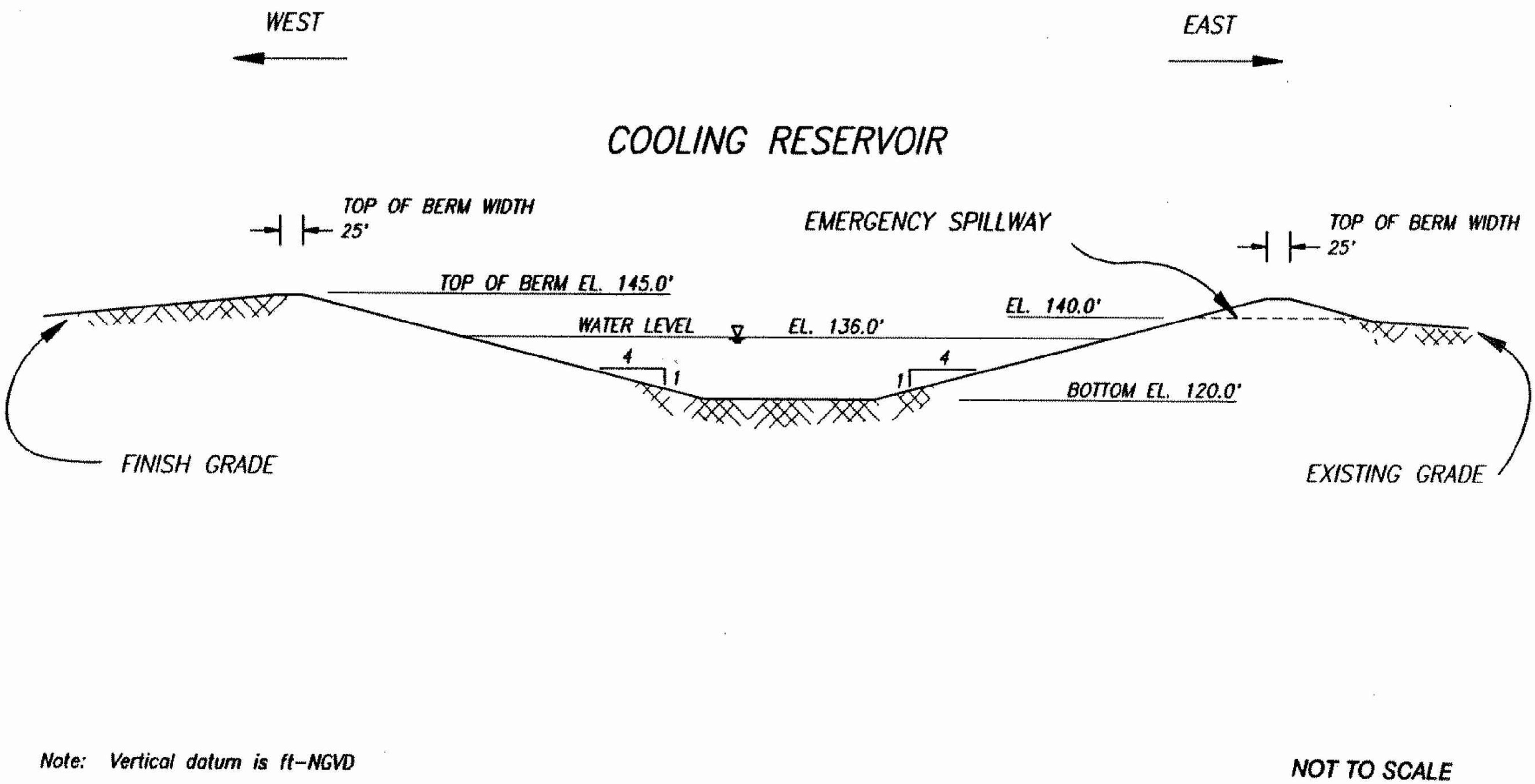

FIGURE 4.5.1-1.
TYPICAL CROSS-SECTION OF COOLING RESERVOIR

Source: ECT, 2012.

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A cooling water intake structure, which is used to supply cooling water to the condenser cooling systems of the STG systems, was installed with Unit 1 and is located in the northern portion of the reservoir. This structure will be expanded for the proposed Project and will be similar to the existing structure (see Figure 4.5.1-2). The intake structure draws water from the reservoir through a series of screens to prevent debris from clogging the pumps and condenser tubes. The proposed expanded intake structure will contain two pumps for the Unit 1 condenser with a total capacity of 129,000 gpm (two at 50 percent), two pumps for the Project condensers with a total capacity of 250,000 gpm (two at 50 percent), and three firewater pumps for PPS and the proposed Project fire loops (three at 50 percent) at 3,000 gpm each. The three existing Unit 1 auxiliary cooling water pumps with a total capacity of 50,000 gpm (three at 50 percent) will normally not be used, but will remain installed as a Unit 1 backup cooling water source during periods of auxiliary cooling tower maintenance and the proposed Project unit is offline. The intake water will be treated with sodium hypochlorite to prevent biofouling.

The reservoir cooling water will be warmed to approximately 21°F above its intake temperature during the heat rejection process to condense the STG exhaust steam of Unit 1 and the Project. This warmed water will be discharged into the reservoir at a location south of the intake. The existing discharge structure will also be expanded for the proposed Project and will be similar to the existing structure (see Figure 4.5.1-3). The discharge flow will travel 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, much of the 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 in the recirculation cooling system. With a total cooling water discharge to the reservoir of 376,500 gpm with the proposed Project and a reservoir volume of 3.5 billion gallons, the travel time through the reservoir (residence time) will be approximately 6.5 days.

To maintain the water quality in the reservoir in compliance with Florida surface and groundwater standards, the reservoir includes a discharge control structure (Outfall D-001) for blowdown discharges from the reservoir to an unnamed reclaimed lake in a drainage system leading to the Little Payne Creek. These discharges are needed to prevent trace metals, solids, and other potential constituents from accumulating in the reservoir and control cooling reservoir level during

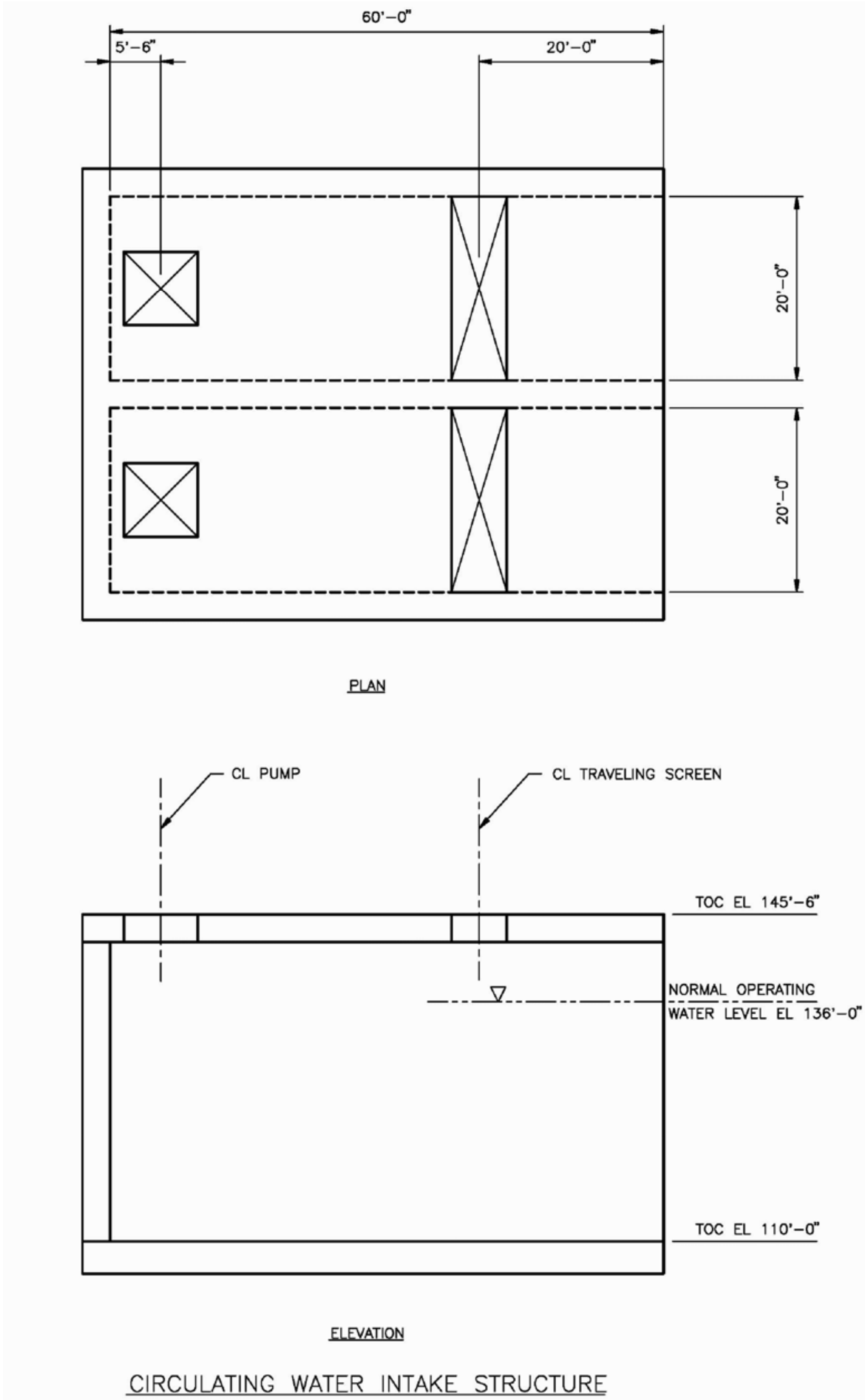

FIGURE 4.5.1-2.

CIRCULATING WATER INTAKE STRUCTURE

Source: Black & Veatch, 2012.

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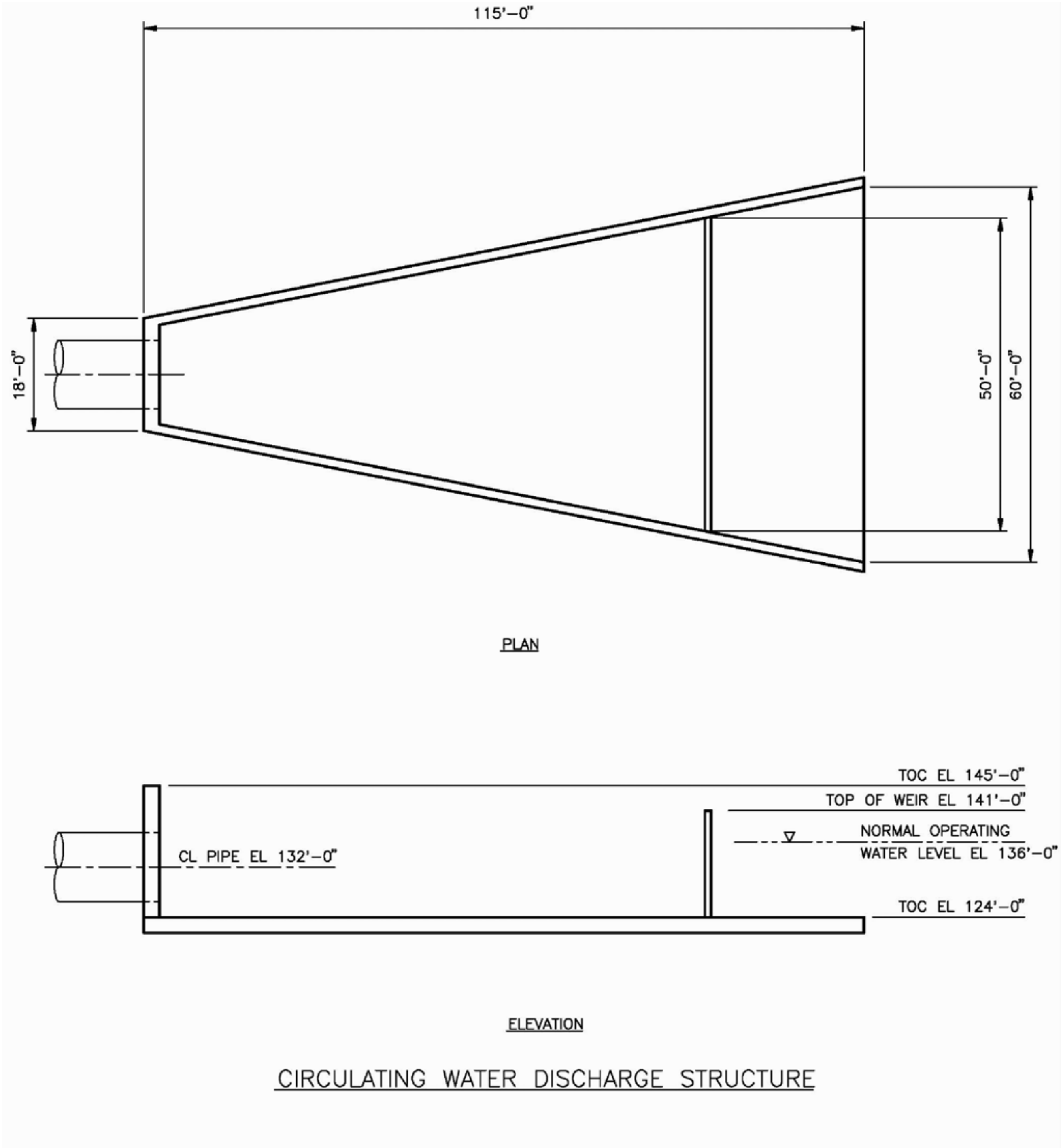

FIGURE 4.5.1-3.

CIRCULATING WATER DISCHARGE STRUCTURE

Source: Black & Veatch, 2012.

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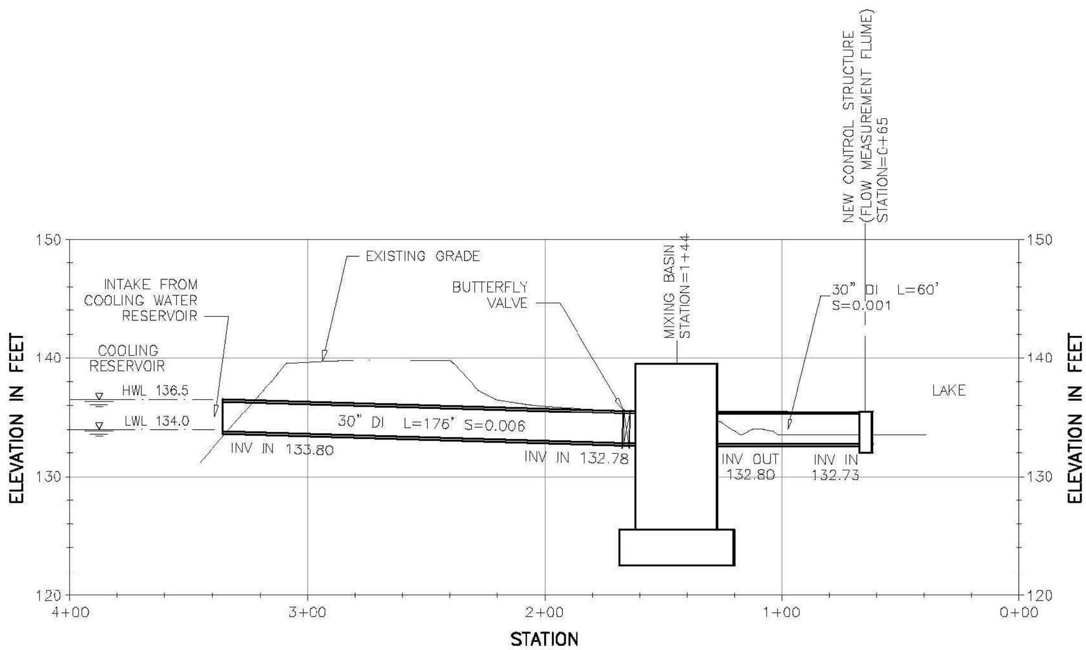
extreme storms. Under normal operating conditions with the addition of the proposed Project and modifications to the Unit 1 auxiliary cooling systems, it is anticipated that there will typically be approximately 2.0 MGD blowdown discharge from the cooling reservoir to the Little Payne Creek system under normal operating conditions.

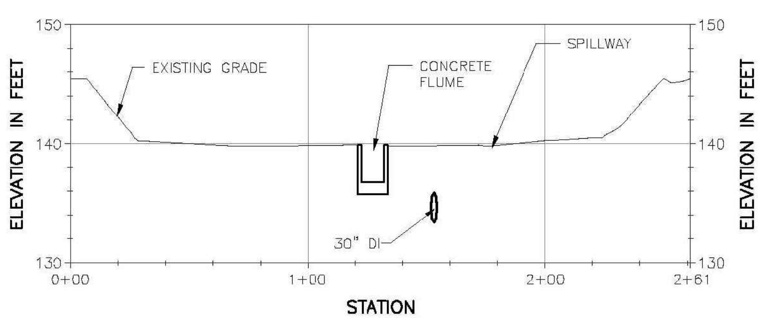
In addition to the discharge pipe, the blowdown discharge control structure for the reservoir (Outfall D-001) includes a 10-ft-wide rectangular emergency concrete flume that was installed with Unit 1 to provide for drainage control during extreme storm events (see Figure 4.5.1-4). A 200-ft-wide emergency spillway was also installed to ensure berm safety in the event of extreme weather conditions. The normal operating water level in the reservoir will be controlled at approximately 136 ft-NGVD. The water level fluctuation will be approximately +0.5 ft. The overflow elevation of the 10-ft-wide stormwater management flume is 136.6 ft-NGVD, and the emergency spillway is at an elevation of approximately 140 ft-NGVD. Figure 4.5.1-4 presents the design of the outfall control structure. This structure is designed to allow stormwater 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 was designed to control stormwater runoff discharges to meet the applicable requirements to manage peak and mass flow runoff discharges compared to premining conditions.

The discharge control structure (Outfall D-001) is located at the northeast corner of the cooling reservoir, and discharged water will drain into the northern portion of the existing unnamed reclaimed lake to the east of the reservoir on the Site (see Figure 4.2.0-1). Water in the lake drains through a swale along its southern edge and exits the Site, flowing into a manmade ditch running along the western side of Fort Green Road. This water is ultimately routed to Little Payne Creek. As shown in Figure 4.5.1-4, the blowdown structure will be an orifice (i.e., pipe) with an invert elevation of approximately 133.8 ft-NGVD. The size of this pipe will be increased from 10 to 30 inches as part of the reclaimed water treatment and use project at PPS. The new pipe structure will also include a butterfly valve to control the discharge flow and a flow measurement flume. The increased pipe size will be needed to accommodate higher discharge flows of tentatively up to 5 to 8 MGD for future phases of the reclaimed water project as increasing amounts of reclaimed water become available from the City of Lakeland and other sources. These increased discharge flow rates were addressed as part of the SCA Modification N and NPDES permit modification processes for the reclaimed water treatment facilities at PPS. Therefore, depending on operating conditions and amount



SECTION 1 (EAST–WEST)

SCALE:
H: 1"=40'
V: 1"=8'



SECTION 2 (NORTH–SOUTH)

SCALE:
H: 1"=40'
V: 1"=8'

FIGURE 4.5.1-4.

COOLING RESERVOIR OUTFALL D-001 STRUCTURE

Source: AECOM, 2012.

of available reclaimed water, discharges from the reservoir may be up to 5 to 8 MGD.

Cooling Tower

The heat rejection system for the proposed Project will incorporate a cooling tower to lower the amount of heat rejected to the cooling reservoir. The cooling tower will be sized based on two factors: limiting the heat rejected to the cooling reservoir to prevent the reservoir from becoming unacceptably hot and keeping the cooling tower as small as possible to reduce the consumptive use of water. Cooling towers reject heat primarily through evaporation, while the cooling reservoir rejects heat through convection radiation, conduction, and evaporation. Therefore, optimizing the size of the cooling tower reduces the consumptive use of water.

The auxiliary cooling loads for the new Project and Unit 1 will be moved to the new cooling tower. This cooling tower will be used to reject approximately 403 MMBtu/hr heat load from Unit 1 and 115 MMBtu/hr from the Project (518 MMBtu/hr total). The cooling tower will be treated with H_2SO_4 for pH control, sodium hypochlorite to prevent biofouling, and an antiscalant for scale control.

Makeup water for the cooling tower will primarily be provided from the treated reclaimed water from the City of Lakeland to further minimize the use of groundwater. Some groundwater will be used for the cooling tower, as needed, to supplement the treated reclaimed water. The cooling tower will be a six-cell close-approach fiberglass mechanical draft cooling tower of industrial design. The tower will be operated at three to five cycles of concentration to control fouling. The blowdown from the tower will be discharged to the cooling reservoir.

4.5.1.2 Sources of Cooling Reservoir and Cooling Tower Water Makeup

As discussed previously, water losses will occur from the cooling water reservoir and cooling tower. Makeup water will be needed to continuously replenish the reservoir water to maintain an operating water level as required for cooling efficiency and water quality management purposes. Makeup water will also be needed for the cooling tower to replace water lost through evaporation and blowdown discharges. As shown in Figure 4.5.0-1, in addition to treated reclaimed water from the City of Lakeland, the other sources of water supply to the reservoir will include direct rainfall, runoff from the berm areas, surficial groundwater inflow, treated process water from the industrial wastewater treatment facilities, treated stormwater runoff, and groundwater from the onsite wells.

Despite maximizing the use of other sources, significant components of the cooling reservoir makeup water will be treated reclaimed water from the City of Lakeland and groundwater withdrawn from the onsite wells. Table 4.5.0-3 provides the expected quality of the treated reclaimed water and groundwater for the cooling reservoir makeup. According to the water source analysis, a total annual average makeup of approximately 9.4 MGD will be required to maintain required water level and water quality conditions in the reservoir during annual average, anticipated plant operating conditions (see Figure 4.5.0-1). The expected peak month daily makeup requirement under anticipated summer plant operating conditions and maximum ambient temperature conditions will be approximately 11.6 MGD (see Figure 4.5.0-2). This peak makeup rate may occur for up to a 2-month period under assumed worst-case plant operating conditions (i.e., high-load and abnormally dry, hot weather conditions).

As shown in Figure 4.5.0-1, makeup water for the cooling tower will primarily be supplied by treated reclaimed water. The cooling water makeup needs for the cooling tower will be 0.85 MGD on an annual average basis and 1.23 MGD on a peak daily basis.

As described in the beginning of Section 4.5, in the event of an interruption in the availability of reclaimed water from the City of Lakeland (e.g., pump failure or pipeline break), additional groundwater withdrawn from onsite wells in the Upper Floridan aquifer will be required to supply the cooling reservoir and cooling tower makeup on a standby or emergency basis. Any such interruptions in the reclaimed water system are anticipated to be relatively short in duration. Other potential unanticipated events or conditions that may require increased use of groundwater for reservoir makeup are also described in Section 4.5.

4.5.1.3 Recirculating Cooling Water

The cooling reservoir system for the proposed Project will be similar to the existing system. Cooling water will be withdrawn from the reservoir, and the heated water will be returned to the reservoir. The heated water will be discharged through an open pipe and discharge structure to the reservoir. Other waters that will be added to the reservoir include reclaimed makeup water, direct rainfall, stormwater runoff, cooling tower blowdown, and treated plant wastewater.

The recirculating cooling water flow rate for the cooling reservoir will be increased by approximately 200,000 gpm by the addition of two pumps for Project operation. The total recirculation flow for condenser cooling for Unit 1 and the Project will be approximately 373,000 gpm.

The reservoir's intake and discharge structures will be expanded to accommodate the proposed Project's increased flow. The intake structure will be expanded to accommodate the additional pumps and an additional discharge structure added for the proposed Project recirculating cooling water flow to moderate the discharge velocity.

The new cooling tower will be used for cooling auxiliary equipment for the proposed Project, as well as the existing Unit 1. As shown on Figure 4.5.0-1, the total recirculating cooling water flow rate for the cooling tower will be 62,450 gpm.

4.5.1.4 Blowdown, Screened Organisms, and Trash Removal

Blowdown from the cooling reservoir needed to control water levels and TDS concentrations will be discharged through Outfall D-001. This blowdown discharge will average approximately 2.0 MGD and may vary from 0 to 5 MGD.

The primary makeup water for the cooling reservoir will be treated reclaimed water, and there will be no new intake structure in natural waters. The existing intake structure in the reservoir will be expanded at its present location and the screening, servicing, trash removal, and disposal will be similar to the existing conditions.

4.5.1.5 Injection Wells

As discussed previously, two deep injection wells are currently being developed on the PPS Site as part of the reclaimed water treatment project. These wells will be used to dispose of RO reject wastewater from the reclaimed water treatment process and from the PPS process water treatment system and certain wastewaters from the existing Polk Unit 1 operations. Figure 4.5.1-5 shows the onsite locations of the injection wells, and Figures 4.5.1-6 and 4.5.1-7 depict the construction details of the injection wells and associated dual zone monitoring wells.

These injection wells will not be used for disposal of any cooling water blowdown from the proposed Project. The two injection wells are being separately

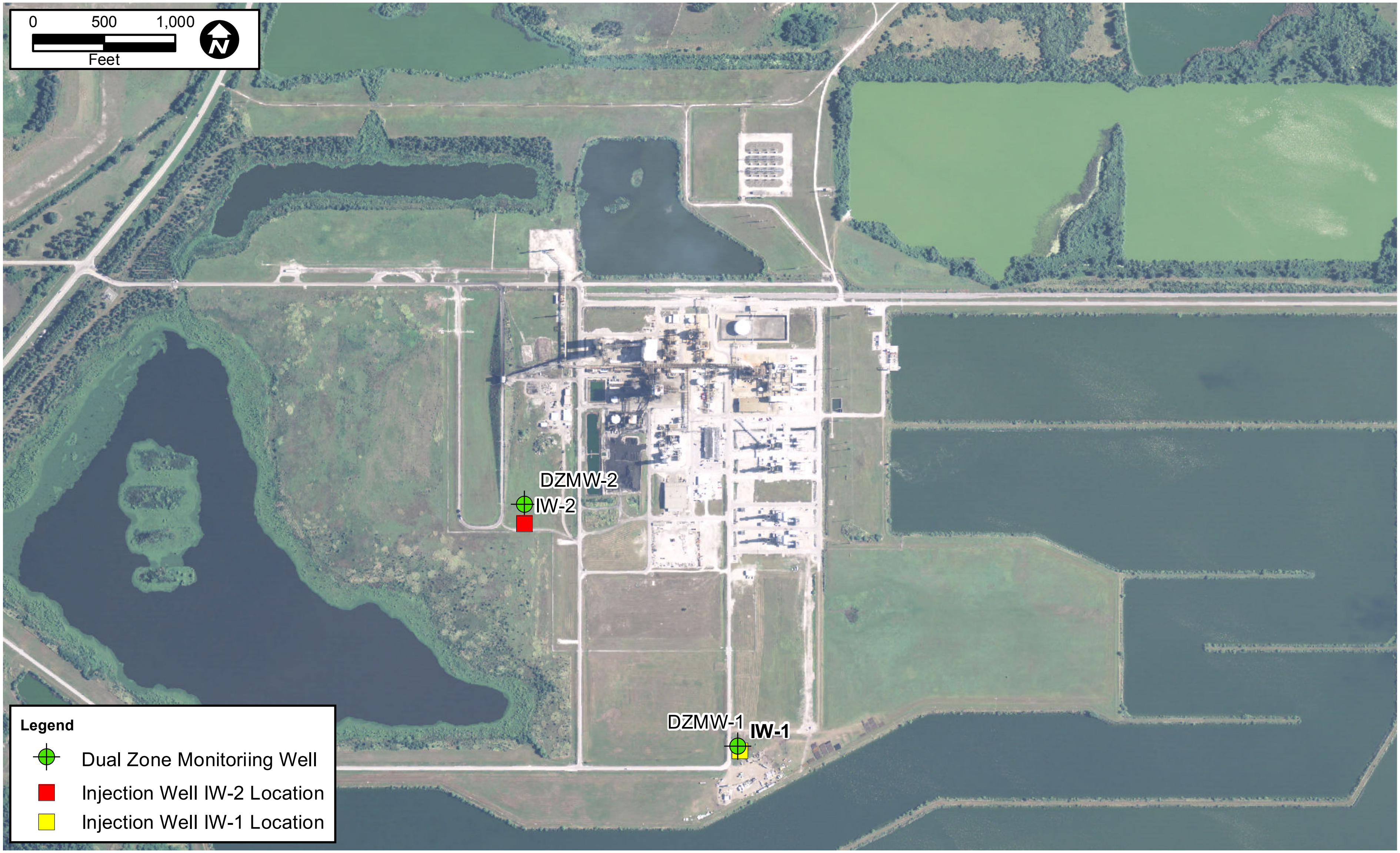


FIGURE 4.5.1-5
LOCATION OF INJECTION WELLS AND DUAL ZONE MONITORING WELLS

Sources: USDA, 2010; ECT, 2012.

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Injection Well IW-2

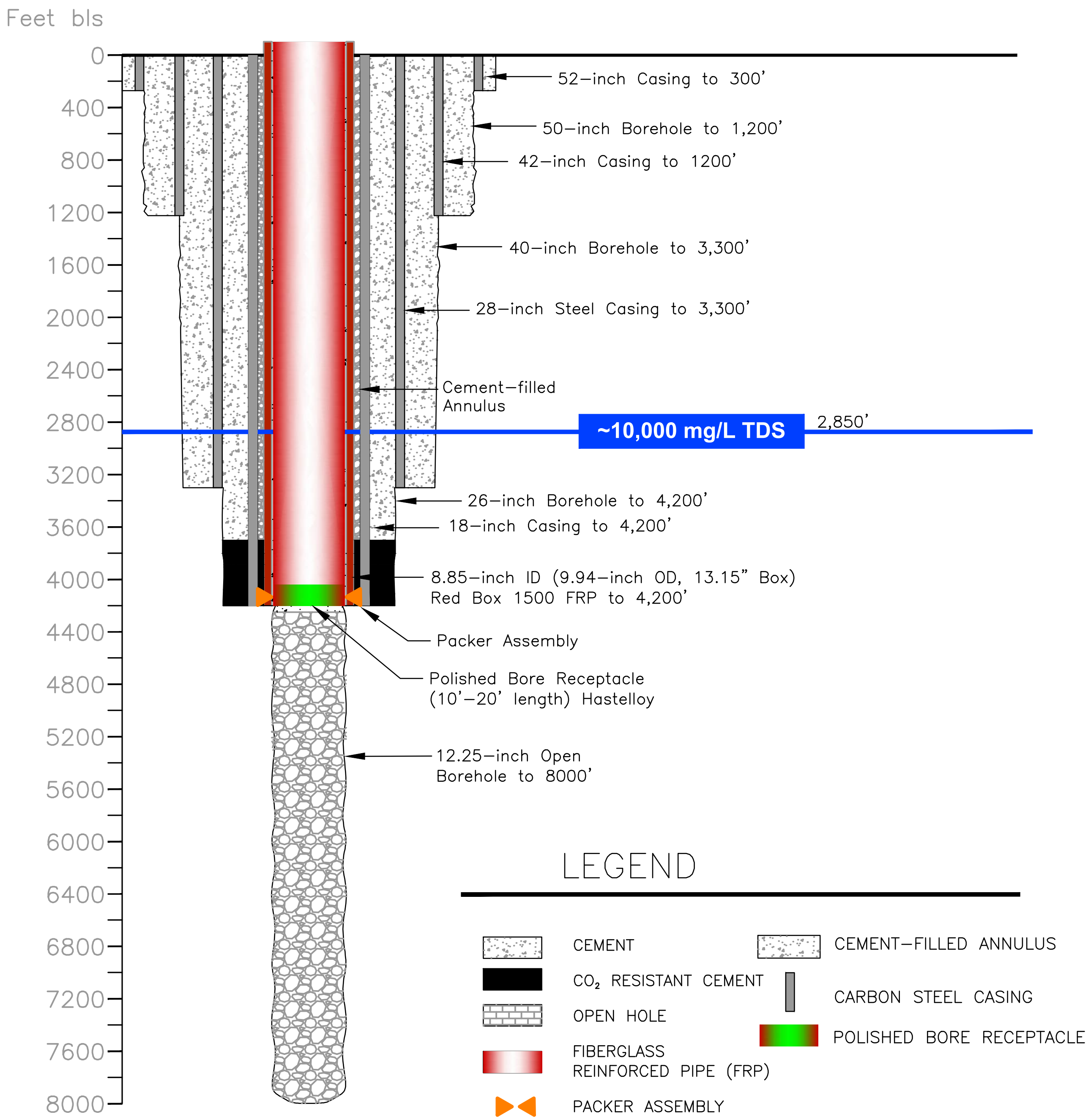

FIGURE 4.5.1-6.

INJECTION WELL CONSTRUCTION DETAILS

Source: ECT, 2012.

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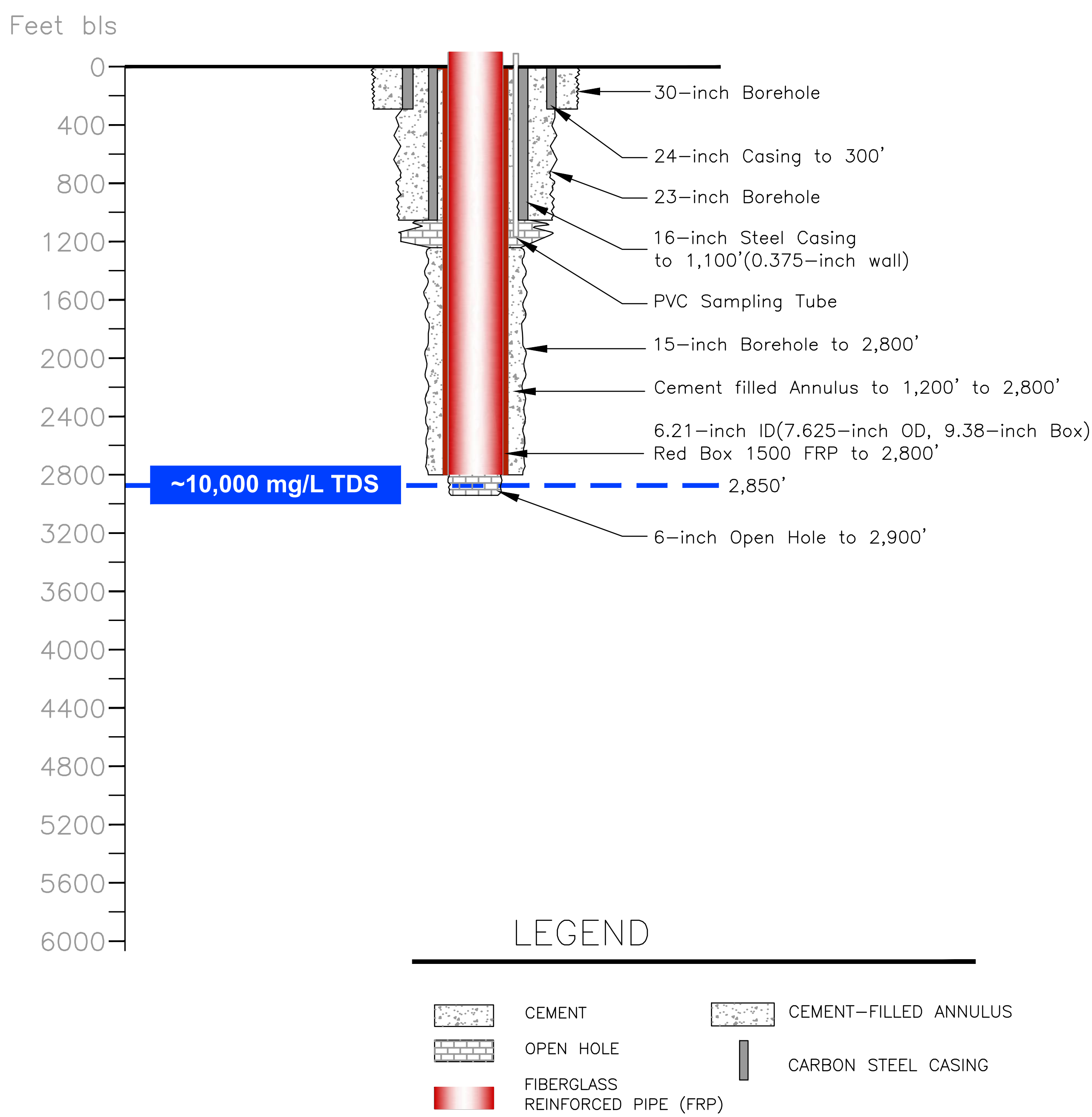

FIGURE 4.5.1-7.

DUAL ZONE MONITORING WELL DESIGN DETAILS

Source: ECT, 2012.

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permitted under FDEP's UIC program and are not included in this PPSA certification proceeding for the proposed Polk 2-5 Conversion Project.

4.5.2 DOMESTIC/SANITARY WASTEWATER

The existing facilities at the PPS Site for potable water and sanitary wastewater treatment will be used to meet the proposed Project needs. No additional PPS staff will be required to operate the proposed Project. Originally, for the PPS operations, a sanitary treatment package plant was used for sanitary wastewater treatment. This system was replaced by a septic tank and drainfield system in 2001. The discharges from showers, wash basins, bathrooms, drinking fountains, and other facilities at the current power plant support a staff of 78 persons per day and produce an average sanitary wastewater flow of approximately 2,300 gpd. The existing sanitary sewage septic tank and drainfield system is designed for a flow of 5,000 gpd. Therefore, the Project will not require the installation of any additional sanitary treatment capacity since the current staffing levels are within the capacity of the existing system. Additional needs for sewage handling during construction and during plant maintenance outages will be handled by portable chemical toilets.

4.5.3 POTABLE WATER SYSTEMS

Groundwater withdrawn from the Upper Floridan aquifer through the onsite wells provides noncooling process (service) water and potable water for the existing PPS needs. Potable water for the Project will involve an extension of the existing potable water distribution system to cover the safety showers and eyewash stations near the new equipment. The existing potable water treatment system was designed to provide 10,500 gpd and will be sufficient to provide the water for the Project needs. The estimated total potable water needs for the proposed Project and existing unit operations is approximately 4,000 gpd.

The existing system is classified as a nontransient, noncommunity water system and is operated in accordance with Chapters 17-550 and 17-560, F.A.C., and other relevant standards.

4.5.4 PROCESS WATER SYSTEM

PPS process water is directed to the existing service water storage tank.

Process water is used as nonpotable service water and demineralized water and is provided by the existing PPS well water treatment system. Treated reclaimed water will also be used to supplement the current well water supply system. Service water for the proposed Project will be drawn from the existing Unit 1 service water distribution system. Makeup to the existing demineralized water treatment system is drawn from the process water and effluent from the reclaimed water treatment facilities. The process water stream is first treated by activated carbon filtration, RO, decarbonation, and then blended with additional reclaimed water treatment effluent prior to mixed-bed ion exchange demineralization.

As shown in Figures 4.5.0-1 and 4.5.0-2, the projected process water requirements for Unit 1 and the proposed Project under normal operations are as follows:

	Annual Average	Maximum Daily
Unit 1	381 gpm	531 gpm
Project	116 gpm	136 gpm
Total	497 gpm	667 gpm

The following subsections describe the various process water uses and water treatment system components.

4.5.4.1 Service Water Use

CTG and Other Equipment Water Washing

CTGs experience a loss of performance during operation as a result of deposits on internal components that occur due to intake of air containing contaminants that pass through the inlet air filter or impurities in the combustion gas. Compressor washes will be performed on the CTGs approximately three times per year to remove these accumulated deposits. The existing wash water system consists of a water tank and a detergent tank. The detergent is used on the compressor parts. Any detergent used for washing will not contain Resource Conservation and Recovery Act (RCRA)-listed chemicals. CTG wash water will be collected in water wash drain tanks and disposed offsite by a licensed contractor.

Other equipment requiring periodic washing includes HRSG gas side, heat exchangers, and pumps. The wastewaters from these washings will be reused within the process.

Miscellaneous Low Volume Uses

Service water will be provided throughout the PPS for washdown purposes, pump and equipment gland seals, and flushes, as needed. Designated hose stations will be conveniently located to allow equipment and facility washdowns. Drainage from these uses will enter the existing PPS industrial wastewater treatment system for treatment and reuse within the plant process water system and/or makeup water to the cooling reservoir.

4.5.4.2 Demineralized Water Uses

Demineralized water will be used primarily for HRSG boiler makeup, HRSG chemical cleaning, and NO_x control injection water.

For the proposed Project, the existing Unit 1 demineralization system will be expanded by an additional 150-gpm capacity, for a total PPS site capacity (for Unit 1 and the Project) of 550 gpm. Demineralized water for the Project will be directed to a new, nominal 500,000-gallon storage tank.

HRSG Boiler Makeup

For the proposed Project, demineralized water will be required to make up the steam generation feedwater lost to blowdown, sampling, and leakage. The steam generation feedwater will be treated to prevent corrosion or scaling in the STG components of the Project. The steam generation feedwater will be treated with amines or ammonia for pH control. Sodium phosphates may also be fed to the steam drums, if required. The steam drums on the HRSGs can blow down up to 2 percent of the feedwater to control water chemistry in the steam drums.

HRSG Chemical Cleaning

The Project steam generation components will be chemically cleaned at commissioning and then nominally once every 5 years, or as otherwise necessary. The spent cleaning solutions will be contained in a chemical cleaning water holding tank for reuse in the process or transported to an offsite appropriately permitted disposal facility.

NO_x Control Injection Water

Demineralized water used for NO_x control is required only when firing ULSD fuel oil. This water is injected into the CTG combustors and must be very pure to avoid damaging the CTG internals.

4.5.4.3 Fire Protection Water

The PPS fire protection system is fed from existing dedicated pumps in the intake structure of the cooling reservoir. The system is designed to deliver 6,000 gpm. Fire water main piping loops and hydrants already exist in the Project areas.

4.6 CHEMICAL AND BIOCIDE WASTE

In addition to the chemicals and treatment systems used for treatment of process water for plant service and demineralized water uses and treatment of reclaimed water for cooling reservoir and cooling tower makeup water uses, the proposed Project will use various chemical systems (as described previously) to treat the condenser circulating water, steam cycle water, and cooling tower water.

The various water, wastewater, and waste streams that will be treated in the plant processes and wastewater treatment systems are described in the following sub-sections.

4.6.1 CONDENSER AND OTHER ONCE-THROUGH NONCONTACT COOLING WATER

Cooling of the proposed Project STG condenser and miscellaneous components will be achieved by recirculating, noncontact cooling water loops (i.e., the cooling water is not in contact with process fluids). Recirculating water for this application will be withdrawn and subsequently discharged to the existing cooling reservoir. An oxidizing biocide (sodium hypochlorite or chlorine) will be used to suppress biofouling in the reservoir cooling water system. Under normal operations, water will be discharged from the cooling reservoir to control the build-up of dissolved solids in the cooling water. With the proposed Project addition, the offsite discharge flows from the cooling reservoir will remain generally the same as under currently permitted conditions as required to maintain safe operating water levels and suitable water quality in the reservoir.

4.6.2 COOLING TOWER BLOWDOWN

A new cooling tower will be used to cool auxiliary facilities in the new Project and existing Unit 1 gasification and power plant, including the air separation units. The cooling tower will be nominally operated at three to five cycles of concentration. The cooling tower will be treated with oxidizing biocide (sodium hypochlorite) to control biological fouling and may be treated with a dispersant, scale inhibitor, acid, and/or corrosion inhibitor to control deposition, scaling, pH, and corrosion throughout the cooling tower circulating water system.

To limit the concentration of dissolved solids in this system, blowdown from the tower will be required. This blowdown will be directed to the cooling water reservoir.

4.6.3 LOW-VOLUME WASTES

Low-volume wastes from the proposed Project will consist mainly of wastewaters from equipment and equipment area drains, area runoff, and boiler blowdown. These wastewaters typically contain higher concentrations of total suspended solids (TSS) and TDS than does service water (treated well water). Equipment area drains may contain minimal amounts of various plant chemicals from small leaks or spills. Spill containment provisions (e.g., berms, isolated pump-out sumps, absorbent and neutralizing materials) will be used to prevent the 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 iron, which are picked up from steam generation and other heat transfer surfaces. Boiler blowdowns and nonoily equipment wastewater drains will be combined in a wastewater collection sump and recycled to the cooling tower as makeup water.

Oil-bearing equipment will be segregated using curbed areas with drains directing wash-down, runoff, minor leaks, and spills to a new oil/water separation system. The oil/water separation system will be used to remove oil, grease, and sludge from wastewater prior to discharge to the cooling reservoir. The oil is directed to a skimmed oil tank for disposal offsite.

4.6.4 METAL CLEANING WASTES

Metal cleaning chemical wastes will be generated during equipment cleaning. Metal cleaning will be conducted at proposed Project startup and as required thereafter. The metal cleaning wastes characteristics may include high or low pH, high TSS, and trace metals, such as nickel, molybdenum, vanadium, iron, and chromium. Spent metal cleaning chemical wastes from this infrequent activity will be collected and taken offsite by a licensed contractor for disposal at an appropriately permitted disposal facility.

4.7 SOLID AND HAZARDOUS WASTES

4.7.1 SOLID WASTES

The proposed Project will not generate any solid waste, such as combustion ash or flue gas desulfurization scrubber waste, from the electric generation process. The firing of natural gas or ULSD fuel oil does not create significant combustion byproducts. Project operations will not require any onsite landfills or solid waste disposal areas. The existing commercial trash services will be contracted to haul away typical solid wastes that result from the proposed Project operations, such as increased office debris.

4.7.2 POTENTIALLY HAZARDOUS WASTES

Waste oil is the major potentially hazardous substance generated by the proposed Project operation. Used oils and used oil filters will be periodically generated from the CTG cleaning, pumps, fans, bearings, and compressors. Such used oil includes, but is not necessarily limited to, lubricating oil, hydraulic oil, motor oil, diesel oil, fuel oil, and transformer mineral oil. Oily waste includes oily water, petroleum contact water, used oil filters, rags, absorbent pads, and oily sludge. Used oil and oily waste contaminated with solvents will be collected separately. Used oils will be temporarily stored onsite for pickup by an appropriate oil recycler or disposal contractor.

Oily wastewaters that are generated will be conveyed to the new oil/water separator for the Project. Waste oil collected in the oil/water separators will be hauled offsite as needed by a licensed contractor for ultimate disposal.

Small quantities of other hazardous wastes, such as paints and cleaners, are used in maintenance and will be segregated from the plant drainage system and disposed offsite to a licensed contractor.

The SCR catalyst will require periodic replacement based on either pressure drop across the catalyst or degradation of catalyst performance. The SCR treats the flue gas to remove NO_x. Solid particles in the flue gas can plug the catalyst, and chemical degradation of the catalyst will eventually result in higher NO_x emissions. During scheduled maintenance outages, the SCR catalyst will be removed, and it will be characterized for proper disposal. Spent SCR modules will be removed from PPS by a licensed contractor.

4.8 ONSITE DRAINAGE SYSTEM

The proposed Project will not significantly impact the existing stormwater management system or stormwater runoff quantity or quality.

The proposed Polk 2-5 Conversion Project will not modify and/or change the drainage pattern on the PPS Site. During the original certification process for PPS, the overall onsite drainage plan was designed and approved for ultimate buildout of the plant facilities. Figure 4.8.0-1 shows the ultimate buildout drainage plan for

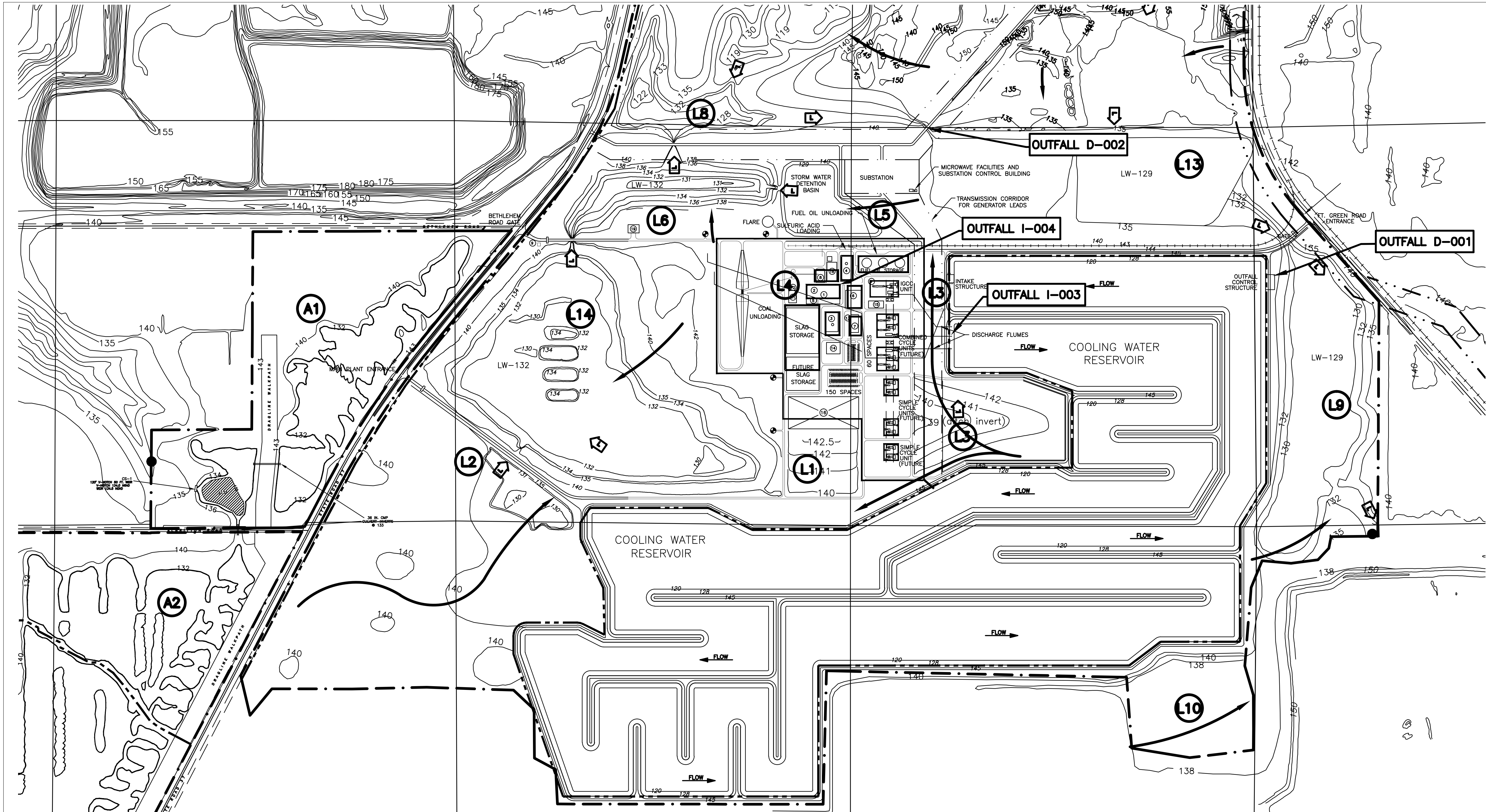

FIGURE 4.8.0-1.

POSTRECLAMATION/DEVELOPMENT DRAINAGE BASINS AND TOPOGRAPHY: 1992 SCA

Source: ECT, 2012.

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the plant facilities from the original SCA (ECT, 1992). The new proposed Project facilities will be located on land within the existing facilities area in Basin L4. The construction parking and laydown area for the proposed Project will be located in Basins L4 and L1, which will have already been previously developed and used as the parking and laydown areas for construction of the reclaimed water treatment facilities project. As shown in this figure, the ultimate buildout plans included a CC unit in the same plant facilities area as the currently proposed Polk 2-5 Conversion Project CC unit. During construction of Polk Unit 1, the total plant facilities area was developed in accordance with the approved drainage plan. Under the original drainage plan of 1992, stormwater runoff from the plant facilities area is routed north to the stormwater pond.

As shown in Figure 4.8.0-1, drainage from the future simple cycle unit's area located south of the proposed CC area and the northern portion of the vacant area to the west of the future simple cycle area was also routed north to the stormwater pond in the originally designed drainage system. Portions of these areas will be used for construction laydown and parking for the proposed Polk 2-5 Conversion Project (see Figure 4.8.0-2). Drainage from these areas (i.e., approximately 29 acres) will be changed from draining north to the stormwater pond to draining south to the cooling reservoir as part of the construction activities for the reclaimed water treatment facilities (see Figure 4.8.0-3). This change in drainage pattern will reduce the drainage area to the stormwater pond by 29 acres and the flow volume to the stormwater pond by approximately 18 acre-feet (ac-ft) during a 25-year, 24-hour storm event compared to the original drainage plan. This change in drainage was previously approved under Modification N of the PPS site certification. Therefore, the existing stormwater pond will receive lower stormwater flow volume than it was originally designed to contain.

Since the proposed Polk 2-5 Conversion Project facilities will be constructed within an area already considered as developed for such facilities in the approved drainage plan, the expected change in runoff will be minimal. Also, the proposed Project will not change the approved, existing drainage patterns and systems (i.e., culverts, ditches) in the plant facilities area, which are used to route the runoff to the existing stormwater pond. The existing stormwater pond has adequate storage and water quality treatment capacity to handle runoff from the proposed Project facilities areas. Therefore, development of a new stormwater management plan and related environmental resource permit information are not needed for the proposed Project.

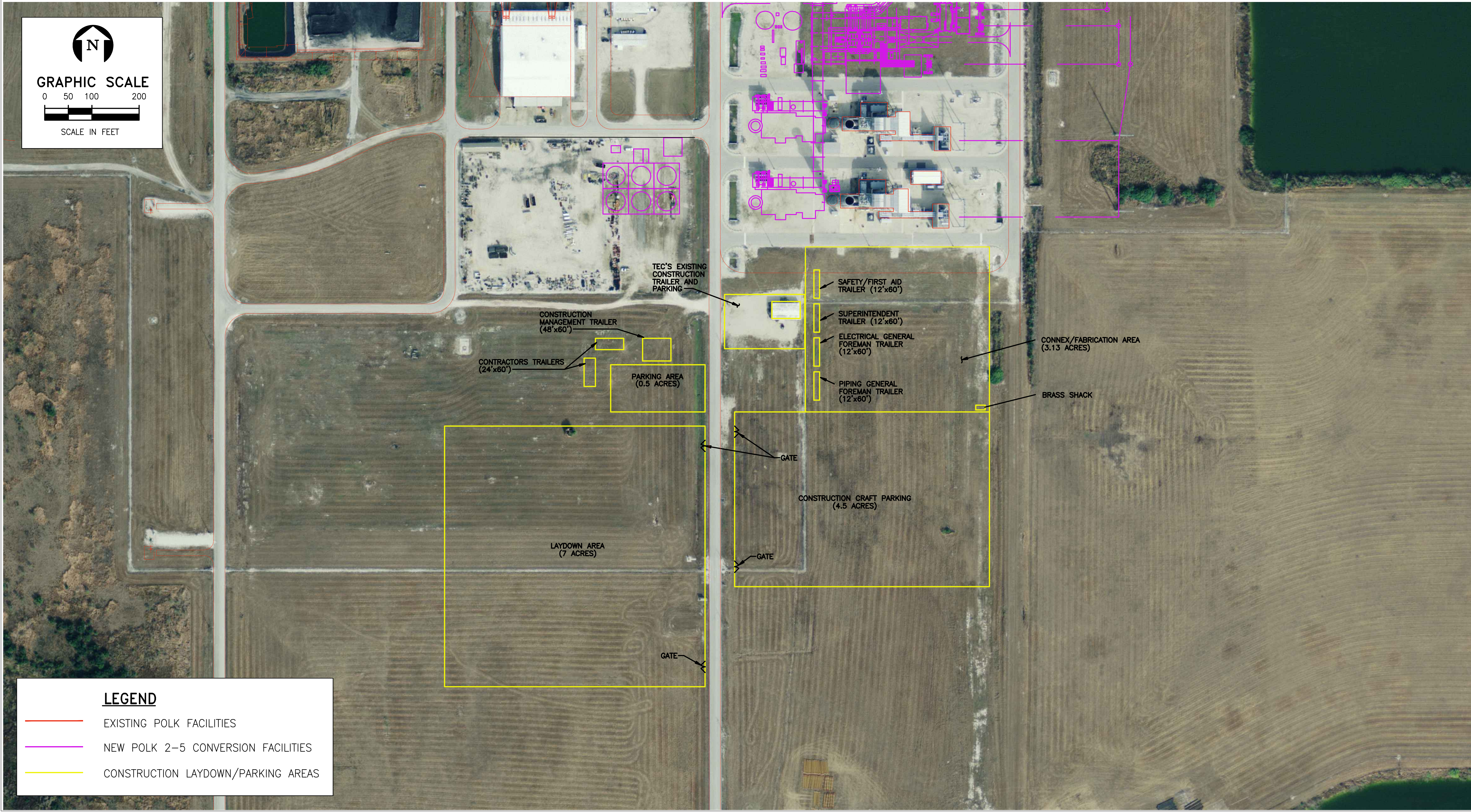

FIGURE 4.8.0-2.

CONSTRUCTION LAYDOWN AND PARKING AREAS FOR PROPOSED PROJECT

Sources: 2011 Dept. of Revenue Aerials; Black & Veatch, 2012; Tampa Electric, 2012; ECT, 2012.

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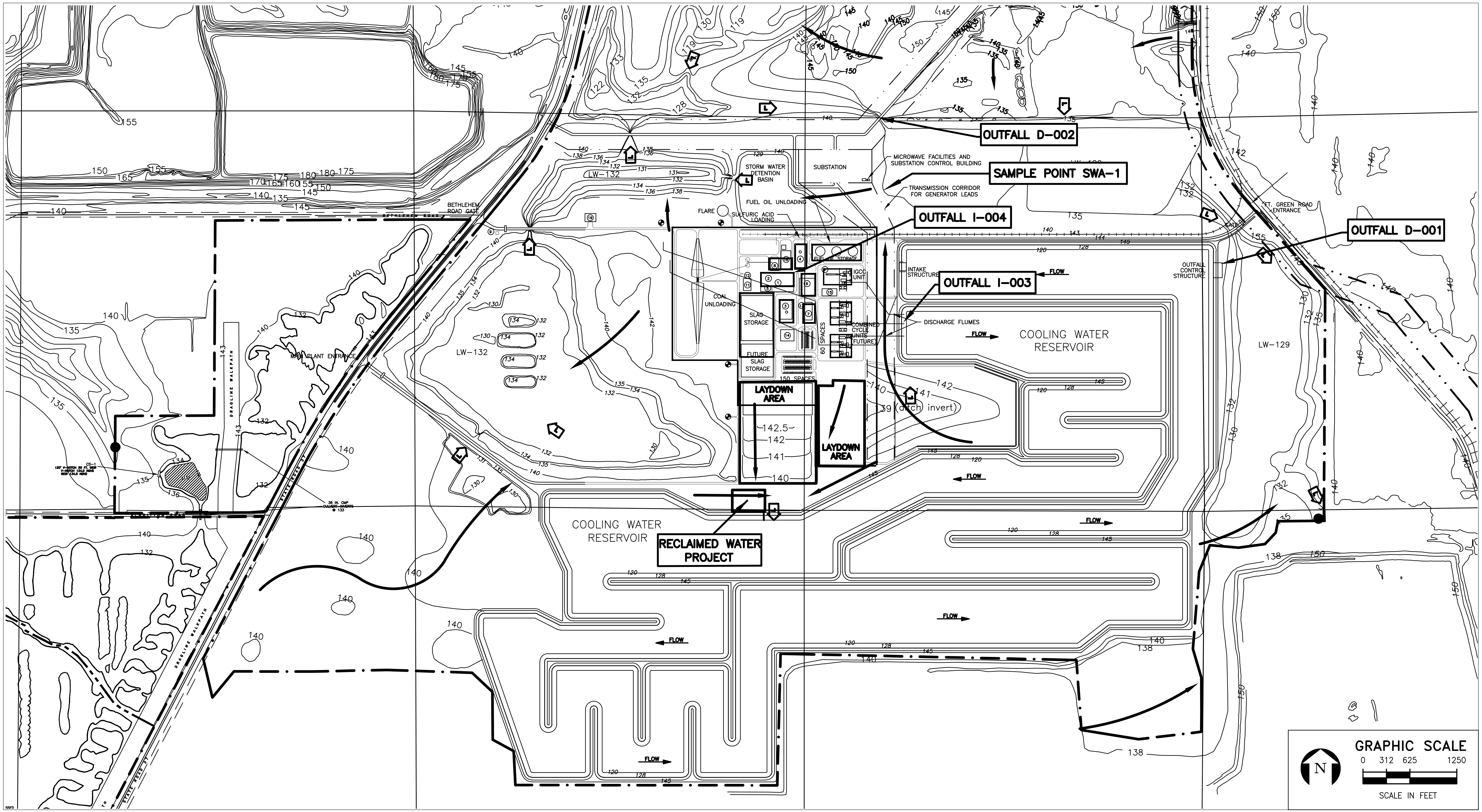

FIGURE 4.8.0-3.

MODIFIED SITE DRAINAGE PLAN FOR RECLAIMED WATER PROJECT

Sources: Bethel, 1993; ECT, 2012.

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TAMPA ELECTRIC

During the construction of new facilities, best management practices (BMPs) for erosion and sediment control measures will be implemented. Perimeter silt fences and hay bales will be used to prevent the sediment-laden runoff from the construction site from entering into the ditches. The perimeter ditches will convey the stormwater runoff from the project area into the existing stormwater pond and the cooling reservoir. A stormwater pollution prevention plan will be prepared to establish BMPs.

4.9 HEAVY EQUIPMENT AND MATERIALS HANDLING

4.9.1 CONSTRUCTION EQUIPMENT AND MATERIALS

For construction of the proposed Project, the majority of equipment and materials will be delivered to the PPS Site by trucks using the existing roadway system, similar to the construction deliveries for the existing units. The existing main plant access roads from SR 37 on the west side of the Site and the access road from Fort Green Road on the east side will be used to accommodate the truck deliveries, as well as the construction workforce (see Figure 4.2.0-1). These access roads and intersections were constructed and used for delivery of equipment and materials for Units 1 through 5 and are anticipated to be adequate to support the proposed Project construction activities. The CSX railroad network and existing onsite rail spur, depending on the timing of the deliveries, will be used to transport certain heavy equipment and plant components to the PPS Site, such as the HRSGs and STG. Also, initial transport to Port Manatee may be used for certain oversized, heavy equipment. From Port Manatee, such equipment would be transported to the PPS Site by specially designed crawler. Some roadways between Port Manatee and the Site may require temporary closure during the transport process.

Once on the Site, the equipment and construction materials will be unloaded for immediate erection or placed in designated construction laydown areas using cranes and trucks. As shown on Figure 4.8.0-2, approximately 15 acres of the PPS Site located to the south of the Project area will be used for construction laydown and construction labor force parking. The construction laydown and parking areas have been previously graded, and appropriate drainage provisions have been provided. As needed, these areas will include access roads that will typically consist of gravel installed over geo-textile fabric. A portion of the laydown area will also be covered with gravel installed over geotextile fabric and primarily used for temporary storage of equipment and equipment assembly along with space for prefabrication, preassembly, welding, painting, and other activities necessary for the preparation of the equipment. Temporary fencing will be installed around the construction laydown and parking areas. The construction laydown and parking areas will be compacted, and water wagons will be used, as necessary, during the construction activities to control fugitive dust emissions. Also, as discussed in Section 4.8, appropriate stormwater runoff management systems will be provided to control potential sediment erosion impacts.

4.9.2 OPERATIONS MATERIAL HANDLING

Similar to the existing PPS plant operations, materials for the proposed Project will be transported to and from the Site via trucks using existing roadways or by railroad. Other larger volume materials associated with Project operations, such as SCR ammonia deliveries, will also be transported to the Site by truck or rail. The handling, storage, and transport facilities for these materials will include appropriate pollution control measures.

4.10 ASSOCIATED LINEAR FACILITIES

The proposed Project will include two directly associated linear facilities that will extend off the PPS Site and will be part of this PPSA certification proceeding. These facilities include a new approximately 27-mile, 230-kV transmission line and upgrades to an existing 230-kV transmission line. The new single-circuit, 230-kV transmission line will run west from the existing PPS substation to SR 37 within the onsite corridor containing two existing 230-kV lines. The transmission line corridor will run southwest along SR 37 and then west along SR 674, crossing into Hillsborough County, to the existing Tampa Electric Mines substation. From the Mines substation, the corridor will run northwest and north to an existing Tampa Electric 230-kV transmission line corridor and follow the corridor westward to a new Tampa Electric substation, known as the Aspen substation, which will be located adjacent to an existing Tampa Electric-owned corridor. From the Aspen substation, two new 230-kV transmission line circuits will run north-northeast in the Tampa Electric-owned corridor to the existing Fishhawk substation.

The other linear facility will involve upgrades to a portion of Tampa Electric's existing 230-kV transmission lines from PPS to the Pebbledale substation. The proposed upgrades will occur in the approximately 5-mile initial portion of the lines running north along Fort Green Road on the eastern PPS Site boundary. The upgrades will involve separating the two 230-kV lines within a transmission line corridor to improve the reliability of the lines.

Again, the proposed new 230-kV transmission line from PPS to the Fishhawk substation and the upgrades to the PPS to Pebbledale substation are included in this PPSA proceeding. The new Aspen substation is not included in this PPSA proceeding. Chapter 9.0 of this SCA provides detailed descriptions of the new transmission line and corridor and transmission line upgrades and the potential environmental effects.

4.11 EMERGENCY DISASTER PREPAREDNESS PLANS

Tampa Electric fully recognizes the importance of emergency prevention and preparedness programs focused on providing rapid, effective protection of human health and the environment during emergency situations or events. To meet its commitment to such programs and in accordance with applicable federal and state requirements, Tampa Electric has prepared and implemented two comprehensive, coordinated emergency plans for PPS, as well as similar plans for its other facilities and operations: PPS integrated contingency plan (ICP) and PPS emergency contingency/response plan (ECRP). The ICP consolidates, into a single functional plan, several plans for PPS compliance with applicable federal and state contingency planning requirements regarding chemical spills or physical releases. The other contingency plans and requirements include the following:

- RCRA requirements for hazardous waste generators.
- Oil pollution prevention requirements under the Clean Water Act (CWA) for a spill prevention, control, and countermeasure plan and facility response plan.
- Emergency Planning and Community Right-to-Know Act requirements.
- Occupational Safety and Health Administration requirements.
- State requirements governing release prevention and response for pollutants stored in tanks.

The ECRP for PPS address preparedness and response measures during various types of emergencies such as inclement weather and acts of terrorism. The ICP supports and comprises a portion of the ECRP. The ICP and ECRP are controlled documents that are periodically reviewed and revised, as necessary, to reflect current conditions at PPS and changes in key response team personnel. These plans will be appropriately revised to incorporate the proposed Project at PPS and properly implemented.

REFERENCES

Environmental Consulting & Technology, Inc. (ECT). 1992. Polk Power Station Site Certification Application. Prepared for Tampa Electric Company. ECT No. 90263-0100. July. Gainesville, Florida.