4.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

This chapter provides descriptions of the proposed power plant facilities, the key components and systems of the plant and their operations, and the directly associated facilities that will comprise GREC. The descriptions include estimates of the expected character, quality, and quantity of discharges and emissions from the plant facilities and operations. The 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 will 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 GREC.

4.1 BACKGROUND

GREC will involve the construction and operation of a nominal 116-MW gross (nominal 100-MW net) biomass electric generating unit and directly associated facilities on an approximately 131-acre Site in the City of Gainesville, Alachua County, Florida. The GREC Site will be leased from the City of Gainesville, d/b/a GRU, and is located within the boundaries of the certified site for GRU's existing DGS. GREC will involve the development of several associated linear facilities that will extend from within the GREC Site onto GRU's DGS property. Construction activities are anticipated to begin in late 2010 and the unit is scheduled for commercial operation in late 2013. GREC LLC is seeking certification of the proposed GREC electric generating unit and associated facilities within this PPSA proceeding.

The following subsections provide descriptions of the major power plant and associated facilities and systems comprising GREC. Detailed descriptions of the linear facilities that extend onto the DGS site are provided in Chapter 9.0.

4.1.1 MAJOR POWER PLANT FACILITIES AND SYSTEMS

The main electric generating facilities for GREC will consist of a BFB boiler and steam turbine generator.

The biomass fuels will be combusted in the BFB boiler, a unit that can accommodate a wide range of biomass fuels. In the BFB boiler, combustion of clean, woody biomass material takes place in the dense, fluidized sand bed located at the bottom of the furnace as well as above the bed. The smaller fuel particles burn rapidly above the fluidized bed, while the larger particles filter into the bed where they are dried and gasified. Residual char is burned mainly in the fluidized bed, while volatile material burns both in and above the fluidized bed. Figure 4.1.1-1 provides a schematic of the BFB boiler.

The fluidized bed consists of sieved natural sand, which is maintained in suspension by a fluidizing air system. The fluidizing (primary) air is introduced into the furnace through the water-cooled, grate air-beam distribution system, while the staging (overfire) air is introduced through air openings located in the furnace walls. The fluidization results in an expanded combustion zone with high turbulence, intimate solids-to-gas contact, and a high heat transfer rate within the bed.

Overfire air is introduced into the furnace above the bed. This is where final combustion and flue gas oxygen content are controlled. Fuel quality, boiler capacity, and bed temperature determine air distribution requirements. During the combustion of biomass fuels, the bed temperature normally varies between 1,350 and 1,700°F. The temperature above the bed, where the overfire air is introduced, is approximately 200°F higher in most cases. Overfire air is injected into the furnace to complete the combustion of volatile gases, such as CO leaving the bed. NO_x emissions are limited by staging the combustion in the bed and in the lower furnace area (freeboard). Due to the reduced flame temperatures that occur with combustion staging, the formation of thermally generated NO_x is reduced.

Flue gas from the boiler will pass through state-of-the-art air emission control equipment and discharge to the atmosphere through one 230-ft stack. Regulated emissions from the

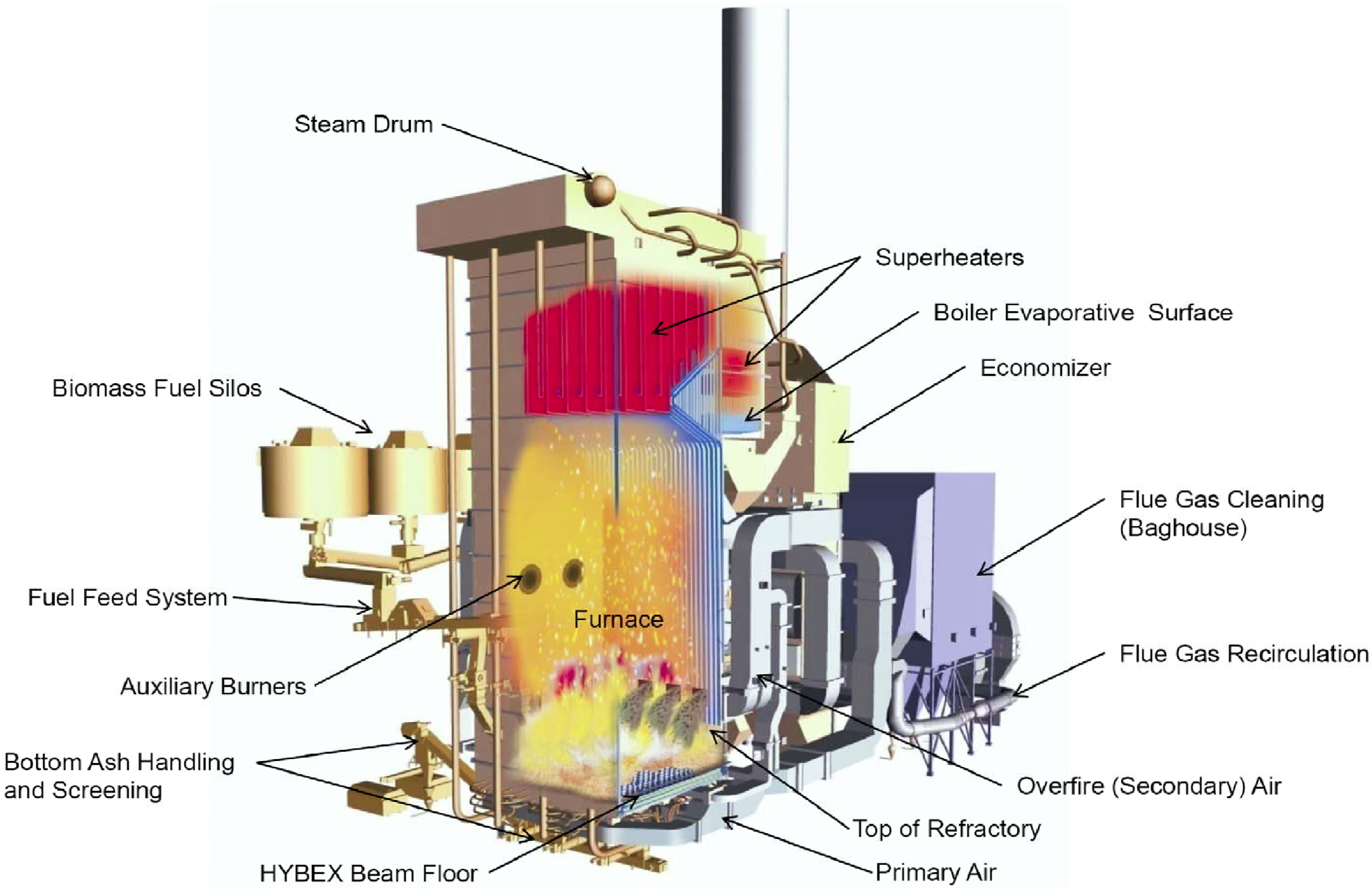

FIGURE 4.1.1-1.

SCHEMATIC OF BFB BOILER

Source: Metso, 2009.

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boiler will be reduced to levels at or below the maximum permitted levels using BACT. Proposed BACT control technologies include:

- BFB boiler technology to minimize NO_x production via combustion staging.
- SCR system to control NO_x emissions.
- BFB boiler technology combined with dry sorbent injection (DSI), low-sulfur biomass fuel, and naturally occurring calcium in the wood ash to control SO_2, H_2SO_4 mist, hydrogen chloride, and hydrogen fluoride emissions.
- Fabric filter baghouse for control of particulate matter.

An important GREC design criterion for the proposed boiler was the ability to burn a wide range of fuels to have access to competitively priced sources of biomass. The unit will be designed to fire clean, woody biomass material such as forest, mill, and urban wood residue and other wood wastes. Natural gas will be used as startup fuel.

Typically, the biomass fuel will be procured from suppliers within a 75-mile radius of the Site. The fuel suppliers will be required to follow strict standards that were established by GRU and GREC LLC in the PPA to protect the sustainability of regional forests. The biomass materials will be processed and chipped/ground at offsite locations prior to being delivered to the GREC Site by covered trucks. Approximately 130 to 150 truck loads per day of fuel, 6 days per week, will be required to meet the fuel requirements during plant operation at full load.

On the Site, the fuel delivery trucks will be weighed and will proceed from the scales for unloading in the drive-through receiving structure, which covers three truck dumpers, three pit bridges, and three in-pit receiving hoppers. The biomass material will be conveyed from the receiving hoppers to the fuel processing system, which consists of a metal detector and magnetic separator, disc screen, and hammer hogs to reduce oversized fuel to the 3-inch or less design size. The fuel screen and hog equipment will be located in an enclosed building with a dust collection system.

The processed fuel will be transported by conveyor to one of two main fuel storage areas. One storage area will have an automatic stacker/reclaimer, and the other area will have a fixed stacker, a conical-shaped pile, and a manual pile groomed and reclaimed by bull-dozers and front-end loaders. These storage piles will be designed to provide sufficient fuel for approximately 15 to 20 days of plant operations. Some fuel that is presized, such as sawdust, will be delivered to the Site by self-unloading trucks and dumped directly in a small, fourth storage pile.

The primary water uses for GREC will be cooling tower makeup, boiler makeup, and process service water. GREC water supply needs will be approximately 1.4 MGD on an annual average daily basis and approximately 1.5 MGD on a maximum daily basis. The plant's heat dissipation system will include a four-cell mechanical draft cooling tower. Water will be supplied by groundwater withdrawn from the UFA through two new onsite wells. Water for drinking and other potable needs will be supplied with two additional onsite wells in the UFA.

The GREC water systems will be designed to minimize the use of water and maximize recycling/reuse through use of a ZLD system. Also, through use of the ZLD system, GREC will have no industrial wastewater discharges from the facility. The well water will be treated with an influent lime softener/clarifier to reduce hardness. The softened well water will be stored on the Site in a 1,000,000-gallon tank to provide makeup for the cooling tower, steam cycle, and dust control, as well as for fire protection water. Cooling tower blowdown will be treated with a sidestream softener/clarifier. A portion of the treated blowdown water will be further treated by a two-pass reverse osmosis (RO) system and a brine concentrator/crystallizer. The remainder of the treated cooling tower blowdown will be recycled as makeup to the cooling tower. Wet salt cake or brine generated in the brine concentrator/crystallizer will be trucked to an approved offsite landfill for disposal.

GREC will have onsite drainage systems and detention basins to manage and control stormwater runoff and minimize potential erosion and sedimentation impacts during construction and operation of the facilities. These onsite stormwater management facilities will be designed in accordance with the requirements of FDEP and SRWMD. Section 4.8 and Appendix 10.4.2 provide more details on the design of the drainage systems.

Fly ash from the boiler convective pass and fabric filter hoppers will be collected dry and transported pneumatically to an onsite storage silo. From the storage silo, the fly ash will either be stabilized using water in a pug mill or loaded dry into a receiving truck. For the fly ash stabilization case, fly ash and water will be mixed in a pug mill and then transferred via a chute into open trucks. During the dry transfer of fly ash, an enclosed process will be used to transfer ash from the silo through a chute into sealed trucks. Air displaced from the trucks will be returned to the ash silo via a vacuum system. The fly ash will be transported offsite for use as agricultural or timberland soil supplement, to the extent possible. Any remaining fly ash will be disposed in an approved offsite landfill.

The bottom ash from the bed will primarily consist of noncombustible material (i.e., rocks, glass, sand, metal) in the biomass fuel. These materials will be collected dry and stored in containers before they are transported to an offsite landfill.

4.1.2 ASSOCIATED LINEAR FACILITIES

GREC will require several associated linear facilities that will extend beyond the GREC leased Site boundaries onto GRU's DGS property. These facilities include (1) a natural gas pipeline, (2) a sanitary sewer force main pipeline, (3) a 138-kV transmission line and switchyard, and (4) a main access road. Figure 4.1.2-1 shows the locations of the corridors for these linear facilities. The main access road will also extend a short distance across the CSX railroad line and FDOT right-of-way properties along U.S. 441. The natural gas and sanitary sewer pipelines will be collocated within a single corridor running from the GREC facilities and interconnecting with the existing GRU utility systems at the DGS facilities.

The new 138-kV transmission line will be run from the GREC switchyard in the power block area to a new GRU-owned switchyard located on DGS property just outside the GREC Site. A new, approximately 300-ft, GRU-owned 138-kV line will be constructed from the new switchyard to interconnect with GRU's existing 138-kV transmission line located on the east side of U.S. 441. GREC LLC will be responsible for obtaining necessary approvals and constructing the new GRU-owned switchyard and transmission line.

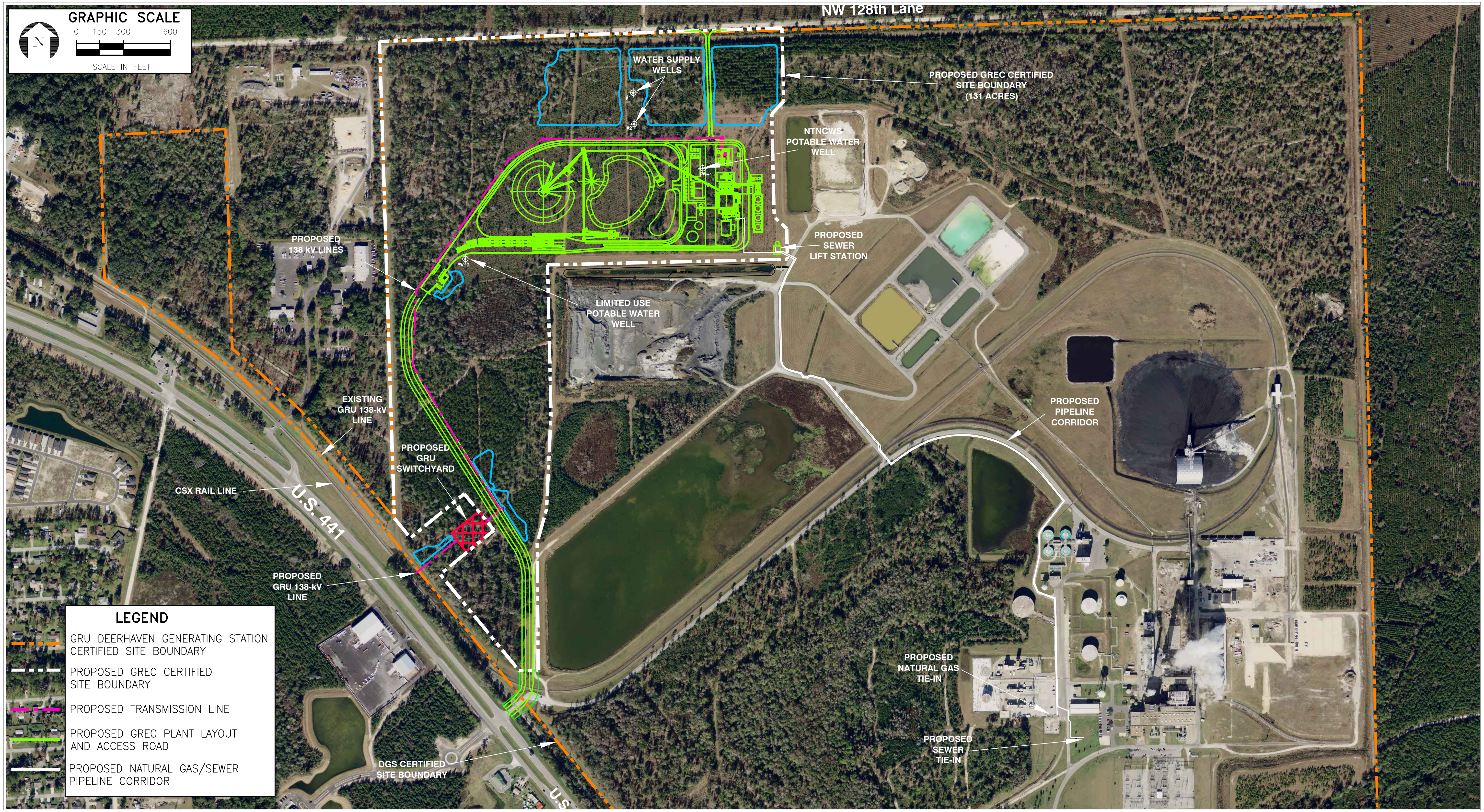

FIGURE 4.1.2-1.

LOCATIONS OF PROPOSED GREC ASSOCIATED LINEAR FACILITIES

Source: FDOT, 2008; Zachary, 2009; EDA, 2009, Genesis, 2009; ECT, 2009.

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Section 4.10 and Chapter 9.0 of this SCA provide additional details on these associated linear facilities.

4.2 SITE LAYOUT

The GREC Site consists of approximately 131 acres of land located in the westerly quadrant of the existing, previously certified, 1,146-acre GRU DGS site owned by the City of Gainesville. The Site will be leased from the City of Gainesville, d/b/a GRU. The Site is bordered by Northwest 128th Lane to the north, U.S. 441 to the south, and the Alachua County Department of Public Works Maintenance Complex to the west. The existing DGS facilities are located east of the Site. Currently, the Site is undeveloped and consists primarily of wooded areas actively managed for timber production with a series of trails. Several areas of cypress and mixed forested wetlands are located in the northwestern, central, and southern portions of the Site. The entire boundary of the DGS site has a 6-ft-high chain link fence with three strands of barbed wire on top. The majority of the Site has been disturbed by installation of perimeter drainage swales, furrowing and periodic timber harvesting, and the maintenance of existing service roads/trails for fire protection purposes.

Figure 4.2.0-1 shows the overall layout of the existing DGS facility site (bordered in ORANGE) and the proposed GREC biomass facility leased Site (bordered in white) on a recent aerial photograph dated 2008. Figure 4.2.0-2 shows the layout of the proposed facilities within the GREC Site at a larger scale. As shown in these figures, the proposed GREC facilities have been carefully arranged to minimize any impacts to wetlands and sensitive resource areas. There are large wetland areas to the west and southwest of the proposed power plant facilities that will not be impacted by the construction of GREC. The proposed power plant and associated facilities will occupy approximately 60.5 acres of the 131-acre GREC Site.

Figure 4.2.0-3 provides a more detailed layout of the proposed GREC facility and associated infrastructure. As shown in this figure, the power block portion of the facility is situated to the east and consists of various major equipment such as a boiler, steam

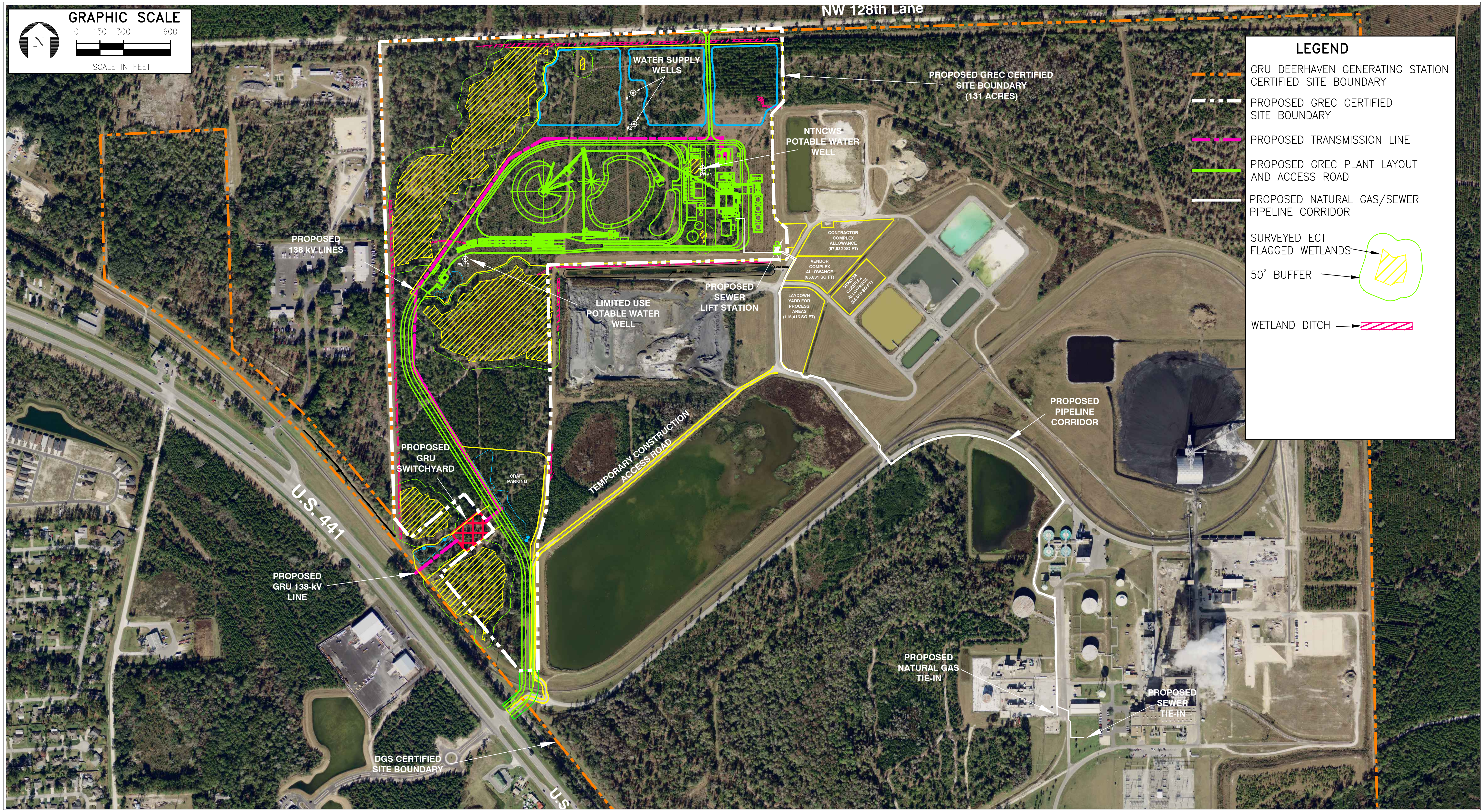

FIGURE 4.2.0-1.

OVERALL LAYOUT OF PROPOSED GREC FACILITIES WITHIN DGS SITE

Source: FDOT, 2008; Zachary, 2009; EDA, 2009, Genesis, 2009; ECT, 2009.

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Nov 19, 2009 - 4:21pm by jroberts

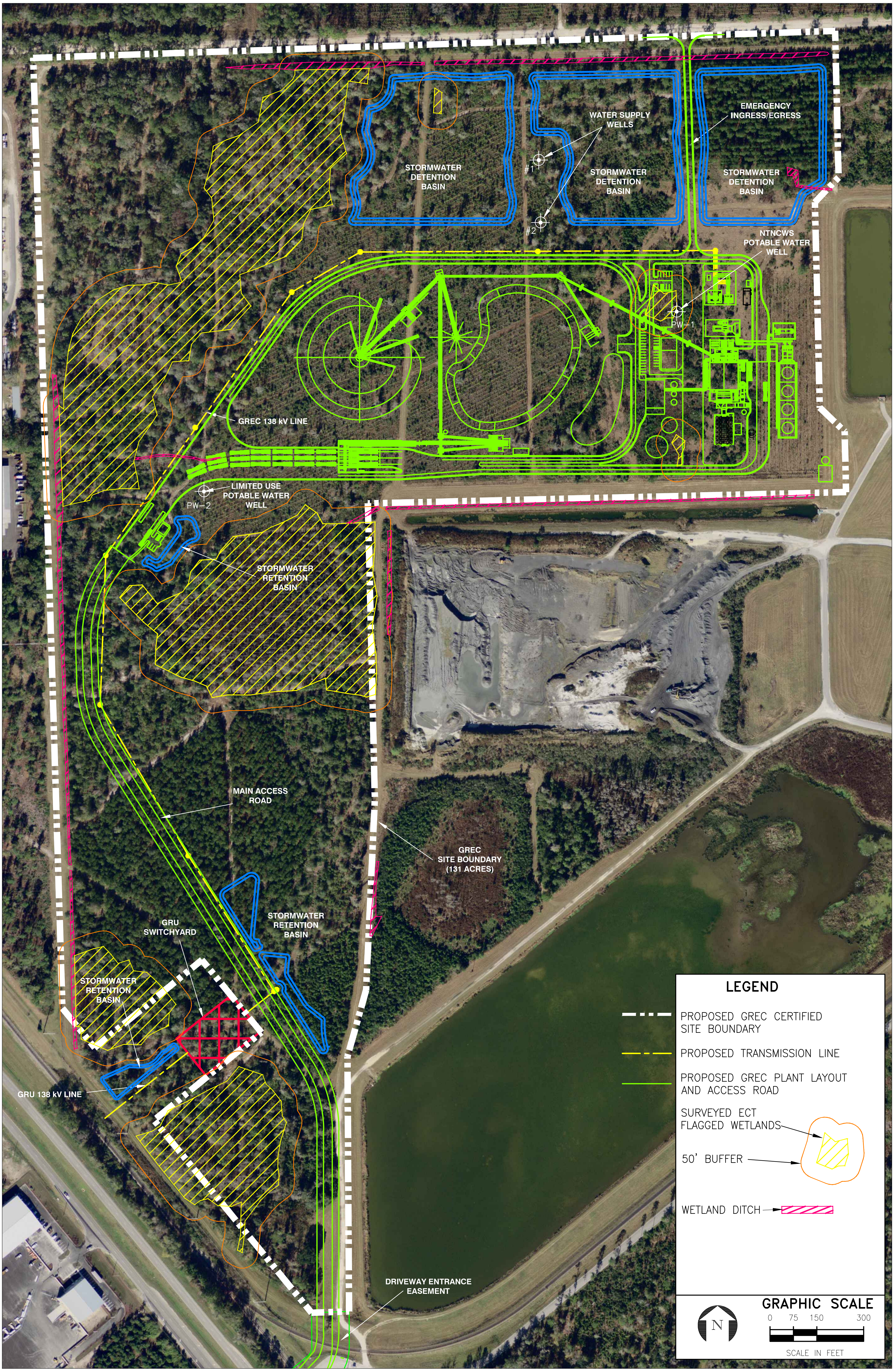

FIGURE 4.2.0-2.
LAYOUT OF PROPOSED FACILITIES
WITHIN GREC SITE

Source: FDOT, 2008; EDA, 2009; Zachary, 2009; Genesis, 2009; ECT, 2009.

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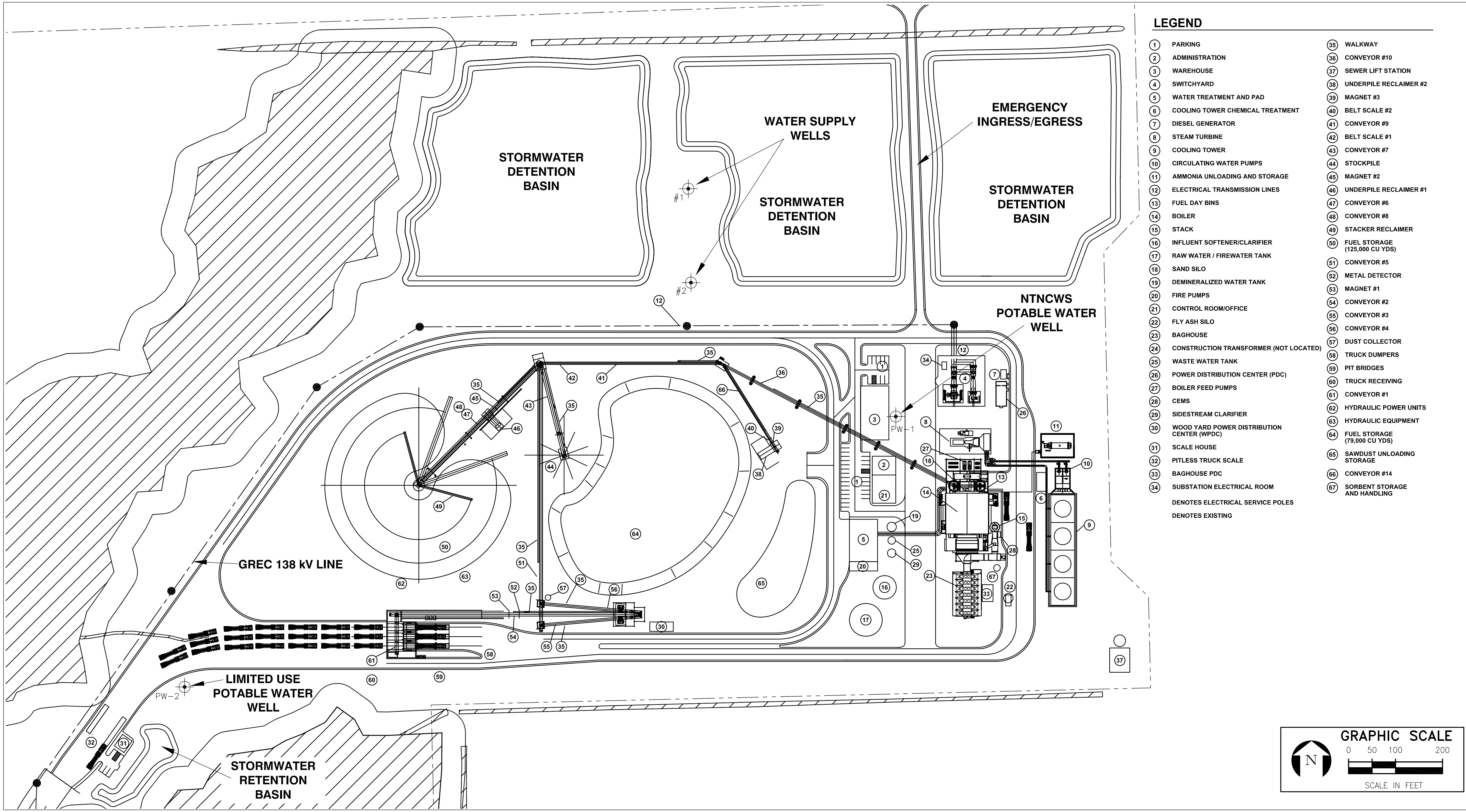

FIGURE 4.2.0-3.

DETAILED FACILITY LAYOUT FOR GREC

Source: FDOT, 2008; Genesis, 2009; Zachary, 2009; EDA, 2009; ECT, 2009.

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turbine, baghouse, stack, cooling tower, switchyard, and ancillary equipment. Adjacent to and west of the power block are the key components of the water and wastewater treatment systems, which consist of a raw water tank, wastewater tank, clarifier/softener, and ZLD system. The control room, offices, warehouse, and parking lot are also located west of the power block.

The westerly portion of the GREC facility is comprised of the fuel delivery, handling, and storage systems. These systems consist of truck scales, truck dumpers, pit bridges, receiving hoppers, sizing disc screens, fuel hogs, conveyors, a stacker/reclaimer, a stationary stacker, and various support structures. One of the fuel storage piles will use an automatic stacker/reclaimer to maintain a constant and groomed supply, while the other pile will be managed by use of manual equipment consisting of a dozer and front-end loader. Other smaller piles of fuel such as sawdust or specialty waste wood products will be separately maintained within the fuel yard. The entire facility will be surrounded with a perimeter road. The combined power block and fuel delivery, processing, and storage areas will occupy approximately 38 acres of the Site.

As shown in Figure 4.2.0-3, three large stormwater detention basins will be located north of the power block and fuel storage areas and will be used to manage runoff from these areas. A small stormwater detention basin will be located at the truck scale area to serve that area. These detention basins will be developed early in the construction phase of GREC to manage runoff from construction activities. Also, as shown in Figure 4.2.0-3, two new groundwater supply wells will be located between two of the large stormwater detention basins. In addition, two potable water wells will be located as shown to provide drinking water and other potable water uses.

Electricity generated from GREC will be transmitted from the plant switchyard in the northern sector of the power block area via a 138-kV transmission line running in a westerly direction and then turning south along the main access road to a switchyard that will be owned and maintained by GRU located just outside the leased Site. A short transmission line will run from the switchyard and will interconnect into GRU's existing 138-kV transmission system running along the east side of U.S. 441.

Primary access to the GREC facility will be via a new main access road constructed at an existing entrance, which was used by the GRU DGS facility for construction, maintenance and repair activities (construction entrance). GRU will have the right to continue to use this entrance, as needed; however, the primary purpose of this entrance will be for GREC.

At the primary entrance along U.S. 441, all vehicles will be routed via a two-way roadway configured to avoid wetlands impacts while ensuring the facility can receive the biomass fuel necessary to maintain continuous operations. Shoulders will be incorporated along the roadway to maintain an unimpeded flow of traffic. This new access road will cross over an existing CSX rail spur that is used for the delivery of coal to the GRU DGS facility, as well as the existing CSX rail line that runs along U.S. 441. As discussed in Subsection 5.1.2, improvements will be made to U.S. 441 at the entrance, including lengthening acceleration and deceleration turning lanes, to safely facilitate the project-related traffic at the entrance.

A second, emergency access road will be constructed running north from the plant area to Northwest 128th Lane. This access road will be provided solely for public safety purposes, such as emergency vehicles. This entrance will remain secured, except if a situation warrants its use.

As shown in Figure 4.2.0-1, construction trailers, equipment laydown, and preparation areas will be temporarily provided in an approximately 8-acre area southeast of the GREC power block area on DGS property just off the GREC Site. Currently, this area consists of grassy fields, and GRU maintains these fields by periodic mowing. A series of existing improved roadways, which will provide excellent ingress and egress, transect throughout this area. GREC-related construction traffic will temporarily use an existing road on DGS property running from the entrance to the laydown area. Also, as shown in Figure 4.2.0-1, an area for temporary use for construction personnel parking will be provided in the southern portion of the Site between the new entrance road and the eastern Site boundary. In addition, during certain stages of the construction activities, the manually managed fuel storage area and other areas within the construction limits will be temporarily used for miscellaneous supply storage, staging, and preparatory work.

Figure 4.2.0-4 presents a conceptual rendering of the proposed GREC facility, which was overlain on a photographic view taken from the boiler building at the existing DGS facilities. This view was selected because it is the only area with an unobstructed view of the proposed GREC facility area. At any offsite viewshed surrounding the Site, the heavily wooded surroundings and distances would shield the facility from view with the potential exception of the upper portions of the fuel piles, stack, boiler, and baghouse.

Table 4.2.0-1 provides the approximate dimensions of the major structures and facilities for GREC.

4.3 FUEL

The primary fuel for GREC will be clean, woody biomass material consisting of forest residue (i.e., tops, limbs, and other material left from traditional logging operations), mill residue (i.e., sawdust, bark, sander dust, and processed butt cuts), precommercial tree thinnings, used pallets, and urban wood waste, which includes woody tree trimmings that are generated by landscaping contractors, power line clearance contractors, and other nonforestry related sources of woody debris. Supplementary fuels could include herbaceous plant matter, clean agricultural residues (i.e., rice hulls, straw, etc.; no animal wastes or manure), diseased trees, woody storm debris, whole tree chips, and pulpwood chips. This fuel will principally be sourced from a 75-mile radius of GREC from a variety of sources. The facility will not use as fuel any form of treated, painted, or coated wood; municipal solid waste; construction and demolition debris; coal; petroleum coke; or tires. Limited quantities of natural gas will be used for startup fuel. Also, limited quantities of ultra-low sulfur diesel (ULSD) will be used for fuel for the emergency generator, emergency firewater pump, and biomass fuel-handling rolling stock (i.e., front-end loaders, bulldozers, etc.).

The GREC facility has been designed to be capable of using the variety of biomass materials mentioned previously, even though the materials may vary in moisture content,

FIGURE 4.2.0-4.

CONCEPTUAL RENDERING OF GREC FACILITY

Source: Zachry, 2009; ECT, 2009.

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Table 4.2.0-1. Dimensions of Major Structures and Facilities

Building/Facility	Dimensions (ft) North to South	East to West	Height
Fuel storage pile (manual reclaim)	400	400	35
Fuel storage pile (automatic reclaim structure)	400	465	85
Turbine enclosure	60	110	40
Boiler structure	167	88	179
Air quality control system area	140	60	70
Office/control room	100	50	30
Wastewater treatment building	60	50	45
Maintenance Facility	115	60	40
Cooling tower (top of fan stack)	240	60	50
Hog/disc screen structure	66	50	77
Truck receiving	54	25	54
Exhaust stack	12*	12*	230

*Diameter.

Sources: Zachry, 2009.
GREC LLC, 2009.

species, size, and age. The biomass materials will be primarily processed (i.e., sorted, chipped/ground, and screened to design-specified size) at offsite fuel preparation locations in the fuel procurement region prior to being delivered to the facility. The delivered biomass material will be further screened and processed onsite and mixed in the fuel yard prior to entering the boiler to achieve a homogenous fuel mixture with an expected average moisture content of approximately 50 percent. The flexibility to use a wide range of biomass materials will enable GREC to obtain its fuel from multiple, regional locations and, therefore, take advantage of competitive fuel pricing and availability opportunities.

While the City of Gainesville’s decision in May 2007 to pursue biomass-fueled generation technologies to meet its future capacity needs was driven primarily by environmental and sustainability concerns, GREC will also reduce fuel price volatility and diversify GRU’s existing fuel mix, which is dominated by coal (and therefore is potentially at risk under future GHG regulations) and natural gas, which is highly volatile in price and availability and also, to a lesser degree than coal, potentially at risk under future GHG regulations. Currently, GRU relies on a single rail carrier for coal and one major pipeline for natural gas. Oil supplies are received in a fairly diverse manner but represent a small fraction of GRU’s energy production. GREC will greatly add to the diversity of GRU’s fuel supply, providing benefits in terms of diversity of transportation, mitigating fuel price volatility, and contributing to Florida’s overall energy independence. GREC will receive fuel deliveries from a number of different directions and a redundant fleet of third party-owned processing equipment and trucks.

The commodity price paid to growers for timber harvest residuals is expected to be relatively independent of commodity price swings in the paper pulp and chip and saw markets. To some extent, these markets are inversely related; for example, when paper pulp markets become soft, growers are incentivized to thin their stands (fuel for GREC) to grow larger trees for the chip and saw market. The most volatile cost for the production and delivery of biomass fuel is the cost of diesel fuel, which represents roughly 5 to 10 percent of the total fuel cost. As a result, the fuel cost for GREC is expected to be much less volatile than conventional fossil fuels and to escalate much more slowly. Furthermore, GREC has the advantage of being able to take advantage of opportunity fuels, such as woody debris from hurricanes, forest fires, ecosystem restoration, land clearing, and insect invasions.

4.3.1 FUEL INVESTIGATION

GRU commissioned four biomass resource studies to determine if sufficient fuel might be economically available, and could be sustainably harvested, within a procurement region of the GREC Site. In addition, GREC LLC conducted an independent fuel assessment to understand the myriad of potential suppliers of the different types of biomass material and how much each material would cost from different locations. These investigations concluded that a more-than-sufficient supply of economically available biomass material exists to support the GREC facility.

4.3.2 FUEL PROCUREMENT STANDARDS AND SUSTAINABILITY PROGRAMS

The City of Gainesville and GRU were concerned about how to minimize the potential for the fuel acquisition process to reduce ecosystem biodiversity in the region. An ad hoc advisory committee of forestry and ecosystem experts from both industry and academia was assembled to address this issue, which resulted in two significant results, as described in the following subsections.

4.3.2.1 Fuel Minimum Sustainability Standards

The first result was a set of stringent minimum sustainability standards for forest-derived fuel acquisition that are part of the PPA between GREC LLC and GRU. Examples of these standards include: (a) acquiring material from timber operations performed according to the Florida Division of Forestry best management practices (BMPs), (b) not using stumps (which would promote soil erosion), (c) not using material derived from the conversion of natural forest to a plantation forest, (d) not using fuel derived from nonnative species unless harvested as part of a forest restoration project, (e) source certification and accountability by truckload, and (f) requiring suppliers to attend an annual sustainability and best practices seminar organized by the GREC procurement staff.

In addition to these minimum sustainability standards, the PPA between GREC LLC and GRU mandates the following:

- GREC shall hire an independent forestry consultant to conduct annual audits of its compliance with the minimum sustainability standards for forest-produced biomass. The independent forestry consultant shall conduct inspections and visits to a randomly selected sample of harvesting sites no less than twice per calendar year.
- GREC shall institute a documentation policy to ensure its suppliers comply with biomass fuel supply contract terms.
- Supply contracts for forest-produced biomass fuel shall incorporate the minimum sustainability standards for forest-produced biomass, and the suppliers shall agree to compliance with these standards.
- Each supply contract for forest-produced biomass must be signed by a professional forester representing the supplier certifying that the professional forester has been engaged by the supplier to ensure compliance with the minimum sustainability standards for forest-produced biomass and confirming the professional forester's understanding of and commitment to fulfill this responsibility.
- Each delivered load of biomass fuel must be labeled by a unique identification number corresponding to the supplier identification number, contract identification number, tract identification number, crew, transport, date, and time and be accompanied by a manifest signed by the harvesting foreman and driver listing such information. If possible, GREC shall seek to use electronic media to increase the accuracy of the information.
- GREC shall record the delivery identification information.
- GREC shall inspect at least 10 percent of all delivered loads to assure compliance with the minimum sustainability standards for forest-produced biomass.
- Suppliers shall keep on file harvesting contracts, cutting agreements, and other related documents for each harvested area, and these files shall be available for inspection by GREC for a period of 3 years following harvest.

- GREC shall conduct semiannual inspections of all suppliers to verify compliance with its recordkeeping procedures and harvesting practices.
- GREC shall reject noncomplying deliveries of biomass fuel.
- GREC shall suspend deliveries from a biomass fuel supplier for a period of no less than 1 year if the supplier is found to be in noncompliance in three separate instances within any 1-year period.

4.3.2.2 Forest Stewardship Program

The second result was what may be the first utility-sponsored Forest Stewardship Incentive Plan in the United States. This plan provides a supplemental payment per ton of fuel delivered for growers operating under an approved independent forest certification program that provides a level of biological protection substantially better than the Division of Forestry BMPs. Currently, two such programs are approved and will earn the grower an additional $0.50 or $1.00 per ton, depending on the program. Once the grower receives certification, it will be issued a contract by GRU that will entitle it to the incentive payment, which will remain in effect as long as the certification is kept current. The administration of the program is subject to Gainesville City Commission policy and GRU staff, while GREC LLC will administer the day-to-day operation of the program. Incentive payments are at the sole expense of GRU.

4.3.3 FUEL PROCUREMENT AREA

GREC intends to source its fuel from an approximately 75-mile radius from the facility. This region has abundant, available fuel wood and a well-established forest industry. There are 6.44 million acres of timberlands within the 75-mile radius, of which 81 percent is privately owned. Figure 4.3.3-1 shows the major timber resource areas and forest product mill locations within this radius. Most of the privately owned timberlands are being actively managed for timber production and are comprised primarily of planted pine timber. The road system in the procurement area is excellent and allows economical transport of wood fuel to the GREC facility. The forest harvesting and hauling sector in the region is also large and capable of supplying GREC with the annual feedstock requirement.

FIGURE 4.3.3-1.

MAJOR TIMBER RESOURCE AREAS AND FOREST PRODUCTS MILLS WITHIN 75-MILE RADIUS OF GREC

Sources: American Renewables, 2009.

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GREC LLC estimates that the majority of the fuel will be forest-produced biomass, which will come from all quadrants within the 75-mile procurement radius surrounding the Site (see Figure 4.3.3-1). The remainder of the fuel will consist of urban wood waste and, to a lesser extent, mill residues. Most of the urban wood waste will likely originate in the Gainesville area to the south of GREC.

4.3.4 FUEL QUALITY

Table 4.3.4-1 outlines the typical constituents of the wood fuel.

Natural gas will be used as the boiler startup fuel. After establishment of a minimum bed temperature of 900°F, wood fuel will be introduced, and the ignition burners will be shut down. Table 4.3.4-2 shows the typical composition of natural gas.

The emergency generator and the emergency firewater pump will be designed to ULSD fuel. Table 4.3.4-3 shows the typical composition of ULSD fuel.

4.3.5 FUEL QUANTITY

The quantity of biomass fuel required at GREC will vary depending on the fuel characteristics (moisture content and chemical constituents). At any moment of unit operation, the fuel firing rate will be influenced by the boiler heat input requirement, boiler efficiency, and fuel higher heating value (HHV). The maximum boiler heat input (British thermal units per hour [Btu/hr]) corresponds to the maximum operating boiler load (i.e., the condition of maximum steam generation). The fuel firing rate (pound per hour [lb/hr]) required to produce the maximum boiler heat input is determined by dividing the boiler heat input by the product of the boiler efficiency (for the specific fuel being fired) and the fuel HHV (British thermal unit per pound [Btu/lb]). The maximum annual quantity of fuel required is the maximum hourly fuel-firing rate for 8,760 hours per year (hr/yr). Based on average annual moisture content of 50 percent, the unit's full load fuel consumption will be 159.3 tons per hour (tph).

Table 4.3.5-1 summarizes maximum annual quantities of biomass fuel required by GREC over the range of potential fuels.

Table 4.3.4-1. Typical Constituent Analysis of Wood Fuel

	Percent by Weight Dry (Unless Otherwise Noted)				
	Slash Pine	Loblolly Pine	Sand Pine	Hard-wood	Weighted Average
Percent of Fuel Mix	59	9	4	28	100
Carbon	50.0	47.3	48.6	47.3	49.0
Sulfur	0.017	0.018	0.016	0.020	0.018
Hydrogen	6.9	5.1	4.4	5.5	6.3
Oxygen	42.1	46.6	45.9	44.5	43.3
Nitrogen	0.16	0.24	0.25	0.20	0.18
Chlorine (ppmw)	36	40	28	54	41
Ash	0.78	0.763	0.76	1.46	0.98
Gross heating value (Btu/lb)	8,624	8,835	8,985	8,166	8,529

Note: Btu/lb = British thermal unit per pound.
ppmw = part per million by weight.

Sources: GREC, 2009.
ECT, 2009

Table 4.3.4-2. Typical Natural Gas Composition

Component	Mole Percent (by volume)
Gas Composition	
Pentane	<0.1
Propane	0.3
I-butane	0.1
N-butane	0.1
Nitrogen	0.3
Methane	96.8
Carbon dioxide	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 units per cubic foot.
gr/100 dscf = grain per 100 dry standard cubic foot.

Source: ECT, 2009.

Table 4.3.4-3. Typical ULSD 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)	138,000 Btu/gal

Note: Btu/gal = British thermal unit per gallon.

Source: ECT, 2009.

Table 4.3.5-1. Quantities of Biomass Fuel-Fired (Based on Design Constituents)

	Unit	Design Basis Biomass Fuel Blend
Maximum rate of design fuel-fired	tph	159.3
Maximum annual quantity of fuel	tpy	1,395,000

Source: GREC LLC, 2009.

The quantity of natural gas fired at GREC will depend on the number of cold boiler starts. The average heat input to the boiler from the warm up burners during a typical 14-hour cold startup is 2,300 million British thermal units. The main boiler could have at least 20 cold starts each year for dispatch, one start following its scheduled maintenance outage, and may have additional starts annually due to brief unscheduled maintenance outages, some of which could also result in cold restarts of the unit based on the duration of the outage. Table 4.3.5-2 summarizes the estimated natural gas requirements based on the assumed number of 20 cold starts each year.

ULSD fuel will be used for the emergency generator and backup firewater pump. The emergency generator and emergency firewater pump diesel drives will have maximum heat inputs of approximately 5.1 and 2.0 million British thermal units per hour (MMBtu/hr), respectively. The routine testing of the emergency generator and emergency firewater pump engines will take place approximately once each month for an 8-hour maximum run. This will result in approximately 96 hr/yr of operation for each engine.

Table 4.3.5-3 summarizes the estimated annual ULSD requirements at GREC based on the liquid fuel characteristics presented in Table 4.3.4-3.

4.3.6 FUEL TRANSPORTATION

The biomass fuel will be delivered to GREC in covered trucks with an average capacity of 25 tons per load. Typically, fuel deliveries will occur over a 15-hour (i.e., 5 a.m. to 8 p.m.) period per day, 6 days (i.e., Monday through Saturday) per week. To meet the facility's annual fuel requirements, approximately 130 to 150 truck loads of fuel will be delivered to the Site daily. To accommodate peak delivery periods, three drive-through truck dumpers will be capable of unloading 24 loads of fuel per hour or 600 tph. The average fuel delivery rate is expected to be approximately 12 loads per hour.

Fuel delivery trucks will access the GREC Site via the main entrance road, entering either from the northwest or southeast from U.S. 441. U.S. 441 is a major four-laned, divided highway in the vicinity of the Site. As part of GREC, improvements will be made to U.S. 441 at the entrance road to safely facilitate the truck delivery traffic, including

Table 4.3.5-2. Quantity of Natural Gas Fired

	Unit	Biomass Boiler per Cold Startup
Heat input per startup	MMBtu/startup	2,300
Number of cold startups per year	Startups/yr	20
Annual quantity of fuel	$MMft^3/yr$	43.8

Note: MMBtu/startup = million British thermal units per startup.
Startups/yr = startups per year.
$MMft^3/yr$ = million cubic feet per year.

Source: GREC LLC, 2009.

Table 4.3.5-3. Quantities of ULSD Fuel Fired

Unit	Emergency Generator	Emergency Firewater Pump
MMBtu/hr	5.1	2.0
hr/yr	96	96
Gallons per year	3,533	1,411

Source: Zachry, 2009.

extending the deceleration and acceleration turning lanes, per FDOT requirements. Detailed transportation analyses were conducted for both the construction and operational phases of GREC to assess potential impacts of the project-related traffic on roads and an intersection in the vicinity of the Site. The results indicate that the traffic impacts due to GREC operations are not expected to be significant on nearby roadways. Section 5.7 and 6.9 and Appendix 10.7.1 of this SCA provide details of the results on these analyses.

4.3.7 BIOMASS FUEL HANDLING AND STORAGE

Design of the fuel handling and storage system focuses on ease of delivery and unloading procedures, location of long-term storage, fuel blending capability, and minimizing noise and dust associated with fuel processing. Figures 4.3.7-1 and 4.3.7-2 illustrate the biomass fuel handling, processing, and storage systems.

4.3.7.1 Fuel Delivery and Unloading at the Site

Fuel delivery to the Site will be via covered trucks hauling an average of 25 tons per load. The delivery system includes scales to weigh each truck entering and departing to determine delivered fuel weight. The trucks will proceed from the scales to the receiving structure that covers the three truck dumpers, pit bridges, and receiving hoppers. The three truck dumpers are a drive-through design with a 63-degree (°) tilt. The trucks will dump into the in-pit receiving hoppers, which have chain conveyors to move the material onto the conveyor that will transport the fuel to the fuel processing system. Fuel delivery is expected to occur 15 hours per day (i.e., 5 a.m. to 8 p.m.), 6 days per week. During around-the-clock plant operation at full load, delivery of approximately 130 to 150 loads of fuel will be required each day that fuel is received. During peak delivery periods, the delivery facilities will be capable of unloading 24 truckloads of fuel per hour or 600 tph.

Some of the fuel that is pre-sized such as sawdust will be delivered by self-unloading trucks and dumped directly in a separate storage area.

4.3.7.2 Biomass Fuel Processing

The biomass fuel materials will be initially chipped/ground and processed at offsite locations prior to being delivered to the Site. As shown in Figure 4.3.7-1, once onsite, the fuel

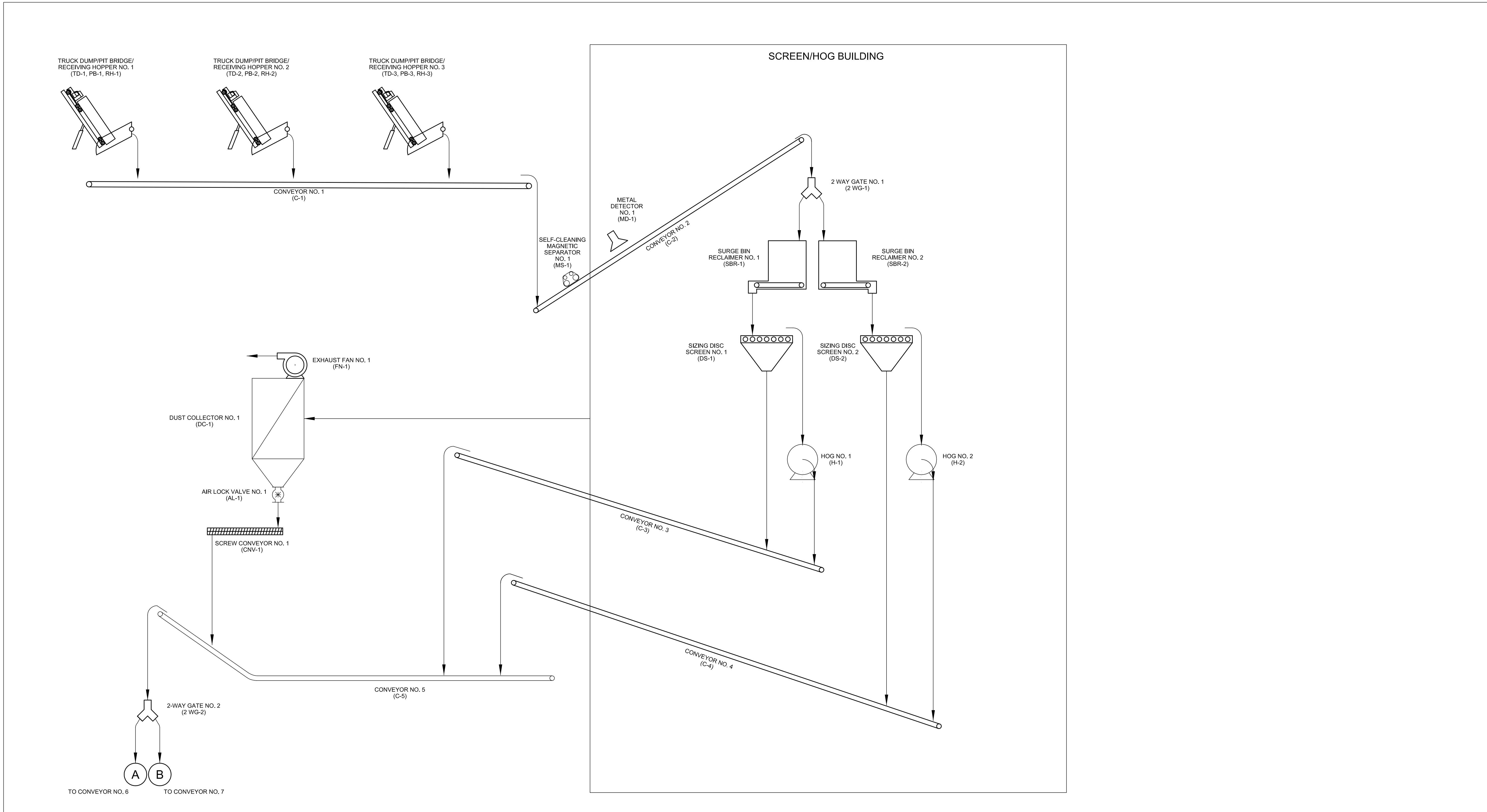

FIGURE 4.3.7-1.

BIOMASS FUEL DELIVERY, UNLOADING, AND PROCESSING SYSTEM

Source: Zachry, 2009; ECT, 2009.

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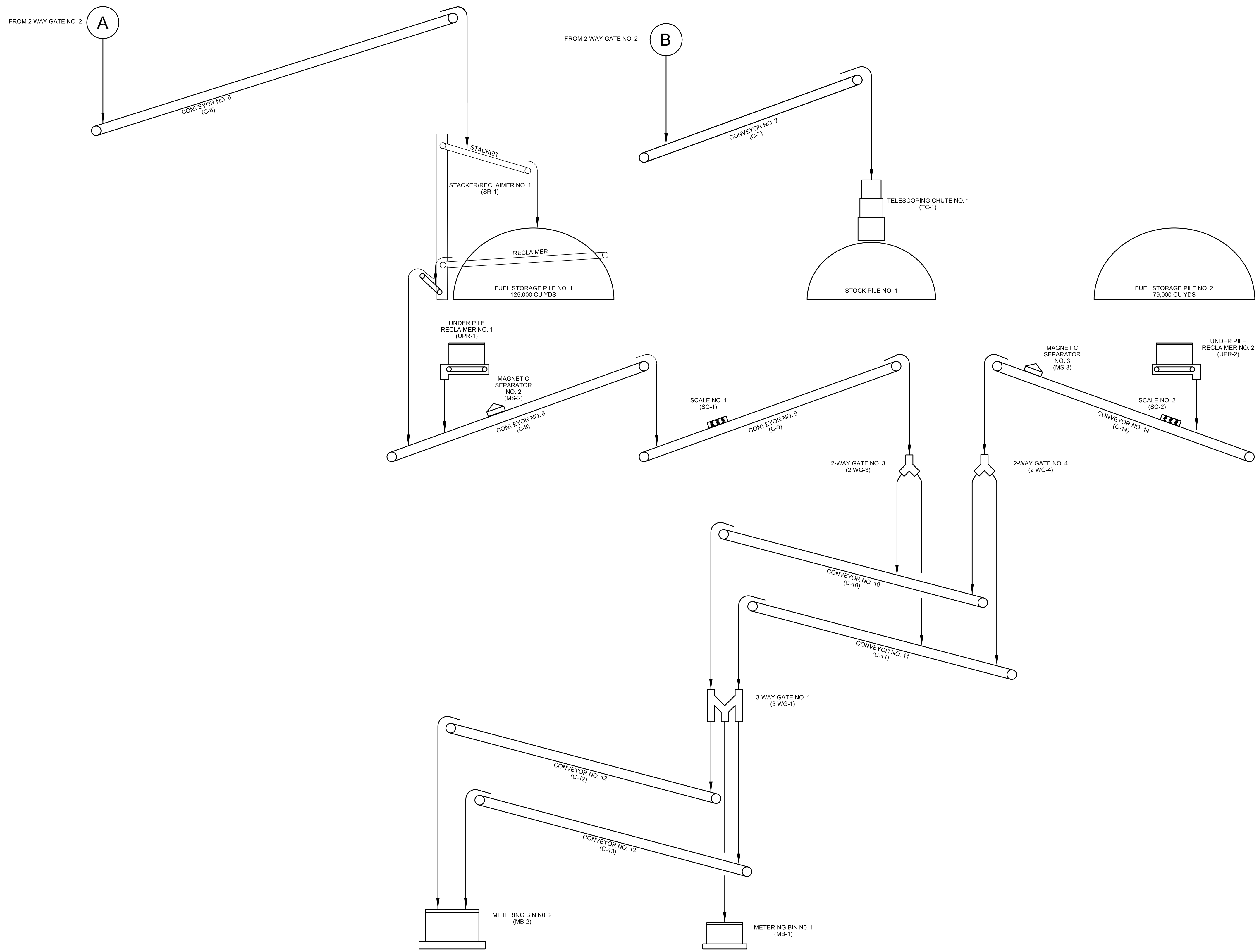

FIGURE 4.3.7-2.

BIOMASS FUEL HANDLING
AND STORAGE SYSTEM

Source: Zachry, 2009; ECT, 2009.

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will be first processed as it is conveyed under a self-cleaning magnetic separator. A metal detector located above the conveyor will then be used to detect ferrous metals, upstream of the disc screen/hammer hog sizing system. The fuel will be fed onto one of two disc screens at a rate of up to 300 tph. Fuel that is 3 inches or less in particle size will drop through the disc screen and onto a conveyor below. A small fraction (typically less than 15 percent) of the fuel that is oversized will not pass through the disc screen slots and will travel over the end of the screen for additional sizing with one of the two hammer hogs.

Each of the hammer hogs is capable of reducing the oversized fuel to a 3-inch minus product at the rate of 100 tph. Hogged fuel will be discharged onto a conveyor for delivery to either the automatic stacker/reclaimer or the fixed stacker. The fuel sizing equipment will be located in the screen/hog enclosure which will include a dust collection system.

4.3.7.3 Biomass Fuel Storage Facilities

The fuel will be stored in one of four storage areas. The first will be a kidney-shaped pile that is formed with an automatic stacker/reclaimer. The pile will be up to 85 ft high and will have a storage capacity of approximately 125,000 cubic yards (yd^3) of fuel. Fuel will be distributed with an articulated stacker boom that rotates up to 240°. The stacker boom can also tilt downward so that the conveyor head is within 20 ft of the ground to minimize the distance that the fuel will drop when the pile is empty. The fuel from the pile will be reclaimed with an over-pile drag bar conveyor that can operate at an angle between 0° to 48° and rotate up to 310° horizontally. During the reclaim process, the over-pile reclaim conveyor will transfer the fuel onto a stationary belt conveyor for delivery to the boiler. The second storage area consists of a conical-shaped pile that is fed with a fixed stacker. The pile will be up to 60 ft high and will have a storage capacity of approximately 8,500 yd^3 of fuel. Rolling stock (i.e., bulldozer or front-end loader) is used to remove fuel from the fixed stacker pile and deliver it to the third manual reclaim storage pile. The manual reclaim storage pile will be approximately 35 ft high with a storage capacity of approximately 79,000 ft^3. Grooming of the manual pile will be performed with rolling stock. A front-end loader will reclaim the material to the boiler feed conveyor system.

The main storage piles will have the capacity to store sufficient fuel for 15 to 20 days of plant operations.

A small fourth pile will consist of sawdust that is delivered in self-unloading trucks. Figure 4.3.7-2 illustrates the fuel storage system.

The delivered biomass fuel will have an average moisture content of 50 percent, which will minimize dust from the storage piles. The storage areas will also be equipped with water spray stations to further control potential dust. Generally, GREC will operate on a *first-fuel-in, first-fuel-out* basis to minimize potential odor and spontaneous combustion fire issues. The storage areas will be looped with a fire main and hydrants for fire protection.

The ground areas under the storage piles will be initially prepared using compacted clay materials, covered by a compacted layer of wood chips. The areas will be contoured and sloped to facilitate drainage of stormwater runoff to the facility's stormwater collection and treatment system.

4.3.8 STARTUP AND EMERGENCY EQUIPMENT FUEL HANDLING AND STORAGE

Natural gas will be used as startup fuel and will be delivered to the Site by an 8-inch underground pipeline running from the existing natural gas system at the GRU DGS. Small day tanks (typically less than 250 gallons) for ULSD fuel for the emergency fire pump and emergency generator will be located within secondary containment areas. ULSD fuel will be delivered as needed to the Site by tank trucks.

4.4 AIR EMISSIONS AND CONTROLS

4.4.1 AIR EMISSION TYPES AND SOURCES

The principal GREC air emissions source is the biomass-fired BFB boiler. Emissions from the BFB boiler comprise 95 percent of total estimated GREC annual emissions. The BFB boiler will be equipped with a comprehensive state-of-the art emission control system that includes BFB combustion, DSI, a fabric filter, and an SCR. This extensive system of emission control equipment will reduce emissions of SO_2, PM, NO_x, H_2SO_4 mist, hydrogen chloride, and hydrogen fluoride.

Emission sources at GREC include:

- BFB boiler.
- Diesel-driven emergency generator.
- Diesel-driven firewater pump.
- Cooling tower.
- Material handling and storage systems.

A description of each emissions source is provided in the following subsections.

4.4.1.1 BFB Boiler

The BFB boiler described in Section 4.1.1 will be the primary source of air emissions. When operating, the BFB boiler will emit the following NSR PSD pollutants: NO_x, SO_2, lead, mercury, CO, VOC, PM/PM_{10}, and H_2SO_4 mist. Each of these pollutants, with the exception of H_2SO_4 mist, lead, and mercury, exceed the PSD significant emission rate thresholds and therefore are subject to PSD review.

Section 4.4.2 provides detailed descriptions of the emission control systems planned for the main boiler. Table 4.4.1-1 provides maximum emission rate estimates for the BFB boiler.

4.4.1.2 Emergency Diesel Generator

An emergency generator will be provided to supply power to the essential service motor control centers during an interruption of the electrical power supply to the Site. Typical essential service loads include plant control systems, turbine turning gear motors, critical oil pumps, plant communication systems, and essential emergency lighting. Based on preliminary design criteria, the size of the emergency generator will be approximately 500 kilowatts (kW). The emergency generator will fire ULSD fuel and be designed with advanced combustion modifications, including retarded timing, to minimize potential NO_x emissions. Excluding operation during emergency conditions, it is estimated that the emergency generator will be operated for a maximum of 96 hr/yr for routine testing and maintenance. Consistent with EPA guidance, for the purpose of estimating potential

Table 4.4.1-1. Biomass-Fired BFB Boiler—Criteria Pollutant and H_2SO_4 Mist Emissions Rates

Pollutant	Averaging Period	Units	Design Fuel
Operating hours	Annual	hr/yr	8,760
Output (100-percent load)	Maximum hourly	MW, gross	116
Heat input (100-percent load)	Maximum hourly	MMBtu/hr (HHV)	1,358
NO_x	Annual	lb/MMBtu	0.070
		lb/MWh	0.82
		tpy	416.4
		lb/hr	95.1
		g/s	11.98
SO_2	Annual	lb/MMBtu	0.041
		lb/MWh	0.48
		tpy	243.9
		lb/hr	55.7
		g/s	7.0
CO	Annual	lb/MMBtu	0.12
		lb/MWh	1.4
		tpy	713.8
		lb/hr	163.0
		g/s	20.5
VOC	Annual	lb/MMBtu	0.013
		lb/MWh	0.15
		tpy	77.3
		lb/hr	17.7
		g/s	2.2
$PM/PM_{10}/PM_{2.5}$ (filterable)	Annual	lb/MMBtu	0.015
		lb/MWh	0.18
		tpy	89.2
		lb/hr	20.4
		g/s	2.6

Table 4.4.1-1. Biomass-Fired BFB Boiler—Criteria Pollutant and H_2SO_4 Mist Emissions Rates (Continued, Page 2 of 2)

Pollutant	Averaging Period	Unit	Design Fuel
$PM/PM_{10}/PM_{2.5}$ (condensable)	Annual	lb/MMBtu	0.027
		lb/MWh	0.32
		tpy	160.6
		lb/hr	36.7
		g/s	4.6
$PM/PM_{10}/PM_{2.5}$ (total)	Annual	lb/MMBtu	0.042
		lb/MWh	0.49
		tpy	249.8
		lb/hr	57.0
		g/s	7.2
H_2SO_4	Annual	lb/MMBtu	0.0010
		lb/MWh	0.012
		tpy	5.9
		lb/hr	1.4
		g/s	0.18

Note: lb/MWh = pound per megawatt-hour.
g/s = gram per second.

Sources: GREC LLC, 2009.
Metso, 2009.
ECT, 2009.

emission rates it was assumed the emergency generator diesel engine would operate up to 500 hours per year.

Table 4.4.1-2 provides maximum emission rate estimates for the emergency diesel generator.

4.4.1.3 Diesel-Driven Firewater Pump

The facility will be designed with a diesel-driven firewater pump to provide water to the firewater system in the event of an emergency that makes the electric motor-driven fire pump inoperable. The firewater pump will be fired with ULSD fuel and will only be used in case of an emergency and for periodic testing. Based on preliminary design criteria, it is estimated that the firewater pump diesel engine will have an output rating of 275 horsepower (hp). Excluding operation during emergency conditions, it is estimated that the firewater pump will be operated a maximum of 96 hr/yr for routine testing and maintenance. As was the case for the emergency generator diesel engine, for the purpose of estimating potential emission rates, it was assumed the emergency generator diesel engine would operate up to 500 hr/yr.

Table 4.4.1-3 provides maximum annual emission rate estimates for the diesel-driven firewater pump.

4.4.1.4 Material Handling Systems and Storage Facilities

Material handling and storage systems for biomass fuel, BFB boiler sand, DSI sorbent, and fly ash will generate PM emissions. In general, particulate emissions from material handling will be generated from four general source categories: transfer points, material processing, storage piles, and fuel bins. A combination of good operating practices and fabric filters will be used to control PM for the GREC material handling emission sources.

Transfer points will include biomass fuel truck unloading, conveyor-to-conveyor drops, material transfers from reclaimers to conveyors, and transfers from conveyors to storage piles and fuel bins. PM emissions will be generated as the material drops through the

Table 4.4.1-2. Emergency Generator Diesel Engine Emission Rate Estimates

Pollutant	Averaging Period	Unit	Value
Operating hours*	Annual	hr/yr	500
Engine output (100-percent load)	Maximum hourly	bhp	757
NO_x	Hourly	lb/hr	5.6
	Annual	tpy	1.4
SO_2	Hourly	lb/hr	0.0078
	Annual	tpy	0.0020
CO	Hourly	lb/hr	5.8
	Annual	tpy	1.5
VOC	Hourly	lb/hr	2.4
	Annual	tpy	0.160
$PM/PM_{10}/PM_{2.5}$ (filterable)	Hourly	lb/hr	0.25
	Annual	tpy	0.063

*Operating hours reflect EPA guidance for estimating potential emissions rates from emergency engines.

Sources: GREC LLC, 2009.
ECT, 2009.

Table 4.4.1-3. Diesel-Driven Firewater Pump Emission Rate Estimates

Pollutant	Averaging Period	Units	Value
Operating hours*	Annual	hr/yr	500
Engine rating (100-percent load)	Maximum hourly	hp	275
NO_x	Hourly	lb/hr	1.3
	Annual	tpy	0.32
SO_2	Hourly	lb/hr	0.0031
	Annual	tpy	0.00078
CO	Hourly	lb/hr	1.6
	Annual	tpy	0.39
VOC	Hourly	lb/hr	0.55
	Annual	tpy	0.14
PM/PM_{10} (filterable)	Hourly	lb/hr	0.15
	Annual	tpy	0.023

*Operating hours reflect EPA guidance for estimating potential emissions rates from emergency engines.

Sources: GREC LLC, 2009.
ECT, 2009.

transfer point. The potential to generate PM emissions at a transfer point is a function of the rate at which the material flows through the transfer point, exposure to wind, and the material's particle size and moisture content. To the extent practical and appropriate, material handling transfer points will be enclosed. Where complete enclosure is not practical, partial enclosure will be utilized to control PM emissions. Silos storing dry materials (i.e., DSI sorbent and fly ash) will be equipped with bin vent filters with a design outlet PM concentration of no more than 0.015 grain per dry standard cubic foot (gr/dscf) or will be vented to the BFB boiler.

PM emissions associated with biomass fuel storage piles include dust emissions produced by adding/removing material from the pile, routine pile maintenance, and dust emissions from wind erosion. Water dust suppression will be applied as required to the active storage piles.

The primary plant roadways will be paved. These roads will be watered or swept, as necessary, to control fugitive PM emissions. Traffic on unpaved roads will be kept to the minimum required for plant operations and will be watered, as necessary, to control fugitive PM emissions.

Controlled material handling point-source annual PM emissions (all of which are assumed to be $PM_{2.5}$ or less) are estimated to total 28.0 tpy. Material handling fugitive PM, PM_{10}, and $PM_{2.5}$ emissions are estimated to be 11.6, 2.3, and 0.34 tpy, respectively. Detailed emission rate calculations are provided in Appendix A of the PSD permit application included in Appendix 10.2.5 (Volume 3) of this SCA.

4.4.1.5 Cooling Tower

PM emissions will occur from cooling towers as a result of the 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. The GREC four-cell cooling tower will use groundwater as makeup. Because of direct contact between the cooling water and ambient air, a small portion of the recirculated 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 re-circulated 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 cooling tower recirculation 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. GREC will minimize the amount of drift from the cooling tower by installing high efficiency drift eliminators that will limit the drift loss rate to 0.0005 percent of the re-circulated cooling water. Drift eliminators are designed to remove as many droplets as feasible before leaving the tower. Recirculation is accounted for in cooling tower design by specifying an inlet wet bulb temperature 2°F greater than the ambient wet bulb temperature.

Controlled cooling tower annual PM, PM_{10}, and $PM_{2.5}$ emissions are estimated to be 1.5, 1.0, and 0.0032 tpy, respectively. Detailed emission rate calculations are provided in Appendix A of the PSD permit application included in Appendix 10.2.5 (Volume 3) of this SCA.

4.4.2 AIR EMISSION CONTROLS

This section describes the emission control technologies that will be used to minimize potential emissions from the main boiler. Figure 4.4.2-1 shows a simplified schematic diagram of the BFB boiler emission control technologies. A detailed description of each control system is provided in the following subsections.

4.4.2.1 NO_x Control

The BFB boiler design is a BFB combustor system equipped with overfire air to stage combustion process and flue gas recirculation (FGR) to reduce peak combustion

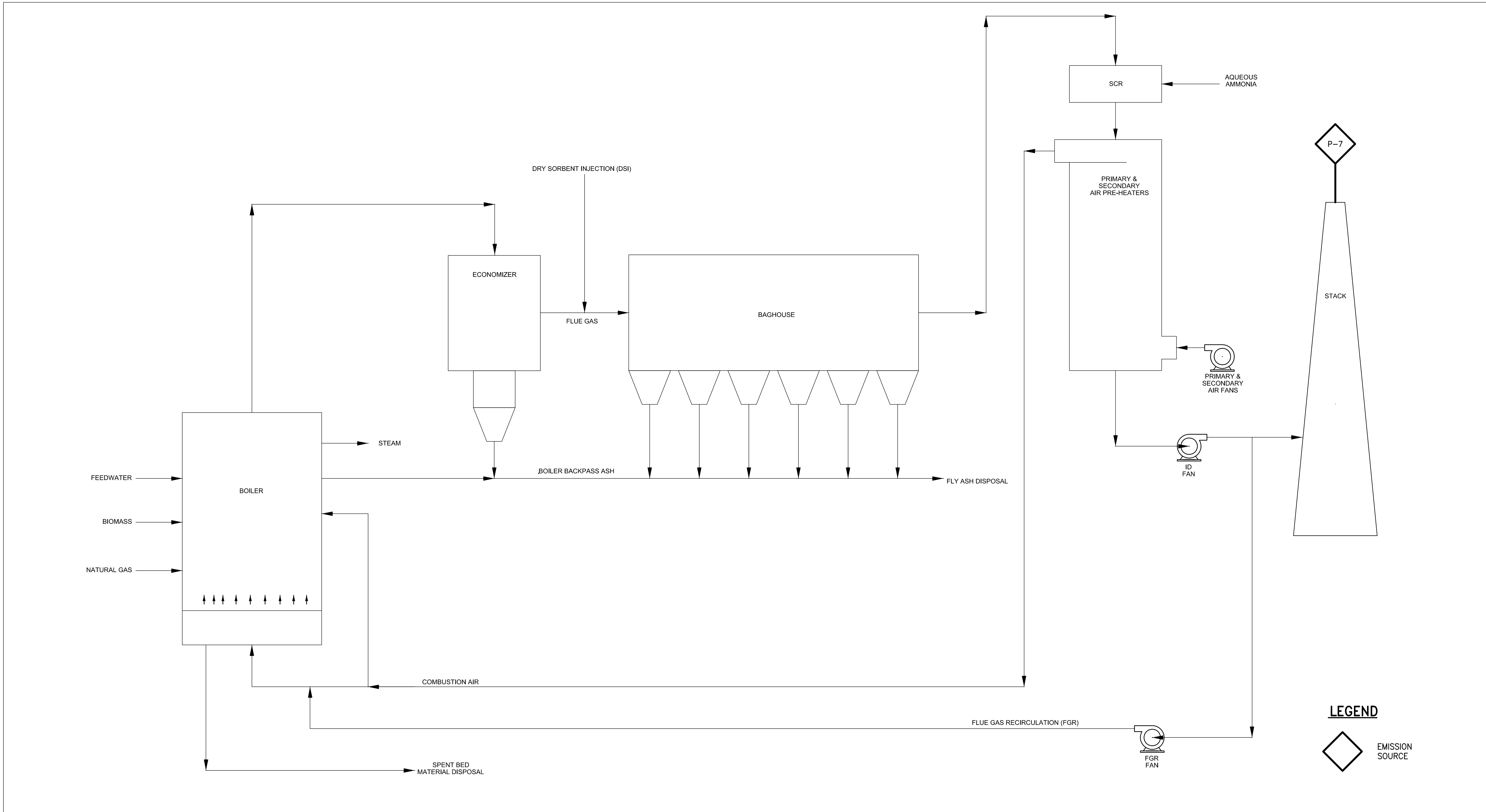

FIGURE 4.4.2-1.

GREC BFB BIOMASS BOILER EMISSION CONTROL TECHNOLOGIES

Sources: Zachry Engineering, 2009; ECT, 2009.

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temperatures. Both of these combustion modifications will reduce the formation of NO_x. A low-dust SCR system will be installed downstream of the baghouse to further reduce NO_x emissions to no more than 0.07 lb/MMBtu. SCR is the state-of-the-art technology for the reduction of NO_x from flue gas streams. The proposed SCR system is designed for low dust loading applications and will be located downstream from the baghouse. The SCR system uses a catalyst and a reactant (ammonia gas [NH_3]) to dissociate NO_x into nitrogen gas and water vapor. The catalytic process reactions for this NO_x removal are as follows:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$

$$4NO_2 + 8NH_3 + 2O_2 \rightarrow 6N_2 + 12H_2O$$

As the optimum operating temperature for the low-dust SCR is between 460°F to 575°F, the baghouse outlet temperature will be maintained at a temperature ranging from 460°F to 550°F. A tubular air heater will be installed downstream of the SCR to transfer heat from the flue gas to the combustion air. The system will be designed to use aqueous ammonia (containing less than 20-percent ammonia by volume) as the reducing agent. Aqueous ammonia will be injected into the flue gas via a distribution grid upstream of the SCR catalyst. Table 4.4.2-1 provides a summary of the preliminary SCR design criteria.

4.4.2.2 PM/PM_{10} Control

A pulse jet fabric filter, or baghouse, will be provided to remove PM from the GREC BFB boiler flue gas stream. The baghouse will consist of 12 individual filter compartments located downstream of the economizer and upstream of the SCR, air heater and induced draft fans. Each compartment consists of a filter bag section with a hopper to collect the fly ash. The top of the bag section includes a tubesheet with nominal 6-inch diameter holes to accommodate several hundred bag and cage assemblies. The filter bag section for each compartment will include between 250 and 350 bags that are 6 inches in diameter and between 14 and 26 ft long. The bag and cage assemblies are supported vertically by the tube sheet over the hopper.

The BFB boiler flue gas enters the baghouse compartment through a rectangular opening near the top of the hopper. Baffles are used to direct and evenly distribute the flue gas

Table 4.4.2-1. Preliminary SCR Design Criteria

Parameter	Unit	Estimated Design Value	Notes
Catalytic reaction temperature	°F	460 to 575	Alternate lower temperature may be considered
Inlet gas temperature	°F	460 to 550	Alternate lower temperature may be considered
Inlet gas flow rate	lb/hr	1,463,200	
Reducing agent		Aqueous ammonia	
Ammonia feed rate	lb/hr	350	
NO_x inlet concentration	ppmvd at 7-percent oxygen	92 (0.15 lb/MMBtu)	
NO_x outlet concentration	ppmvd at 7-percent oxygen	43 (0.07 lb/MMBtu)	
NO_x control efficiency	%	47	
Ammonia slip	ppmvd at 7-percent oxygen	10 ppm	
Catalyst life	Years	2 to 3	

Source: GREC, 2009.

upwards into the array of bag and cage assemblies. Fly ash is collected on the outside of the bag and cage assemblies as the flue gas travels through the bag fabric and through holes in the tubesheet. PM captured on the bags will form a filter cake that increases both the filtration efficiency of the cloth and its resistance to gas flow. The space above the tubesheet is connected to the common clean flue gas outlet duct.

When the pressure drop across the baghouse reaches a predetermined value, the outlet damper for the first of the 12 compartments will close for bag cleaning. Cleaning of the bags is accomplished with high-pressure air blowpipes that are located over the rows of bags. Each blowpipe has round holes located directly above the center of each bag in the row. During each cleaning, a pulse valve is opened for 100 milliseconds to supply the blowpipe with high-pressure air that is directed downward on the inside of each bag in the row. The quick pulsing of the bags with high-pressure air dislodges fly ash from the outside of the bag for collection in the hopper below. Venturi nozzles that are integral to the steel cage assembly aid in improving the distribution of pulse air over the entire length of the bag. After a specified dwell time, another pulse valve is opened to clean another row of bags. This cycle is repeated until all of the rows of bags in the compartment have been pulsed. The compartment outlet damper is then opened to place the compartment back in service. The cleaning cycle is then repeated for each of the subsequent 11 compartments remaining to be cleaned.

A baghouse is a constant outlet PM concentration emission device. Pressure drop across the filter fabric, inlet PM loading, or changes in gas volumes will change the rate of filter cake buildup but will not change the outlet PM concentration. Actual performance of a fabric filter depends on the specific baghouse design criteria including the air-to-cloth ratio, filter fabric material, permeability of the fabric and filter cake, loading and nature of the particulate (e.g., irregular-shaped or spherical), particle size distribution and, to some extent, frequency of the cleaning cycle.

The design of a pulse jet fabric filter system is based on inlet loading rates, fly ash characteristics, and selection of a suitable filter fabric and finish. Although specific design parameters cannot be established until the actual fabric filter manufacturer is selected, the

GREC BFB boiler fabric filter system will be specified to achieve a maximum filterable $PM/PM_{10}/PM_{2.5}$ emission rate of 0.015 lb/MMBtu.

Based on the design biomass fuel ash content of 0.98 percent (on a dry basis) and a 100-percent fly ash distribution of boiler ash, the design particulate loading to the fabric filter will be approximately 1.36 lb/MMBtu. Essentially all of the biomass ash is discharged from the BFB boiler as fly ash since any bottom ash/sand that exits from the bottom of the boiler is separated from the large biomass fuel impurities (e.g., rocks and other large solids) and recycled back to the boiler. Controlling particulate emissions to a rate of 0.015 lb/MMBtu represents a control efficiency of approximately 99 percent. Table 4.4.2-2 summarizes the preliminary fabric filter design criteria.

4.4.2.3 SO_2 Control

The BFB boiler will reduce SO_2 emissions as the lime (calcium oxide) from the ash reacts with the SO_2 to produce calcium sulfate in the bed. Calcium sulfate is a solid that will be removed as fly ash. As the molar ratio of calcium to sulfur in the fuel is at least 8 to 1, there are sufficient amounts of lime in the bed to promote good SO_2 capture. Further reduction of SO_2 emissions is expected due to the use of DSI control technology.

4.4.2.4 Mercury

Mercury emissions from the GREC boiler will be low due to the low concentration of mercury in the biomass fuel. The majority of the BFB boiler mercury emissions are expected to be emitted in gaseous form with an estimated annual emission rate of 16.7 pounds per year (lb/yr).

4.4.3 BEST AVAILABLE CONTROL TECHNOLOGY

The proposed GREC facility will be classified as a major new source of air pollution. As such, the facility will be subject to the NSR PSD preconstruction permitting and review requirements for certain pollutants. Among these requirements, the facility will be required to evaluate potentially feasible emission control technologies and install control technologies that represent BACT for each pollutant that is subject to PSD review: NO_x, CO, PM, PM_{10}, SO_2, and VOC. BACT is defined as an emission limitation based on the

Table 4.4.2-2. Preliminary Fabric Filter Design Criteria

Parameter	Unit	Estimated Design Value	Notes
Flue gas flow rate to fabric filter	ACFM	700,000	Flue gas flow to the fabric filter is based upon the design wood mix
Inlet gas temperature	°F	460 to 550	
Inlet filterable particulate loading	lb/hr	1,850 (1.36 lb/MMBtu)	Based on design wood mix ash content of 0.98 percent and heating value of 8,529 Btu/lb HHV, dry basis and sorbent
Outlet filterable particulate emissions	lb/MMBtu lb/hr	0.015 20.4	Based on maximum heat input of 1,358 MMBtu/hr
Bag material	—	—	To be determined during detailed design
Bag diameter, length, number of bags	—	—	To be determined during detailed design
Number of modules and compartments per module	—	—	To be determined during detailed design
Air to cloth ratio	—	Approximately 4.0 to 1	Final air-to-cloth ratio will be determined during detailed design
Pressure drop across baghouse	Inches of water	6 to 8	
Cleaning mechanism and cycle	—	Pulse jet	

Note: ACFM = actual cubic foot per minute.

Sources: GREC LLC, 2009.
Metso, 2009.
ECT, 2009.

maximum degree of reduction for each pollutant that would be emitted from any proposed installation that the permitting agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for the installation or major modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant.

The primary guidance used in preparation of a BACT analysis is EPA's NSR Workshop Manual: PSD and Nonattainment Area Permitting, Draft, October 1990 (NSR Manual). The NSR Manual describes EPA's *top-down* approach to developing BACT control technologies and emission limits.

The principal GREC emission source will be the BFB boiler. Emissions from the boiler comprise 95 percent of total estimated GREC project annual emissions. Accordingly, the primary emphasis of the BACT analysis conducted for GREC was directed to the BFB boiler. The proposed configuration of a BFB combustor, DSI, baghouse, and SCR is considered the most stringent emission control technology train available for biomass-fired boilers and to represent BACT for the GREC BFB boiler.

4.4.3.1 BACT Methodology

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 provides that all available control technologies be ranked 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.

4.4.3.2 Proposed BACT Technologies and Emission Limits

Table 4.4.2-3 summarizes proposed BACT technologies and emission limits for each pollutant subject to PSD review. The complete BACT analysis is included in Appendix 10.2.5, PSD Air Construction Permit Application (Volume 3), of this SCA.

The following sections discuss proposed BACT control technologies and emission limits for the GREC BFB boiler. As previously stated, the complete BACT analysis is included in Appendix 10.2.5 of this SCA.

4.4.3.3 Nitrogen Oxides

For the control of BFB boiler NO_x emissions, GREC is proposing combustion staging, FGR, and the installation of an SCR control technology. Combustion staging with overfire air and FGR results in lower flame temperatures and consequently reduced NO_x formation. Of the available NO_x emissions control technologies available, SCR is known to offer the maximum reduction. Combustion staging and FGR, combined with SCR, will limit BFB boiler NO_x emissions to a maximum rate of 0.070 lb/MMBtu.

4.4.3.4 Sulfur Dioxide

Control of SO_2 emissions will be initially accomplished in the bubbling bed furnace. Sufficient amounts of calcium, sodium, and potassium will be available from the biomass ash to capture SO_2 in the BFB boiler. SO_2 emissions will be controlled further by injecting a dry sorbent in the duct upstream of the baghouse. BFB boiler technology and DSI will achieve a maximum emissions rate of 0.041 lb/MMBtu.

Table 4.4.2-3. Proposed BACT Emission Limits and Control Technologies

Pollutant	Proposed Emission Limit, Compliance Method, and Averaging Period	Proposed BACT Technology
NO_x (BFB boiler)	0.070 lb/MMBtu (30-day rolling average; CEMS)	BFB technology
SO_2 (BFB boiler)	0.041 lb/MMBtu (30-day rolling average; CEMS)	BFB technology, low sulfur biomass fuel, and DSI
PM/PM_{10} filterable (BFB boiler)	0.015 lb/MMBtu (3-hour stack test)	Fabric filter
CO (BFB boiler)	0.120 lb/MMBtu (30-day rolling average; CEMS)	Proper boiler design and operation
VOC (BFB boiler)	0.013 lb/MMBtu (3-hour stack test)	Proper boiler design and operation
Opacity	10 percent (6-minute average) 20 percent (one 6-minute average per hour)	Fabric filter
PM/PM_{10} (material handling)	0.015 gr/dscf (baghouses)	Transfer Points—spray dust suppression and enclosed or partially enclosed transfer points Storage Piles—compaction, spray dust suppression, wetting agents Storage Silos—fabric filters
Emergency diesel generator		ULSD fuel, limited operation, and NSPS Subpart III emissions limits
Emergency firewater pump diesel engine		ULSD fuel, limited operation, and NSPS Subpart III emissions limits
Cooling tower PM/PM_{10}		Drift eliminators capable of reducing drift from the cooling tower to 0.0005 percent of the recirculating water flow

Note: CEMS = continuous emissions monitoring system.

Sources: GREC LLC, 2009.
ECT, 2009.

4.4.3.5 Particulate Matter

For the BFB boiler, GREC is proposing a fabric filter designed to achieve a controlled filterable emission rate of 0.015 as PM/PM_{10} BACT. The fabric filter control system provides the most effective filterable PM control technology. The BFB boiler fabric filters will also remove reacted acid gases (i.e., hydrogen chloride, H_2SO_4 mist, and hydrogen fluoride) following the addition of an alkaline sorbent by the DSI control system.

4.4.3.6 Carbon Monoxide and Volatile Organic Compounds

CO and VOC are produced by incomplete combustion of carbon and organic compounds contained in the biomass fuel. Excessive emissions of CO and VOC are eliminated by proper boiler operation, e.g., sufficient residence time, adequate temperature, and turbulence in the combustion zone. The type of BFB boiler proposed by GREC is designed to minimize CO and VOC emissions by providing more than 3 seconds of residence time and temperatures above 1,500°F and promoting good mixing with underbed and overfire air in the boiler.

4.4.4 DESIGN DATA FOR CONTROL EQUIPMENT

The GREC BFB boiler will use state-of-the-art technologies to minimize air emissions including the use of BFB combustion, DSI, fabric filter, and SCR. Section 4.4.2 of this SCA provides details of these control technologies.

4.4.5 DESIGN PHILOSOPHY

Air emission control systems planned for GREC have been designed to fully comply with all applicable state and federal regulations. Specific design concepts are summarized as follows:

- Application of BACT for all affected pollutants and emission sources.
- Use of combustion staging, FGR, and SCR to minimize NO_x emissions.
- Use of BFB boiler technology, low sulfur biomass fuel, and DSI to minimize SO_2 emissions.
- Use of a fabric filter to minimize PM/PM_{10} emissions.
- Good combustion practices to minimize CO and VOC emissions.

Air emission control technologies planned for GREC reflect the application of BACT for each affected pollutant and emission source. The proposed BACT limitations are well below applicable state and federal emission standards (e.g., New Source Performance Standards [NSPS]). The proposed BACT emission limit for the principal air pollutant that will be emitted, NO_x, is equal to or lower than the lowest rates that have been mandated for any biomass fired plant in the United States.

4.4.6 CO_2 EMISSIONS

Although significant amounts of CO_2 are generated during the combustion of biomass fuel, the firing of biomass for power generation is considered to be carbon neutral as the amount of CO_2 generated during the combustion process is returning the atmospheric CO_2 that was previously absorbed by the biomass during its growth cycle. Accordingly, GREC will not contribute any new net CO_2 to the atmosphere.

4.5 PLANT WATER USE

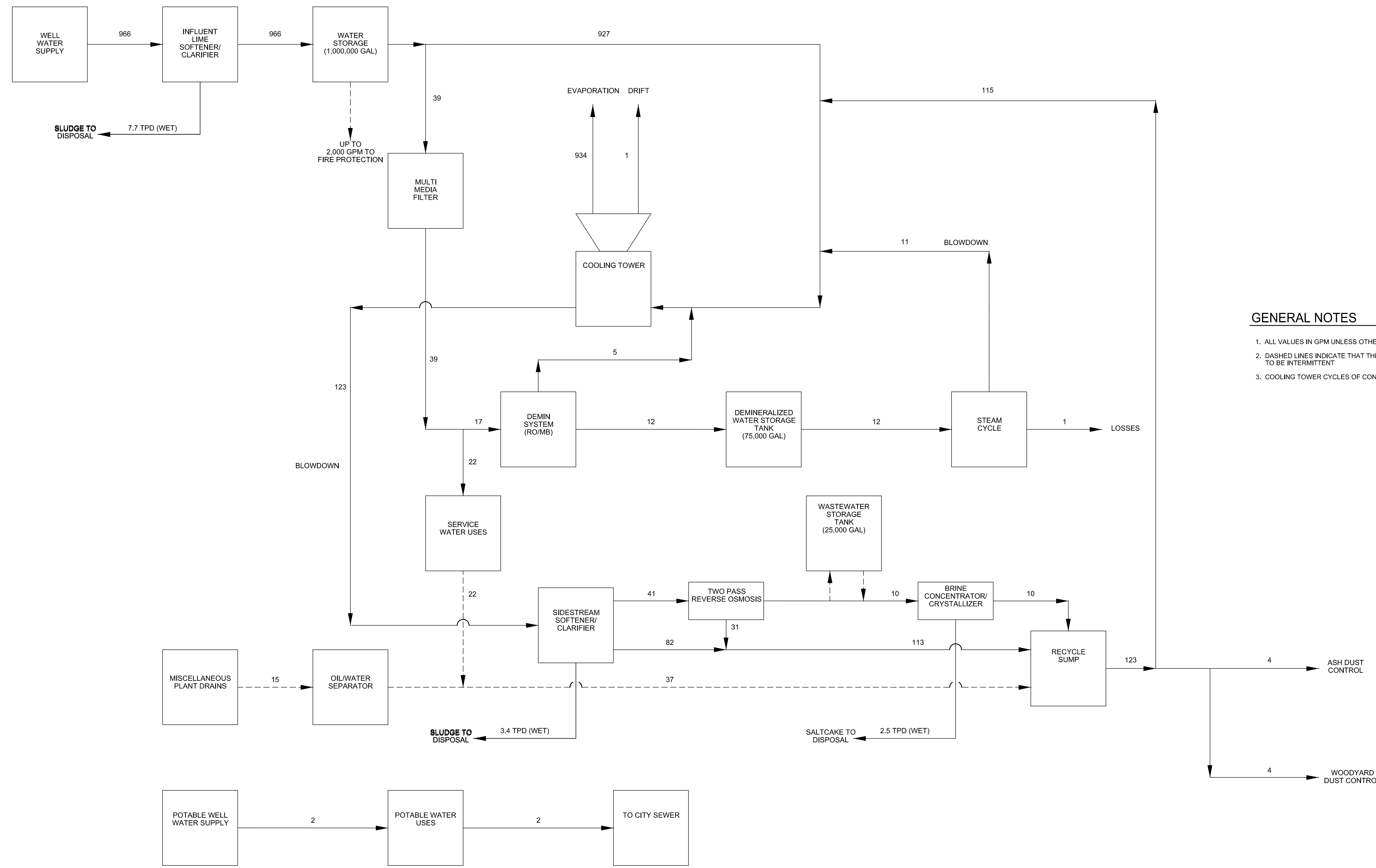
The GREC facility will require water for cooling tower makeup, boiler makeup, other plant process water uses, and potable water uses. The total water requirement is estimated to be approximately 1.4 MGD on an annual average basis and approximately 1.5 MGD on a maximum daily basis. The source of GREC operational water for cooling tower makeup and other process water uses will be groundwater withdrawn from the UFA through two new onsite wells located north of the biomass fuel storage yard. Potable water will be provided by groundwater withdrawn from two separate, small wells dedicated for potable use only. Based on the results of detailed modeling analyses, GREC's proposed groundwater use will have immeasurably small potential impacts on groundwater and surface water levels and quality, wetlands, or other environmental resources on and in the vicinity of the Site. Also, these analyses demonstrate that GREC's proposed water use will comply with all SRWMD applicable requirements for water use permit approval, including the conditions for issuance under SRWMD's recent proposed amendments to Chapter 40B-2, F.A.C. These analyses include an alternative water supply feasibility assessment, which demonstrates that it is currently not feasible to use reclaimed water to meet GREC's water needs. Section 6.3.2 and Appendix 10.8 of this SCA provide details on these analyses and impact assessments.

Further, to minimize potential groundwater use impacts in the Site vicinity, GREC LLC and GRU have an agreement whereby GRU will reduce its existing approved groundwater use allocation for DGS Unit 2 (Case No. PA 74-04H, Condition of Certification III.A) by 1.4 MGD after certification is approved for GREC and prior to the start of GREC commercial operations. Attachment 4 in Appendix 10.8 of this SCA contains a copy of the letter from GRU confirming this agreement.

Based on the proposed water conservation features, the water supply and use plans for GREC have been designed to minimize the use of groundwater while maximizing the recycling and reuse of plant and other wastewaters. Figures 4.5.0-1 and 4.5.0-2 illustrate the facility water balances for annual average and maximum daily flows, respectively, under normal operations. As shown in these figures, the source of water for GREC will be well water supplied from onsite wells. In addition, the water system will be designed to recycle and reuse plant process wastewaters using a ZLD system. The discharge water of the recycle sump will provide water for ash and fuel yard dust control, as well as a small portion of cooling tower makeup. Through use of the ZLD system, GREC will have no offsite industrial wastewater discharges.

Groundwater will be used in plant processes, such as steam cycle makeup and plant service water, and as a makeup for the cooling tower. Groundwater will be withdrawn from the UFA through two onsite wells. The wells will be newly developed during construction of GREC. Further, as shown in Figures 4.5.0-1 and 4.5.0-2, the primary source of water for cooling tower makeup, which constitutes the largest operational water use (i.e., approximately 1.35 MGD of evaporative and drift losses), will be treated groundwater from the two onsite wells.

The raw water from the wells will be treated with a lime softener/clarifier to reduce hardness. The treated well water will be pumped to the 1,000,000-gallon storage tank. Sections 4.5.4.2 and 4.5.4.3 discuss in further detail the additional water systems, such as the demineralized water and ZLD systems.



GENERAL NOTES

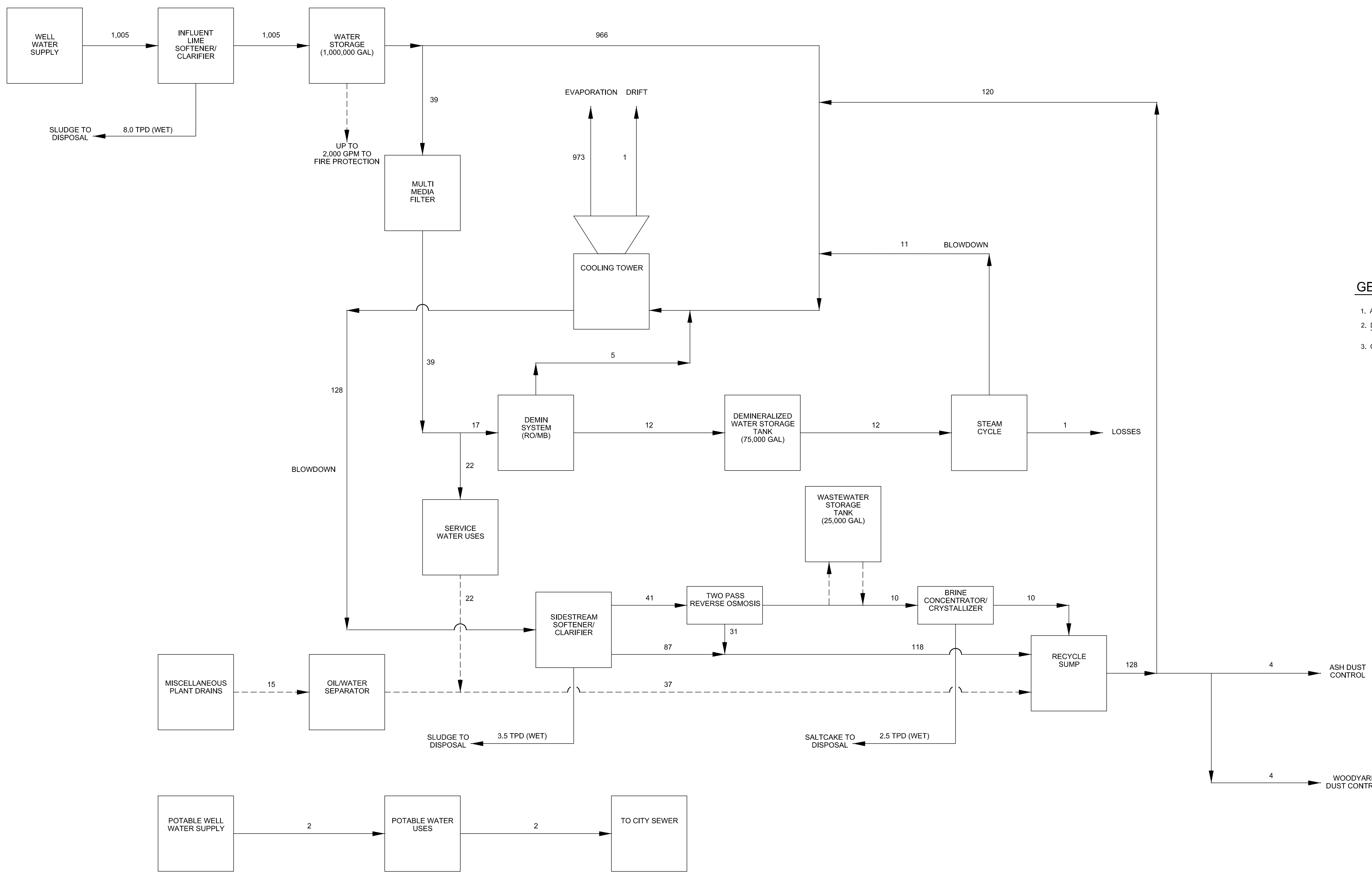
1. ALL VALUES IN GPM UNLESS OTHERWISE NOTED
2. DASHED LINES INDICATE THAT THE FLOW IS EXPECTED TO BE INTERMITTENT
3. COOLING TOWER CYCLES OF CONCENTRATION OF 8.6

FIGURE 4.5.0-1.

GAINESVILLE RENEWABLE ENERGY CENTER
WATER BALANCE ANNUAL AVERAGE WATER USAGE

Sources: Zachry Engineering, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company



GENERAL NOTES

1. ALL VALUES IN GPM UNLESS OTHERWISE NOTED
2. DASHED LINES INDICATE THAT THE FLOW IS EXPECTED TO BE INTERMITTENT
3. COOLING TOWER CYCLES OF CONCENTRATION OF 8.6

FIGURE 4.5.0-2.

GAINESVILLE RENEWABLE ENERGY CENTER
WATER BALANCE MAXIMUM DAILY WATER USAGE

Sources: Zachry Engineering, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

Again, a key feature of GREC to minimize or avoid potential impacts to water resources is that the GREC water system will be designed for ZLD. All cooling tower and steam cycle blowdown, drains and process wastewater flows will eventually collect in the process wastewater tank and be recycled except for evaporation losses and a small amount of water remaining in solid waste and byproduct. Solids from the ZLD system will be transported offsite for disposal in an appropriately permitted landfill.

Groundwater samples were taken from two existing GRU DGS water supply wells in May 2009. Table 4.5.0-1 presents the results of the water quality analyses for the GRU well sampling. Since the two new water supply wells for GREC will be similar to the existing DGS wells (i.e., same depth, casing depth, etc.), the water quality results in Table 4.5.0-1 were used in designing the water supply plans, water balances, and treatment systems for GREC.

4.5.1 HEAT DISSIPATION SYSTEM

4.5.1.1 System Design

The heat dissipation system will include a mechanical draft wet cooling tower, circulating water pumps, surface type condenser, and closed cooling system heat exchanger in a closed loop circulating water system. The surface condenser is designed to condense the full flow of turbine exhaust steam so the condensate can be returned to the feedwater system. The maximum estimated heat rejection to the condenser is 575 MMBtu/hr. The closed cooling heat exchanger is designed to remove heat from the plant closed cooling system. Cold water from the cooling tower collection basin will be circulated through the condenser and heat exchanger where it absorbs heat rejected from the steam cycle and closed cooling system before being returned to the cooling tower. The warmed water returned to the tower is cooled primarily by evaporative cooling and to a lesser degree by convection to the air. A small amount of water is lost as drift. Blowdown from the circulating water system will control the concentration of dissolved solids.

The cooling tower will be a multicelled, counter-flow tower. The structure will have four cells made from fiberglass material with stainless steel hardware, high efficiency fill, and

Table 4.5.0-1. Preliminary Design Analysis of Makeup Water, Well Water

Constituent	Unit	Well # W2	Well # W4	Average
Alkalinity, total	mg/L	186	194	190
Aluminum	mg/L	0.061 U	0.061 U	0.061 U
Ammonia, total	mg/L	0.125	0.119	0.122
Bicarbonate alkalinity	mg/L	186	194	190
Calcium	mg/L	65	65	65
Chloride	mg/L	10	10	10
Conductivity	µS/cm	483	463	473
Hardness, total as calcium carbonate	mg/L	260	250	255
Iron	mg/L	0.038 U	0.038 U	<0.038
Magnesium	mg/L	22	22	22
Manganese	µg/L	7.5	7.6	7.55
Nitrate	mg/L	0.1 U	0.1 U	0.1 U
Nitrite	mg/L	0.1	0.1	0.1
Oil and grease	mg/L	2.3	1.4	1.85
pH	s.u.	7.2	7.2	7.2
Phosphorous (total)	ppm	0.022	0.035	.029
Silica (dissolved)	mg/L	25.9	24.9	24.4
Sodium	mg/L	9.3	9.0	9.15
Sulfate	mg/L	50.0	45.0	47.5
Sulfide	mg/L	0.49	0.71	0.60
TDS	mg/L	303	291	297
TOC	mg/L	1.0	1.0	1.0
TSS	mg/L	3.0	2.0	2.5

Note: mg/L = microgram per liter.
µS/cm = microSiemen per centimeter.
s.u. = standard unit.
U = analyzed but not detected.

Source: Advanced Environmental Laboratories, Inc. Groundwater Sampling Analysis, Serial LAB-090615103612.

drift eliminators. Each cell will include a fan with a 250-hp drive motor. The structure will be erected over a concrete basin.

4.5.1.2 Source of Cooling Water

The primary source of makeup water to replace cooling tower evaporation and drift will be groundwater withdrawn from onsite wells. The majority of cooling tower blowdown is recycled through the ZLD system and returned to the cooling tower makeup supply.

4.5.1.3 Dilution System

GREC will not use a dilution system.

4.5.1.4 Blowdown, Screened Organisms, and Trash Disposal

Cooling tower evaporation loss at maximum load is estimated to be approximately 1.4 MGD. A blowdown of approximately 0.18 MGD will maintain the maximum level of TDS in the circulating water in the closed loop system at approximately 8.6 cycles of concentration. Cooling tower blowdown will be routed to the plant's water treatment system for reuse. There will be no point source discharge of cooling tower blowdown to surface waters. Therefore, an NPDES permit for wastewater discharges will not be required.

Also, since groundwater from wells is the water source, GREC will not have screened organism or trash disposal issues.

4.5.1.5 Injection Wells

GREC will not involve the use of injection wells.

4.5.2 DOMESTIC/SANITARY WASTEWATER

Sanitary waste streams generated by the GREC facility will be routed to a new lift station at the GREC facility, which will be owned and operated by GREC LLC. This lift station will discharge via a new sewer force main pipeline into a new master lift station on the DGS property. The force main pipeline will be routed across DGS property along existing plant roadways and in a trench within a multipipeline (sewer and natural gas) corridor on the DGS property. Chapter 9.0 provides more details on the corridor for this pipeline.

The new master lift station on the DGS property will receive the flow from the GREC lift station (as described previously) and will also receive flows from the existing three lift stations at the DGS site. This new master station will be built to GRU wastewater system design standards and will be maintained by the GRU wastewater system.

On the GREC Site, sanitary facilities will consist of showers, washbasins, toilets, urinals, drinking fountains, eyewash stations, emergency showers, and laboratory sinks to support a staff of up to 44 persons, although during any one shift there is expected to be no more than 28 employees on the Site. Assuming a maximum of 44 persons on the Site and a wastewater flow of 25 gallons per person per 8-hour shift, the maximum projected flow rate would be approximately 2.3 gallons per minute (gpm). The more likely scenario would be 28 persons onsite with 25 gallons per person per 8-hour shift, which equates to approximately 1.5 gpm. The water usage water balances presented in Figures 4.5.0-1 and 4.5.0-2 assume a worst-case 2-gpm potable water and sewer wastewater requirement for GREC. Ongoing discussions with GRU wastewater engineering staff indicate the system would be able to handle this minimal increase in flow; however, further modeling will be conducted to ascertain whether adequate capacity is available and/or if any upgrades are needed at the DGS facilities.

4.5.3 POTABLE WATER SYSTEMS

GRU currently provides potable water service to the existing DGS facilities to the east of the GREC Site and to the Alachua County Department of Public Works Maintenance Complex to the west of the Site via a 12-inch water main along the east side of U.S. 441. GREC LLC requested GRU to evaluate the feasibility of supplying potable water for GREC. Based on its evaluation, GRU determined that it is not technically feasible to supply GREC's potable water needs (see Appendix 10.12 for the GRU letter). This finding was based on the following factors:

- Minimal volume (i.e., 2 gpm average) of GREC's potable needs.
- Cost associated with installing a dedicated (sole-source) water main in excess of 5,700 ft.

- Inability to maintain effective chlorination residual cycle within this long pipeline.
- Inability to provide reliable, adequate pressure due to the proposed facility's location being at the outskirts of the GRU system.

Based on GRU's findings, potable water for GREC facilities will be provided by two on-site potable water supply systems. These two separate systems are to be located approximately 2,200 ft apart and will not be interconnected.

The first system will provide potable water for drinking, restrooms, showers, eyewash, etc., uses in the administration and warehouse buildings under FDEP regulations Chapters 62-550 and 62-555, F.A.C. This potable water system will be classified as nontransient, noncommunity since it will serve more than 25 persons daily for more than 60 days during the year.

This system will be supplied by groundwater withdrawn from the UFA via a dedicated well. The well will be located east of the warehouse building, and its location will comply with all setback distances for a potable supply well (see Figure 4.2.0-3). The dedicated well will be approximately 5 inches in diameter and will be capable of producing approximately 10 to 20 gpm. Proposed treatment is confined to chlorination using sodium hypochlorite. Should sampling and analyses of the water quality of the completed well indicate that additional treatment is required to meet the bacteriological or primary and secondary drinking water standards, additional treatment will then be proposed in an FDEP application (FDEP Form 62-555.900[1]).

A second system will provide potable water for drinking, restrooms, showers, eyewash, laboratory, etc., uses at the scale house. Under FDEP regulations Chapters 62-550 and 62-555, F.A.C., this potable water system will be classified as limited use since it will serve less than 25 persons daily. The actual number of people to be served by this water system is estimated to be less than 10 persons daily.

This limited use system will be supplied by groundwater withdrawn from the UFA via dedicated well. The well will be located northeast of the scale house, and its location will comply with setback distances for a limited use potable supply well (see Figure 4.2.0-3). The dedicated well will be approximately 5 inches in diameter and will be capable of producing approximately 5 to 10 gpm. No chemical treatment or chlorination will be provided. Should sampling and analyses of the water quality of the finished well indicate that additional treatment is required to meet the bacteriological or primary and secondary drinking water standards, additional treatment will then be proposed in an FDEP application (FDEP Form 62-555.900[1]).

Appendix 10.12 provides additional details on each of these water supplies and associated systems. As required by Chapter 62-555, F.A.C., the need for a new water system capacity development financial and managerial operations plan (FDEP Form 62-555.900[20]) is also provided in Appendix 10.12.

4.5.4 PROCESS WATER SYSTEMS

Process water uses for GREC will include a wide array of plant water services. In addition to providing the makeup water to the cooling tower and fire protection system, this system will provide water for the demineralized water system, fly ash unloading, pug mill mixer, and general service uses. Excluding cooling tower makeup water requirements, maximum daily process water requirements are estimated to be approximately 0.05 MGD at 100-percent load. One 1,000,000-gallon storage tank will be installed. Process water uses are illustrated on the water balances shown in Figures 4.5.0-1 and 4.5.0-2 and described in detail the following subsections.

4.5.4.1 Firewater System

Fire protection water will be supplied from the 1,000,000-gallon water storage tank. The storage tank will be designed to retain a minimum 2-hour volume of water for fire protection. The fire protection system will consist of two 2,000-gpm capacity main fire pumps (one electric-driven and one emergency diesel-driven), a 40-gpm pressure maintenance pump, a network of fire protection piping, hydrants, hose stations, and spray nozzles. Pump suction will be from the treated water storage tank. The fire water system will only be engaged for periodic testing and if needed to suppress a fire; therefore, no water demand, on average, is shown for fire protection in the water balances.

4.5.4.2 Demineralized Water System

The demineralized water system will produce the extremely high quality water required for use in the boiler and turbine. Demineralized water will be produced from well water. The well water will be softened in a lime softener/clarifier and filtered in pretreatment steps upstream of the demineralized water system. Wet sludge will be removed from the influent lime softener/clarifier and trucked to an offsite, properly permitted landfill for disposal. The softened water will be stored in the 1,000,000-gallon water storage tank. This water will also provide for cooling tower makeup and dust control. A portion of this water will be further treated by the demineralized water system for steam cycle use.

The demineralized water system will include a multi-media filter, an RO system, a mixed-bed polisher, and a 75,000-gallon demineralized water storage tank. The system will be designed to produce approximately 17,000 gpd. The storage tank will have sufficient capacity to provide makeup water requirements to the boiler during normal operation. The multimedia filter train will remove a large quantity of dissolved solids from the incoming well water. Purge water from the RO train will be discharged to the cooling tower makeup. Output from the RO train will be pumped to the brine crystallizer.

4.5.4.3 ZLD System

The plant water system is designed to minimize the use of groundwater and eliminate industrial wastewater discharges from the Site. This is generally described as ZLD system. The GREC water systems will be designed as a ZLD system. The well water will be treated with an influent lime softener/clarifier to reduce hardness. Approximately 7.7 tons per day (tpd) of wet sludge will be removed from the lime softener/clarifier and trucked to an offsite, properly permitted landfill for disposal. The softened well water will be stored on site in a 1,000,000-gallon tank to provide makeup for the cooling tower makeup, steam cycle and dust control. Approximately 123 gpm of cooling tower blowdown will be treated with a sidestream softener/clarifier. One third (41 gpm) of the water from the sidestream softener will be treated with a two pass RO system. A fourth (10 gpm) of the outflow from the RO will be treated in a brine concentrator/crystallizer. The approximately 2.5 tpd of wet saltcake generated in the brine concentrator/crystallizer will be trucked to an offsite, properly permitted landfill. The treated cooling tower blowdown will be recycled back to the cooling tower.

4.5.4.4 Service Water/General Maintenance

Groundwater from the well water storage tank will be the source for plant service water. Service water will have miscellaneous uses including equipment washdown.

4.6 CHEMICAL AND BIOCIDE WASTE

GREC will use a variety of chemicals for laboratory use, cleaning, and process water treatment. Boiler chemical cleaning waste will be collected in temporary tanks during the cleaning process and removed from the Site for disposal by a licensed contractor. Section 4.7 describes the handling of hazardous laboratory waste. Nonhazardous laboratory waste will discharge through the plant drain system to the oily water separator and then into the recycle sump for use as cooling tower makeup or dust control. Process water treatment waste will be concentrated in the influent lime softener/clarifier, sidestream softener/clarifier sludge, and in the saltcake of the brine concentrator. These wetted waste solids will be trucked to an offsite, properly permitted landfill.

Chemicals and additives will be used in a number of plant systems. None of these chemicals and additives will be discharged off the GREC Site. The types of chemicals that may be used are listed in the following. Among these chemicals, acid and caustic are considered potentially hazardous. As equipment is purchased and specific chemical requirements are defined, material safety data sheets (MSDSs) will be obtained to provide for the appropriate storage, handling, and disposal of these chemicals. Examples of these chemicals are as follows:

- Makeup water treatment:
  - Lime.
  - Polymer or coagulant (flocculent).
  - Acid or caustic (pH adjustment).
- Feedwater system:
  - Carbohydrazide.
  - Oxygen scavenger.

- Circulating water system:
  - H_2SO_4.
  - Sodium hypochlorite.
  - Scale inhibitor.
  - Corrosion inhibitor.
- Demineralized water system:
  - Polymer or coagulant (flocculent).
  - Sodium chloride.
  - Sodium hypochlorite.
  - Sodium bisulfite.
  - Antiscalant.
  - H_2SO_4.
  - Sodium hydroxide.
- ZLD pretreatment clarifier:
  - Polymer.
  - H_2SO_4.
  - Sodium hydroxide.
  - Calcium chloride.
  - Calcium sulfate.
  - Antiscalant.

4.7 BYPRODUCTS AND SOLID AND HAZARDOUS WASTE

4.7.1 BYPRODUCT/SOLID WASTES

For this SCA, the following descriptions of the byproduct/solid waste handling systems, temporary storage areas, and disposal methods are based on current conceptual engineering and design information for GREC. GREC will have no long-term solid waste disposal areas or landfills on the Site.

Most of the byproducts and solid wastes generated by GREC will be products of the combustion process and operation of the air quality control system and wastewater treatment facilities described in previous subsections. The combustion byproducts will be fly ash that will be collected by the fabric filter and bottom ash from the BFB combustor. Wastewater treatment facility solids will be produced in the makeup water clarifier, ZLD pretreatment clarifier, and ZLD crystallizer. Each of these byproducts and solid wastes are classified as nonhazardous. The estimated quantity of each type of byproduct and solid waste produced is dependent on the type of biomass burned and the makeup water quality. Table 4.7.1-1 shows the maximum estimated quantities of byproduct and solid waste to be generated and the method of disposal. Combustion byproduct quantities are

Table 4.7.1-1. Solid Byproduct and Waste Quantities

Source	Quantity* (lb/hr)	Management Method
Bottom ash (noncombustible materials)	3,000	Offsite landfill
Fly ash (all sources)	6,300	Offsite as agricultural/silvicultural soil supplement or offsite landfill
ZLD pretreatment clarifier solids	1,000	Offsite landfill
ZLD crystallizer solids	200	Offsite landfill

*At 100-percent maximum summer load over the range of potential fuels.

Source: GREC LLC, 2009.

based on the anticipated ash content of the range of biomass fuels and the lowest anticipated heating value characterizing those fuels.

Bottom ash consisting of noncombustible materials (i.e., rocks, glass, sand, metal) from the BFB combustor will be collected in ash containers. When these containers are filled, they will be transported and emptied at an offsite, properly permitted landfill. Fly ash will be collected from the boiler backpass ash hoppers and the fabric filter hoppers and transported pneumatically to the fly ash storage silo. The fly ash will be conditioned by adding water to control dust when the silo is unloaded into truck trailers with covers. Alternatively, the fly ash may be loaded dry into sealed trucks using an enclosed process. The conditioned fly ash will then be hauled offsite for use as agricultural or timberland soil supplement, to the extent possible, with the remainder disposed at an offsite, properly permitted landfill. Table 4.7.1-2 provides a summary of the anticipated fly ash composition. As indicated, the primary fly ash constituents are silicon dioxide and calcium oxide.

Waste products removed from the influent water softener/clarifier and ZLD pretreatment clarifier and dry solids (i.e., salts) produced by the ZLD crystallizer will be loaded onto trucks and transported to a licensed solid waste disposal area.

Section 4.9 of this SCA describes construction, operating, and maintenance solid wastes. Refuse from the administration and office service facilities consisting of waste paper, cardboard, office supply packaging, food packaging, food residue, empty plastic and glass containers of janitorial cleaners, etc., will be collected and segregated in dumpsters specifically designated for disposal offsite in a permitted landfill by a licensed waste hauler.

4.7.2 HAZARDOUS WASTE

Small quantities of hazardous waste may be generated by the use of specific laboratory chemicals, cleaners, solvents, etc. These wastes will be collected, handled, and stored in a designated hazardous waste storage area in accordance with applicable hazardous waste rules and regulations and periodically removed from the site for disposal by a licensed hazardous waste hauler.

Table 4.7.1-2. Typical Constituent Analysis of Wood Fuel Ash

	Average Percent by Weight				
	Slash Pine	Loblolly Pine	Sand Pine	Hard-wood	Weighted Average
Percent of fuel mix	59	9	4	28	100
Silicon dioxide	41.50	29.76	20.98	44.62	40.50
Aluminum oxide	1.44	1.06	2.79	2.53	1.76
Titanium dioxide	0.17	0.12	0.13	0.25	0.19
Iron oxide	1.69	0.32	1.94	2.65	1.85
Calcium oxide	23.97	36.60	38.75	24.18	25.76
Magnesium oxide	9.91	7.72	12.41	8.62	9.45
Potassium oxide	5.88	8.07	5.37	3.01	5.25
Sodium oxide	1.74	1.07	1.26	1.15	1.49
Sulfur trioxide	4.57	2.52	4.09	4.19	4.26
Phosphorous pentoxide	5.37	7.79	5.02	4.14	5.23
Strontium oxide	0.06	0.07	0.24	0.07	0.07
Barium oxide	0.04	0.08	0.13	0.07	0.05
Manganese dioxide	0.90	1.65	0.93	0.93	0.98

Sources: GREC, LLC 2009.
ECT, 2009

4.8 ONSITE DRAINAGE SYSTEM

The proposed project will provide an onsite stormwater system in accordance with Part IV of Chapter 373, F.S., which regulates the management and storage of surface waters. The system will contain several stormwater basins that serve different parts of the project. Each of the stormwater basins will be designed to meet the state and local rules and regulations for stormwater systems. For stormwater attenuation and treatment, three wet detention basins with a total area of 14.38 acres and two dry retention basins with a total area of 0.58 acre will be constructed. The stormwater management system also includes 3.67 acres of swales and ditches. A third dry basin will be temporarily used for the craft (construction worker) parking area during construction. Appendix 10.4 2 of this SCA contains a copy of the detailed stormwater management plan.

4.8.1 APPLICABLE REGULATIONS

The onsite drainage facilities will consist of a series of independent noncontact surface stormwater management systems designed and constructed in accordance with all applicable local, state, and federal requirements, as follows.

4.8.1.1 Local Regulations

The Site lies within the City of Gainesville, Alachua County, Florida. The stormwater management system will be designed to meet the requirements of the City of Gainesville Comprehensive Plan, Stormwater Management Element, and the Land Development Code (LDC), Article VII I, Environmental Management, Division 1, Generally; Subdivision II, Stormwater Management, and Division 3, Environmental Overlays, Subdivision II, Flood Control District, and Subdivision III, Surface Water and Wetlands.

Approval of the stormwater system by the City of Gainesville is accomplished during their development plan review approval process.

4.8.1.2 State Regulations

In the Peninsular Florida area, activities involving the alteration of surface water flows, including stormwater runoff, are regulated under the environmental resource permit

(ERP) program, Part IV, Chapter 373, F.S. ERP applications are processed and/or approved by either FDEP or the appropriate water management district (WMD) in accordance with the division of responsibilities specified in the operating agreement between FDEP and the WMD. Under the operating agreements with SRWMD, FDEP has the responsibility for review and approval of ERP applications involving proposed power plants and electrical transmission lines, such as GREC. For projects located within the jurisdictional boundaries of SRWMD, FDEP has adopted SRWMD's stormwater management rules, Chapter 40B-4, F.A.C. FDEP may issue permits/approvals for the construction of surface water management systems if the applicant provides FDEP with reasonable assurance that the system will comply with applicable permit conditions and design criteria. An onsite surface water management system will be constructed to store, treat, and discharge noncontact stormwater runoff generated by, or flowing onto, the site consistent with the permit conditions and design criteria established by SRWMD rules.

Specifically, the surface water management system will be designed and constructed to meet applicable design criteria as set forth in Chapter 40B-4, Environmental Resource and Works of the SRWMD Permits, F.A.C., and Section 40B-4.2030, Conditions for Issuance of Environmental Resource Permits, F.A.C.

GREC is located within the Turkey Creek watershed, and the GREC stormwater systems are designed and shall be installed such that the peak rate of postdevelopment runoff will not exceed the peak rate of predevelopment runoff for storm events up to and including the 100-year critical storm event.

GREC will have no discharges to an Outstanding Florida Water. By SRWMD rule, the minimum stormwater treatment volume shall be the runoff from the first 2 inches of rainfall over the drainage area serving each individual system. The stormwater system will be designed to provide treatment volumes within 72 hours following the end of a design storm event. Wet detention basins are designed with side slopes of four-to-one to a depth at least 2 ft below the control elevation. Side slopes shall be stabilized with vegetation to prevent erosion and provide pollutant removal.

Swales will be designed to treat, through percolation or evapotranspiration, a volume of stormwater equal to at least 80 percent of the runoff resulting from a design storm with a 3-year, 1-hour rainfall depth and SCS Type II distribution with average antecedent moisture conditions.

Where conditions require, the surface water management system shall be equipped with a baffle, skimmer, grease trap, or other alternative appropriate device suitable for preventing oils and greases from exiting through any discharge structures. GREC LLC will provide for the perpetual operation and maintenance of the surface water management system. The system shall be designed to assure no net decrease in the storage volume below the 100-year flood elevation within the project area to prevent increased flood hazards. Detention and treatment storage volumes include no volumes below the average seasonal high-water table for the project area.

The proposed system does not alter contributing areas or watershed boundaries of any watershed or basin not wholly contained within the project area. Operation of the system results in no reduction of floodway conveyance within the project area.

Compliance with these design criteria provides reasonable assurance that the proposed system will meet required local and state conditions, and thus the construction and operation of the surface water management system should be authorized in this PPSA proceeding.

4.8.2 CONSTRUCTION PHASE DRAINAGE

The stormwater management and drainage systems will be installed early in the construction phase for GREC to control runoff, erosion, and sedimentation from disturbed areas. During construction, runoff direction from areas of the site not disturbed by construction activities or plant operations will remain unaltered to the greatest extent possible. As the existing Site is fairly flat and is a high point for the area, there will not be any issues with offsite runoff needing to be directed around the Site. Where necessary, the Site perimeter berms and diversion ditches will prevent any offsite runoff from entering the site drainage system. These diversion ditches will collect runoff flow from the undisturbed areas and direct the flow around the Site to follow natural drainage patterns. Runoff from areas of the Site disturbed by construction activities or plant operations will be collected in a swale and/or ditch system and directed to the onsite stormwater management system. Noncontact stormwater drainage systems will be designed for gravity flow. The drainage in the areas of the new facility construction will be directed away from structures and routed to the onsite stormwater system. Once final grading is complete, accumulated sediment in the basins will be removed and incorporated in the basin berms. Areas will be revegetated as needed.

The drainage of the site areas is described under the operational phase drainage in Section 4.8.3. The site drainage for these areas will be similar for both the construction and operational phases of the project. Silt fencing will be used as sediment barriers around catch basins and manholes, as well as on both sides of the perforated pipe under-drain system in the fuel yard during construction. Grass ditches and swales will have aggregate check dams to prevent sediment from flowing through the stormwater drainage system.

Estimated area surfacing, such as aggregate, impervious, and grass, is presented in Table 4.8.2-1. BMPs for erosion and sediment controls will be employed, in compliance with FDEP requirements and standards, during construction.

The open channels and drainage structures will be designed to collect and direct the runoff resulting from the 100-year, 24-hour storm event. Runoff will be detained in the stormwater basins to a discharge rate not greater than the predevelopment runoff peak discharge. The stormwater system will be built early in the construction phase and serve as sediment basins throughout the duration of plant construction. They will remain in place after construction is complete and throughout the operation of the plant.

A stormwater pollution prevention plan (SWPPP) for construction activities has been prepared and is presented in Appendix 10.4.2. A notice of intent (NOI) application for stormwater discharge will be submitted to FDEP under the generic permit for stormwater discharge from large and small construction activities prior to commencing construction

Table 4.8.2-1. Overall Approximate Areas for Power Block and Fuel Yard

Subsection	Scale Measured Area (ft^2)	Area (acres)
Impervious	395,089	9.07
Rock	180,774	4.15
Rock (road)	41,382	0.95
Wood chips	583,704	13.40
Grass	174,240	4.00
TOTAL	**1,375,189**	**31.57**

Note: ft^2 = square foot.

Source: EDA, 2009.

activities in accordance with Chapter 62-25, F.A.C. Appendix 10.2.2 of this SCA provides a copy of this NOI application.

4.8.3 OPERATIONAL PHASE DRAINAGE

The stormwater system for the proposed project contains three independent systems to provide water quality treatment and attenuation for the proposed development. These systems are shown on Figures 4.8.3-1 and 4.8.3-2. These systems will use a gravity drain system for noncontact stormwater. The individual systems collect, treat and discharge noncontact runoff from the proposed project at predevelopment conditions. Figures 4.8.3-1 and 4.8.3-2 illustrate the locations of these systems. The systems functions are described in the following subsections.

4.8.3.1 Stormwater System 100

As shown in Figure 4.8.3-1, this system provides stormwater facilities for the power plant and fuel yard areas. This system is a wet detention system and contains three wet detention basins. These basins provide treatment and attenuation of the runoff.

The power plant area is divided into a total of six main drainage areas:

- Fuel Yard and Handling Area 2A.
- Fuel Yard and Handling Area 2B.
- North Admin Area 3.
- Power Block and Admin Area 4.
- South Drainage Swale 5.
- North Drainage Swale 6.

The surfacing will be crushed rock in open areas, between equipment and buildings, and for the access/maintenance road. The perimeter road and parking area will be asphalt.

Wet Detention Basin 100 collects the east part of the proposed plant (Power Block and Admin Area 4 and South Drainage Swale 5). The Power Block and Admin Areas 4 and 5 drainage system will incorporate both surface draining with culverts and a storm sewer system. A system of manholes will be used in areas that are difficult to surface drain.

Wet Detention Basin 101 collects the middle part of the proposed plant (Fuel Yard and Handling Area 2B and North Admin Area 3). The south drainage swale will run along the

CONSTRUCTION & POST-CONSTRUCTION DRAINAGE DATA

AREA #	AREA DESCRIPTION	AREA [ACRES]	CONSTRUCTION CURVE NUMBER	CONSTRUCTION TIME OF CONCENTRATION [HOURS]	POST CONSTRUCTION CURVE NUMBER	POST CONSTRUCTION TIME OF CONCENTRATION [HOURS]
1	SCALE HOUSE AREA	0.93	91	0.1	93	0.1
2A	WEST FUEL YARD	8.87	91	0.19	87	0.2
2B	EAST FUEL YARD	8.87	91	0.18	95	0.19
3	NORTH ADMINISTRATIVE AREA	0.71	91	0.1	93	0.1
4	POWER BLOCK & ADMINISTRATIVE AREA	6.45	91	0.11	93	0.12
5	SOUTH DRAINAGE SWALE	4.49	91	0.41	82	1.01
6	NORTH DRAINAGE SWALE	1.25	91	0.14	84	0.39

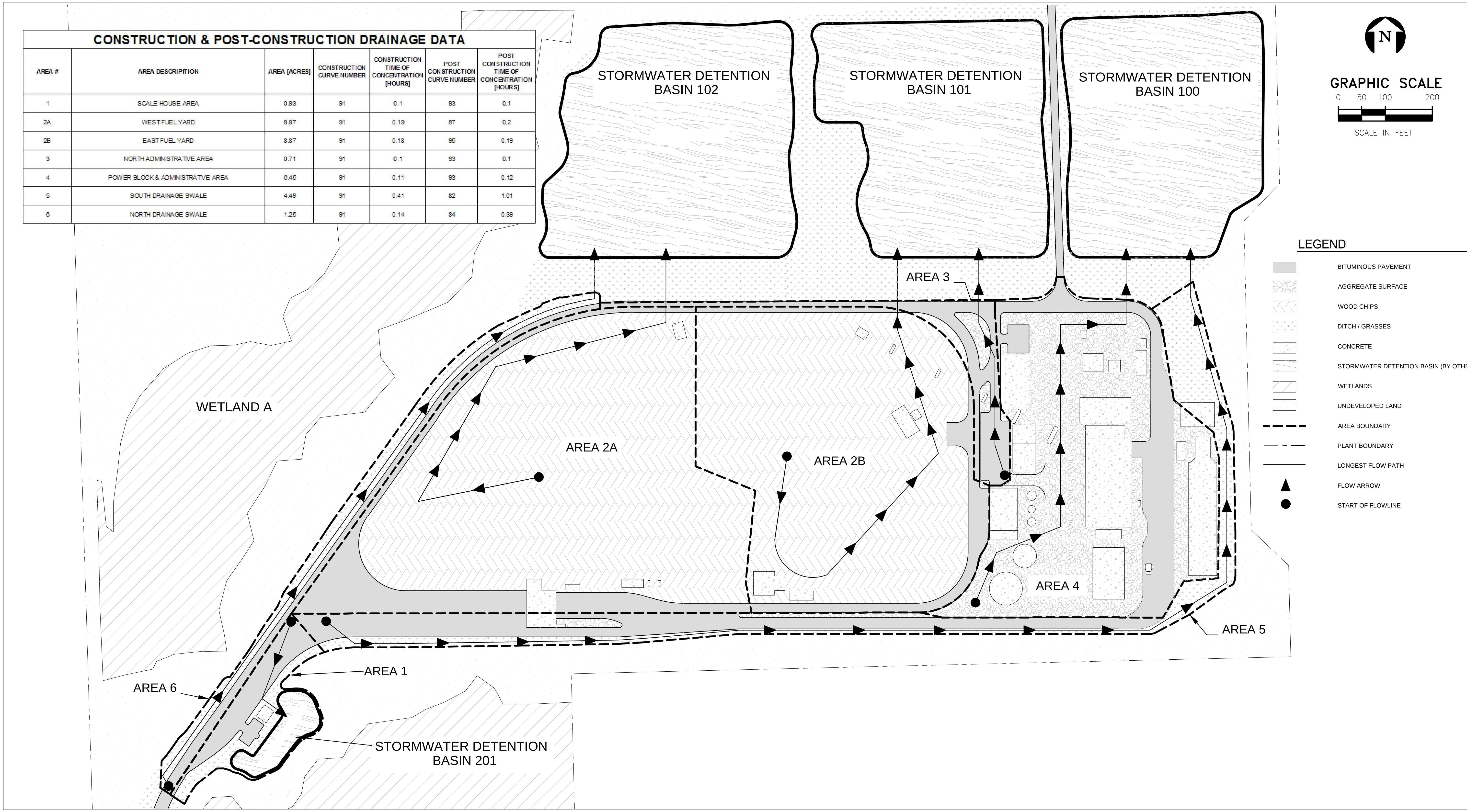


FIGURE 4.8.3-1.

STORMWATER SYSTEM DRAINAGE AREAS FOR POWER PLANT/FUEL YARD AND SCALE HOUSE AREAS

Sources: Zachery, 2009; ECT, 2009.

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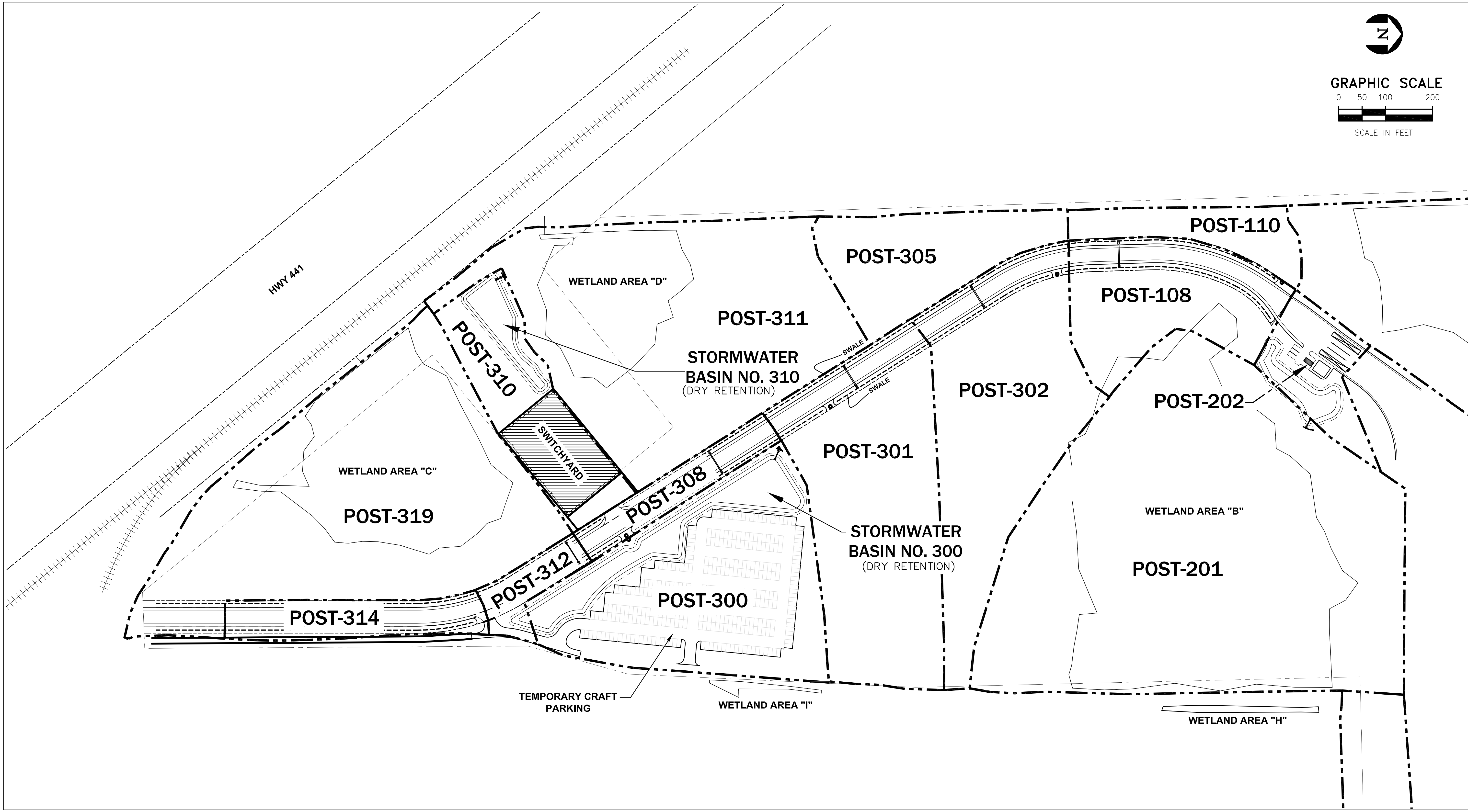

FIGURE 4.8.3-2.

STORMWATER SYSTEM DRAINAGE AREAS FOR ACCESS ROAD, SWITCHYARD, AND TEMPORARY PARKING AREAS

Sources: EDA, 2009; ECT, 2009.

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An American Renewables Company

outside of the southern perimeter road and will collect runoff from the crowned road. This will be sized to handle and store the runoff volume from the design storm and will have an emergency overflow discharging into the Wet Detention Basin 102. The swale will be grass lined.

Wet Detention Basin 102 collects the west portion of the plant including the Fuel Yard and Handling Area 2A and North Drainage Swale 6. The north drainage swale will run along the outside of the east/north perimeter road and will collect runoff from the crowned road. The swale will be grass lined.

The three wet detention basins work together to provide treatment and flood attenuation for the watershed. Basin 100 discharges into Basin 101, and 101 discharges into Basin 102. The final point of discharge of this system (Basin 102) is into the existing wetland (i.e., Wetland A) in the northwest portion of the Site (see Appendix 10.4.2). A BMP structure will be used to control the outflow from the basin to the wetland.

The system will provide water quality and flood control for the watershed area. A small portion of the access road will discharge to Wetland A. The road has a side swale system to treat and attenuate drainage from the proposed improvements. The existing natural ground directs runoff to Wetland A; therefore, the postdevelopment conditions of this area will direct treated runoff to the same point of discharge. All of these individual systems will discharge at predevelopment conditions. The points of discharge will mimic the natural existing condition of the area. The proposed system will maintain the hydroperiod of the point of discharge (wetlands). No increase or reduction of existing flood elevation for Wetland A is proposed with this system.

4.8.3.2 Stormwater System 200

As shown in Figure 4.8.3-2, this system provides stormwater facilities for the area of the scale house and associated structures. The surfacing in this area will be asphalt. This proposed system is a dry retention system. The system collects runoff from the watershed area and provides treatment (by natural percolation) and attenuation of the design storm event. The system discharges at predevelopment conditions and maintains the existing flood elevation of the existing Wetland B (point of discharge). The runoff from the water shed is collected by ditches and swales and directed to Basin 201. Also, the South Drainage Swale from the plant has a point of discharge into Wetland B. Treatment for this area is provided within System 100. A BMP structure will be used to control the outflow from the basin to the wetland.

Figure 4.8.3-3 illustrates the final grading plan for the power plant and fuel yard areas (i.e., Stormwater System 100) and the scale house area (i.e., Stormwater System 200).

4.8.3.3 Stormwater System 300

This system provides stormwater facilities for most of the main access road, temporary construction craft parking area, switchyard, and construction laydown area. This system contains stormwater basins that provide water quality and attenuation for their respective watersheds.

Access Road

A side swale system is provided for the access road. This system collects the runoff of the proposed road by sheet flow and treated by natural percolation. Also, the system provides conveyance for the design storm event.

Switchyard

A dry retention system will be provided to collect treat and attenuate the runoff from the proposed switchyard area. The system will collect the runoff from the water sheet flow at predevelopment conditions to Wetland D.

Temporary Craft Parking Area

This area will be temporarily used for craft parking during construction of GREC. This area will be provided with a dry retention system to collect the runoff and discharge at predevelopment conditions. This system will remain functional as long as the parking area is needed. When the craft parking is removed, the stormwater system will be removed and this area will be returned to existing conditions.

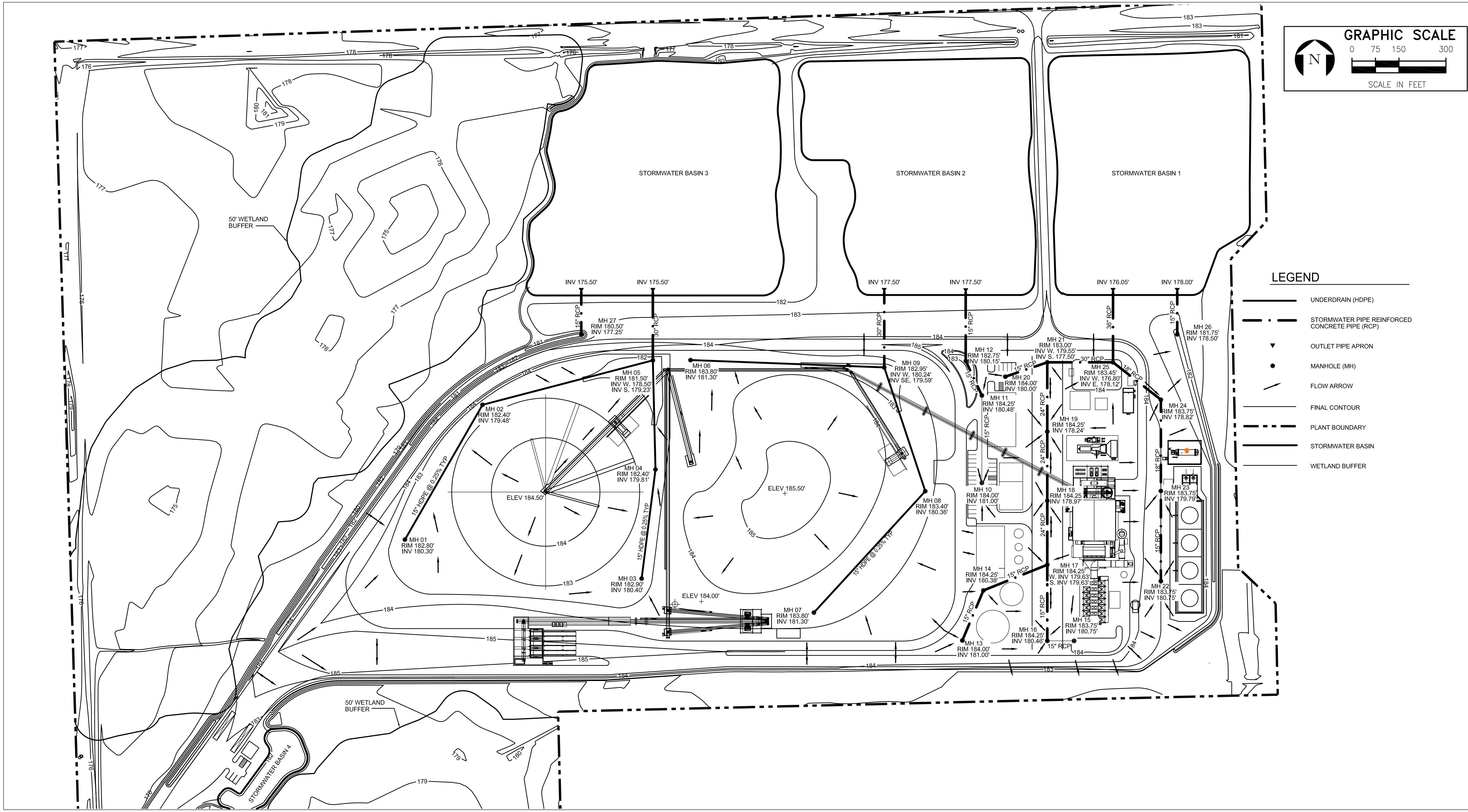

FIGURE 4.8.3-3.

GREC FINAL GRADING PLAN FOR PLANT, FUEL YARD, AND SCALE HOUSE AREAS

Source: Zachery, 2009; EDA, 2009; ECT, 2007.

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Construction Laydown Area

The construction laydown area surface will be improved to accommodate the use of construction apparatus while maintaining proper conveyance of stormwater drainage toward the existing swale through the middle of the proposed area. This existing swale collects and directs runoff from the area to the existing DGS stormwater management system. The proposed stormwater system for this area will be a pretreatment swale adjacent to the exiting swale. This system will provide 1 inch of water quality treatment for the drainage area. A flow control structure will not be provided, since the laydown area is a temporary condition during the construction of the biomass facility. The laydown area will be for the use and storage of equipment, material, parts, and supply trailers. The apparatus located within this area will not produce a substantial increase of runoff because of the progression of project activities. Upon completion of construction activities, this laydown area will be returned to its original condition.

Figures 4.8.3-2 and 4.8.3-3 illustrate the construction and final grading plans.

4.8.4 STORMWATER SYSTEM DESIGN CRITERIA

The following are the criteria for the design of the different stormwater management systems provided within the project:

- Wet Detention Systems—The wet detention systems are designed to provide a minimum of 2 inches of water quality treatment volume over entire watershed and provide attenuation for the 100-year critical storm event. The critical storm event includes the 1-, 2-, 4-, 8-, and 24-hour and 3-, 7-, and 10-day events. Discharge of the system will be controlled to not exceed the predevelopment conditions for the critical event.
- Dry Retention Systems—The dry retention systems will provide a minimum of 1 inch of water quality treatment volume for the watershed and provide attenuation of the 100-year critical storm event as described previously. The water quality treatment is provided by natural percolation of the stormwater basins.
- Side Swale System—This system will provide water quality of at least 80 percent of the 3-year, 1-hour storm event. This water quality treatment

volume is provided by natural percolation of the swales. Also, the system will provide for the conveyance of the critical storm event.

4.8.5 DRAINAGE SYSTEM DESIGN

The proposed drainage system will use inlets, culverts, swales, and mild slopes to convey runoff to the stormwater basins at various locations around the Site. Slopes will vary from approximately 1 to 2 percent adjacent to buildings and approximately 0.5 percent from open areas to 3H:1V slopes in the fill/ditch side slopes. The runoff collection system will convey stormwater to the stormwater basins in a manner to limit onsite ponding and prevent flooding.

Ditches and swales will be designed to convey peak runoff flows at nonerosive velocities. Small runoff events will be detained within the system and allowed to percolate into the groundwater. Maintenance will be performed as necessary to remove sediment and maintain ditch flow capacity.

Drainage culverts will be installed at road crossings and embankments and will be constructed of reinforced concrete pipe (RCP). Each culvert will be designed to convey the 100-year critical storm event without developing excessive headwater elevations.

Contact stormwater will be isolated from other stormwater and routed to an oil/water separator for treatment prior to discharge to the stormwater attenuation system.

4.8.6 EARTHWORK

Suitable onsite materials will be used as engineered fill for the plant facilities/buildings. If any unsuitable material is identified, it will be stockpiled at locations that will not impact wetlands or anticipated construction activities. Silt fencing will be installed surrounding the stockpiles, except for vehicle access points. The stockpiles will have maximum side slopes of 3H:1V and maximum heights of 30 ft. Active side slopes will be stabilized by application of seed in accordance with FDOT temporary grass seeding specifications. Stockpile material will be used to the extent possible for landscaping and other onsite uses or appropriately disposed offsite.

Excavation of wetland materials deemed unsuitable for an engineered fill will be done using conventional earthwork techniques such as scrapers, backhoes, end-loaders, and dump trucks. Acceptable fill will be placed and compacted in lifts after unsuitable material is removed. Fill material will be obtained from offsite sources.

Deep foundations extending below the water table will need to be dewatered for construction. If dewatering is needed for excavation areas extending below the water table or following rainfall events, the water will be pumped as required in the construction SWPPP document. No direct offsite dewatering will occur.

4.8.7 EROSION AND SEDIMENT CONTROL MEASURES

Erosion and sediment control measures will be installed as part of initial construction to control sediment disposition. The stormwater basins will provide settling of sediments during construction and reduce the suspended solids level.

Construction erosion and sedimentation control measures include silt fencing around the perimeter of all construction areas and ditch checks to provide filtering of sediment before stormwater runoff reaches the detention basins. Filter rock will be used at construction entrances to prevent tracking of sediment offsite. Disturbed areas will be limited to only the area needed for construction. Temporary seeding will be used in areas that are to remain disturbed for extended periods of time.

Permanent sediment control measures include the stormwater basins to provide settlement, surfacing of disturbed areas to stabilize the subgrade and riprap at all discharge points to prevent erosion.

Appendix 10.4.2 provides further details on erosion and sediment control measures.

4.8.8 NPDES PERMITS RELATED TO STORMWATER DISCHARGES, DEWATERING

Prior to the initiation of construction, permit coverage under FDEP's Generic Permit For Stormwater Discharge From Large And Small Construction Activities (CGP) must be obtained. The permit is adopted by reference by FDEP's Rule 62-621.300(4)(a), F.A.C. Prior to filing an NOI for permit coverage, an SWPPP must be prepared. The SWPPP will detail the BMPs to be employed to assure adequate erosion and sedimentation control during construction. Once the plant is in operation, permit coverage must be obtained under FDEP's Multisector Generic Permit For Stormwater Discharge Associated With Industrial Activity (MSGP), which is adopted by reference at Rule 62-621.300(5)(a), F.A.C. The facility will fall under Sector O of the MSGP addressing stormwater discharges from steam electric generating plants. An SWPPP setting forth BMPs as required under Sector O must be prepared. Permit coverage under the CGP and MSGP will be obtained by filing an NOI with FDEP's NPDES stormwater notices center. Appendix 10.2.2 of this SCA contains a copy of the CGP and MSGP NOIs

Should dewatering be required during construction of the surface water management system, or the facility itself, permit coverage under FDEP's Generic Permit for Produced Groundwater from Any Uncontaminated Site, Rule 62-621.300(2), F.A.C, must be obtained prior to any discharge of dewatering water to surface waters or a stormwater management system that discharges to surface waters. The foregoing generic permits are issued under the authority of FDEP's EPA-approved NPDES permitting program.

4.9 MATERIALS HANDLING

4.9.1 CONSTRUCTION MATERIALS HANDLING

The major components that will be erected at GREC include the following:

- BFB boiler.
- Steam turbine generator.
- Biomass fuel receiving and handling equipment.
- Air quality control system components.
- Cooling tower.
- Transformers.

The major components and all other required equipment will be delivered to the Site by truck. Once onsite, construction materials will be unloaded for immediate erection or placed in designated construction laydown areas using portable cranes and trucks. Figure 4.2.0-1 in Section 4.2 provides the locations of access roads and construction laydown areas.

Fugitive dust, stormwater runoff, and solid waste disposal associated with construction material handling will be controlled as follows:

- Fugitive dust will be suppressed using water wagons to spray roads, parking lots, and laydown areas.
- Runoff associated with construction areas will be handled as described in Section 4.8.
- Construction debris will be disposed offsite at a permitted construction debris facility.

4.9.2 OPERATIONS MATERIAL HANDLING

Section 4.3 discusses the handling and storage of biomass fuels. Handling and storage of solid byproducts and wastes (bottom ash and fly ash) is discussed in Section 4.7. Other routine material handling operations include receiving, storing, and, in some cases, disposing of the following:

- Water/wastewater treatment chemicals.
- Aqueous ammonia.
- Process gases.
- Lubricating oils.
- Hydraulic fluids.

4.9.2.1 Water/Wastewater Treatment Chemicals

The chemicals used for treatment of makeup water and wastewater will consist of lime, soda ash, coagulant, coagulant aid, sodium hypochlorite, H_2SO_4, sodium hydroxide, and scale inhibitor. These chemicals will be delivered by truck to the Site and appropriately stored in tanks or chemical totes within secondary containment basins.

4.9.2.2 Aqueous Ammonia

The process for using aqueous ammonia in SCR systems will consist of pumping stored liquid ammonia to a vaporizer skid. The vaporizer heats the liquid ammonia and vaporizes it to a gas. Ammonia vapor leaving the vaporizer is mixed with dilution air and transported to the injection grid in the flue gas, upstream of the SCR reactor. Occupational Safety and Health Administration (OSHA) standards require that a hydrostatic relief valve or equivalent shall be installed in each section of piping between shutoff valves to relieve pressure that could be developed by trapped liquid ammonia. The concentration of ammonia required for NO_x reduction is regulated by the ammonia control system. As the NO_x emission levels increase or decrease, the ammonia supply pump output level changes accordingly.

Aqueous ammonia (19.5 percent) will be delivered by truck and stored in one outdoor 30,000-gallon tank designed and fabricated in accordance with U.S. Department of Labor 29 CFR 1910.111, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, ANSI K 61.1, and applicable requirements of Chapter 67-762, F.A.C., Aboveground Storage Tank (AST) Systems. The tank will be located within a secondary containment basin.

A fire hydrant will be located within 100 ft of the storage area, and emergency showers and eyewash stations will be located both inside and outside of the tank containment basin.

Truck deliveries will be transferred to the storage tank by pumps located on the trailer. For GREC, the aqueous ammonia flow rate is approximately 600 lb/hr at full boiler load. On a weekly basis approximately two trucks (6,500 gallons per truck) of 19.5-percent aqueous ammonia will be delivered to the Site.

4.9.2.3 Lubricating Oil and Hydraulic Fluid

Clean lubricating oil and hydraulic fluid will be delivered by truck. Clean lubricating oil will be stored in a clean oil tank. Turbine lubricating oil will be filtered and dewatered for reuse. Lubricating oil no longer suitable for its original intended use will be stored in a used oil tank for transfer to a truck for removal from the Site. The oil storage areas will be located within secondary containment areas for spill control in accordance with the applicable provisions of Chapter 62-762, F.A.C. Hydraulic fluid no longer suitable for its original intended use will be stored in sealed drums for removal from the Site. Used oil and hydraulic fluids will be removed from the Site by a licensed waste hauler.

AST systems having individual storage tank capacities greater than 550 gallons that store regulated substances will be constructed, operated, maintained, and registered in accordance with the applicable provisions of Chapter 62-762, F.A.C. GREC will also comply with local requirements for AST systems.

4.10 ASSOCIATED LINEAR FACILITIES

The proposed GREC project will use four directly associated linear facilities that will extend off the leased parcel but remain within the existing GRU DGS certified site, which are a natural gas pipeline, sanitary sewer force main pipeline, 138-kV transmission line, and main access road.

- Natural Gas—Natural gas will be used for startup of the proposed biomass facility. The facility will consume approximately 2,300 MMBtu at 100 psig per startup. Each startup will have a duration of approximately 14 hours and occur a maximum of 20 times per year (depending on operational scenarios). The proposed pipeline will be constructed from GRU's existing natural gas take station located adjacent to the DGS facilities.
- Sanitary Sewer—GREC will construct a dedicated lift station at the southeast quadrant of its biomass facility to collect and discharge its sanitary waste streams via a force main pipeline across the DGS certified site to GRU's existing sewer force main situated adjacent to the existing DGS facility.
- 138-kV Transmission Switchyard—The power generated from GREC will be routed within the GREC lease parcel over a new overhead 138-kV transmission line located along the main access road to a new interconnection switchyard located just off the GREC Site on DGS property that will be owned and maintained by GRU. From that switchyard, two new transmis-

sion lines will interconnect into GRU's existing 138-kV transmission system along U.S. 441, still remaining within the DGS certified site.

- Main Access Road—A new main access road will be constructed from U.S. 441 to the GREC power plant facilities. The entrance of this road will be located at an existing entrance road to the DGS property, which was previously used for construction and secondary access. The new road will initially cross FDOT right-of-way along U.S. 441, a CSX railroad line, and DGS property prior to entering the GREC Site. The two-laned road has been located so as to avoid impacts to onsite wetlands.

Chapter 9.0 of this SCA provides more details on these associated linear facilities and their corridors.

4.11 EMERGENCY DISASTER PREPAREDNESS PLANS

GREC 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, GREC LLC will prepare and implement a comprehensive, coordinated emergency action plan for GREC. The emergency action plan will address preparedness and response measures during various types of emergencies such as hurricanes, acts of terrorism, etc. The emergency action plan will be a controlled document that is periodically reviewed and revised, as necessary, to reflect current conditions at GREC and changes in key response team personnel. This plan will be implemented through appropriate training of plant personnel.

REFERENCES

Florida Administrative Code (F.A.C.). Chapter 40B-4, Environmental Resource and Works of the District Permits. Suwannee River Water Management District (SRWMD).

F.A.C. Chapter 40B-400, Environmental Resource Permits. Suwannee River Water Management District (SRWMD).

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