2.0 PROJECT DESCRIPTION

2.1 PROJECT LOCATION, AREA MAP, AND PLOT PLAN

GREC will be built on leased property at the existing GRU Deerhaven Generation Station (DGS), which is located approximately 8 miles northwest of downtown Gainesville and approximately 7 miles southeast of the city of Alachua. The Site is located within the City of Gainesville and is bordered by Northwest 128th Lane on the north, the existing GRU DGS on the east, U.S. 441 on the south, and the Alachua County Public Works Department Complex on the west.

Figure 2-1 shows the GREC location within the state of Florida and within Alachua County. Figure 2-2 illustrates the leased property boundaries of the 131-acre GREC Site on a U.S. Geological Survey (USGS) 1:24,000-scale topographic quadrangle map. Figure 2-3 depicts the Site leased property and the GRU DGS certified site boundaries on a recent (January 2008) aerial photograph.

The Site is currently undeveloped. Historically, the Site has been used for agriculture and pine silviculture. Most of the Site is actively managed for timber production and has been altered by land preparation (furrowing) and periodic harvesting of timber. The adjacent property to the east of the Site is part of the GRU DGS, a nominal 440-MW coal-, oil-, and natural gas-fired electrical power generating facility. Facilities associated with the DGS located immediately adjacent to the Site include a stormwater treatment pond, a brine disposal area, and an ash disposal/storage area. Facilities of the Alachua County Public Works Department, a radio tower, and undeveloped land are situated to the west of the Site. Undeveloped, wooded land is located north of the Site. U.S. 441 and commercial uses, including plumbing and construction supply stores, a carwash, retail shed sales, and boat sales and storage, are located south of the Site.

Figure 2-4 provides the GREC general arrangement overlaid on the January 2008 aerial photograph. Figure 2-5 presents a conceptual rendering of the major GREC facilities.

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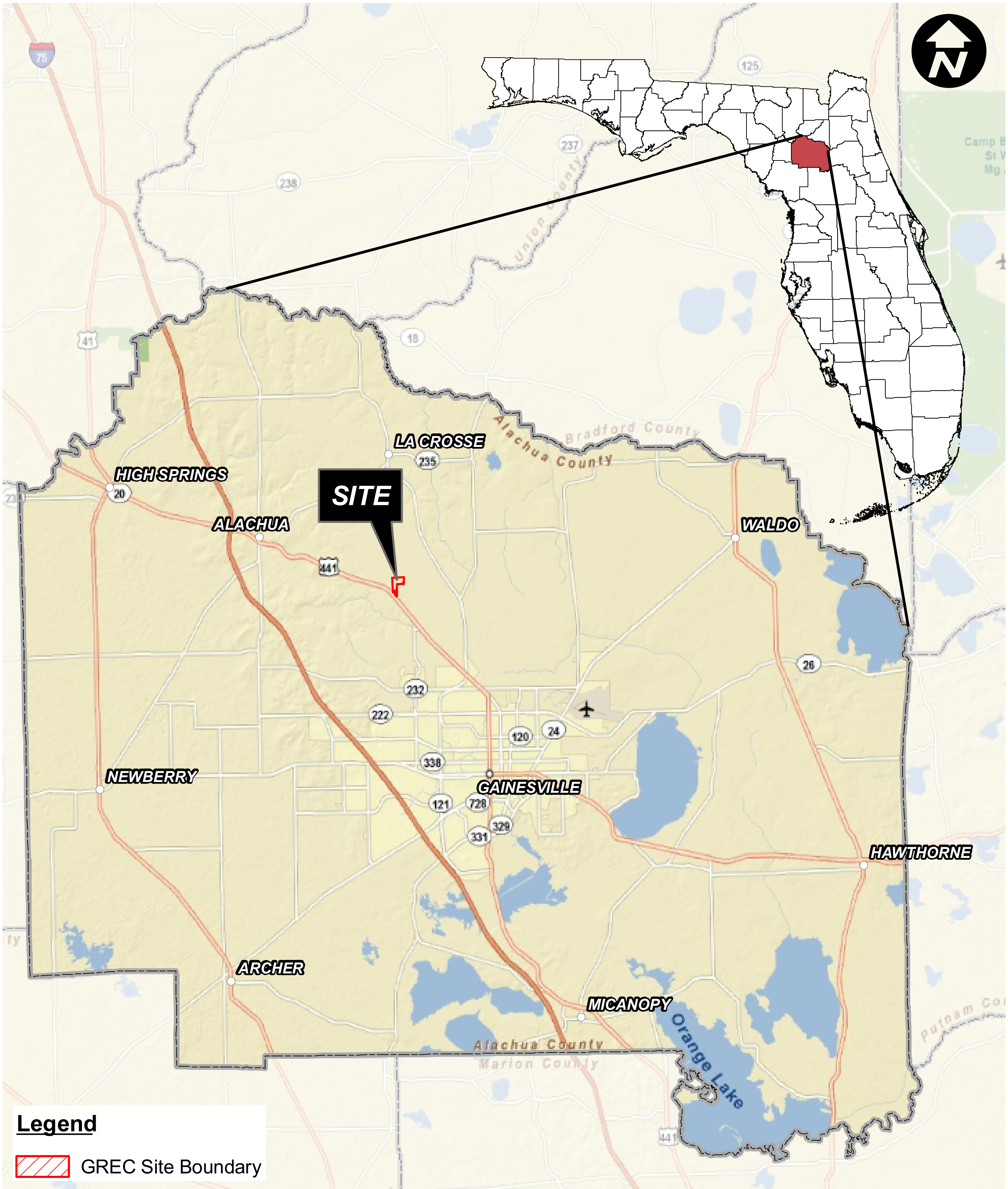

FIGURE 2-1.

GREC SITE LOCATION WITHIN FLORIDA
AND ALACHUA COUNTY

Sources: ERSI, 2009; US Census, 2000; ECT, 2009.

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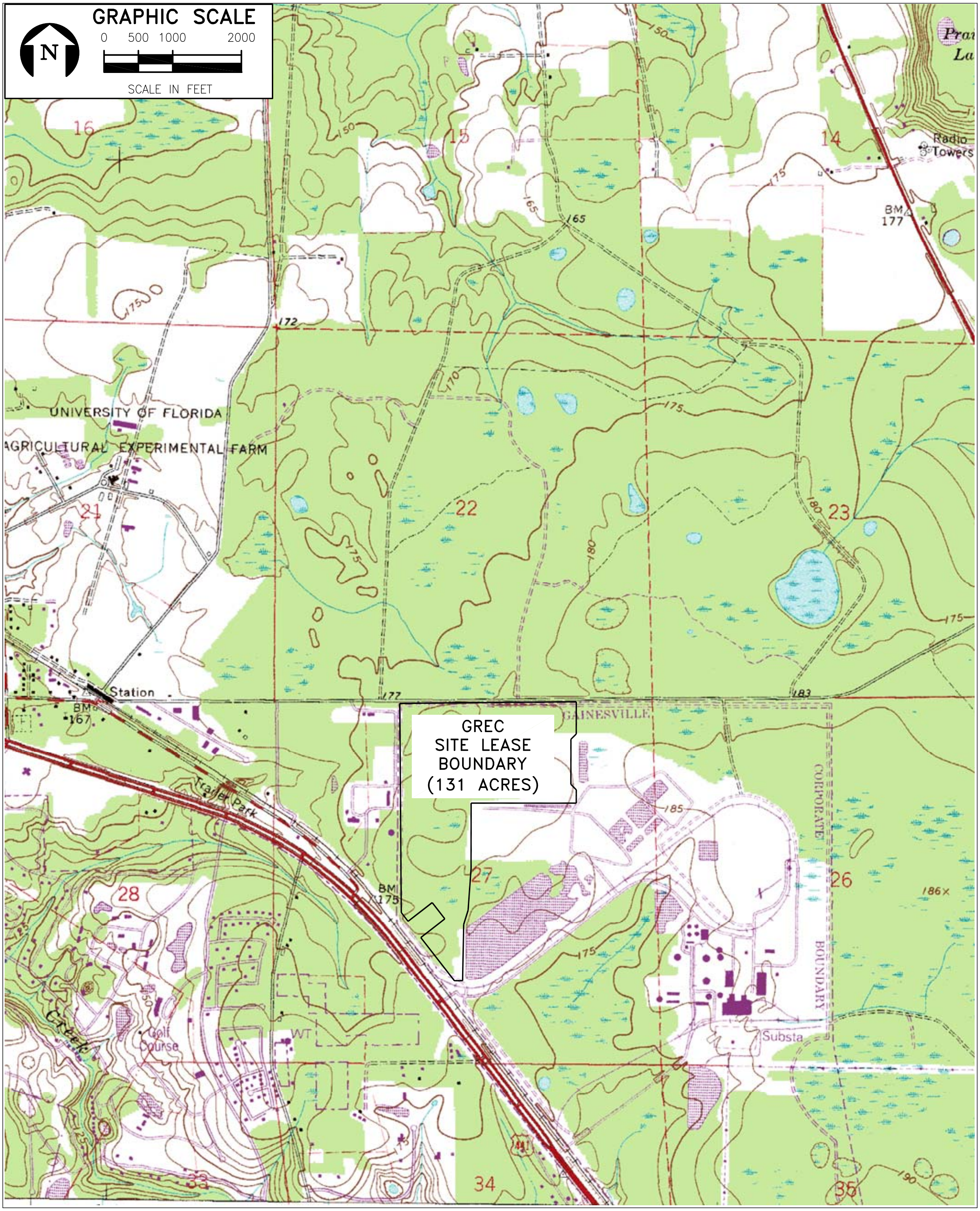

FIGURE 2-2.

GREC SITE LOCATION AND VICINITY

Sources: USGS Quad, Alachau, FL, 1993; ECT, 2009.

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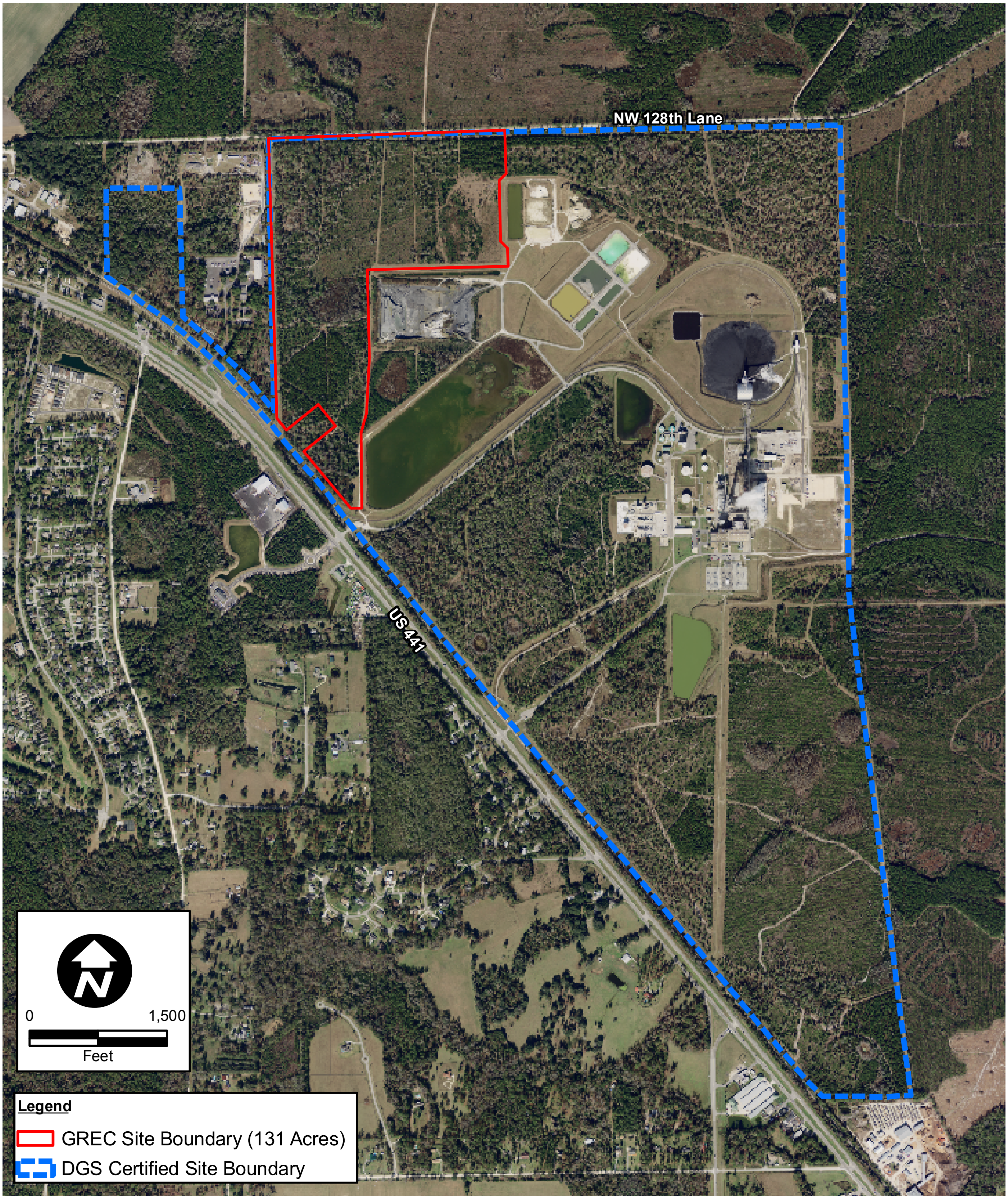

FIGURE 2-3.

GREC SITE

Sources: GRU, 2009; FDOT, 2008; GENESIS, 2009; ECT, 2009.

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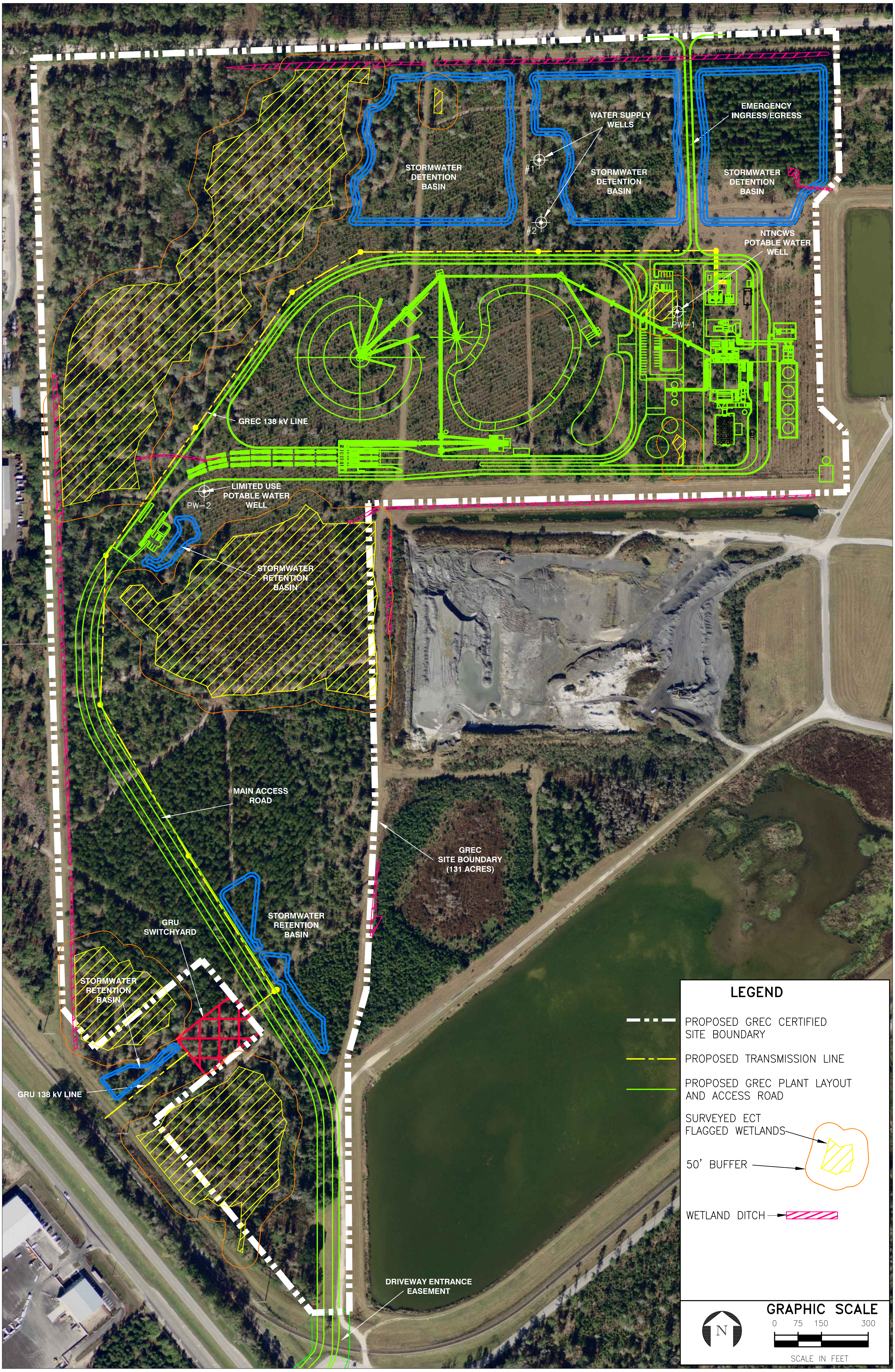

FIGURE 2-4.
LAYOUT OF PROPOSED FACILITIES
WITHIN GREC SITE

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

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FIGURE 2-5.

CONCEPTUAL RENDERING OF GREC FACILITY

Source: Zachry, 2009; ECT, 2009.

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The main access road to the Site will run north from U.S. 441 to the fuel storage and power block areas. The Site main access road intersection with U.S. 441 will be approximately 0.5 mile north of the main entrance to the GRU DGS. An emergency access road will run north from the fuel storage/power block area to Northwest 128th Lane.

The main power block facilities (i.e., BFB biomass boiler, steam turbine, emission control equipment, boiler stack, cooling tower, etc.) will be located in the northern portion of the Site approximately 3,200 ft (0.6 mile) north of U.S. 441, 2,200 ft (0.4 mile) west of the Alachua County Public Works Department Complex, and 1,100 ft (0.2 mile) south of Northwest 128th Lane. The biomass fuel storage areas will be situated immediately to the west of the power block area. Facilities of the existing GRU DGS are located east and southeast of the GREC power block area. The planned locations of the GREC power block area and biomass fuel storage areas will provide a significant buffer between plant operations and adjoining land uses.

Additional GREC facilities will include an administration building, warehouse, scale house, water and wastewater treatment facilities, BFB boiler sand and fly ash handling and storage, two emergency diesel engines, and several stormwater runoff basins. Construction laydown and parking areas will be located to the north and east of the power block area. GREC construction activities will impact approximately 65 acres of the Site, including temporary activities such as construction parking that will be located south of the plant area.

2.2 PROJECT FUELS

2.2.1 BIOMASS FUELS

The primary fuel for the GREC BFB boiler 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 may 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. These biomass fuels will principally be obtained within a 75-mile radius of GREC from a variety of sources. The facility will not use as fuel any form of treated or coated wood, municipal solid waste, construction and demolition waste, coal, petroleum coke, or tires. Natural gas will be used as the startup fuel for the BFB boiler.

GREC has been designed to be capable of using the variety of biomass materials mentioned previously, even though the materials may vary in moisture content, 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 source its fuel from multiple, regional locations and, therefore, take advantage of competitive fuel pricing and availability opportunities.

Biomass fuel will be delivered to GREC in covered trucks with an average capacity of 25 tons per load. Fuel delivery trucks will access the GREC Site via the main facility entrance road, entering from either northbound or southbound U.S. 441. 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 truckloads 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 trucks per hour. The average fuel delivery rate is expected to be approximately 12 trucks per hour.

Table 2-1 provides typical constituent analyses of the GREC biomass fuels.

2.2.2 NATURAL GAS

Natural gas will be used as the startup fuel for the BFB boiler. After establishment of a minimum bed temperature of 900 degrees Fahrenheit (°F), biomass fuel will be

Table 2-1. 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

introduced, and the ignition burners will be shut down. Table 2-2 shows the typical composition of natural gas.

2.2.3 ULTRA-LOW SULFUR DIESEL FUEL OIL

The two GREC emergency diesel engines (i.e., emergency generator and emergency firewater pump diesel engines) will be fired with ULSD fuel oil containing no more than 15 parts per million by weight (ppm) of sulfur. Small day storage tanks for ULSD fuel oil will be located within secondary containment areas near each diesel engine. Excluding emergencies, each diesel engine will operate for approximately 96 hours per year (hr/yr) for routine testing and maintenance. Table 2-3 shows the typical composition of ULSD fuel oil.

2.3 PROJECT DESCRIPTION AND FLOW DIAGRAMS

Major components of GREC facility will include: (a) biomass fuel receiving, processing, handling, and storage areas; (b) one biomass-fired BFB steam boiler; (c) one steam turbine generator (STG); and (d) systems used for the handling and storage of sand, fly ash, and bottom ash. Ancillary equipment will include a process water treatment system, a four-cell mechanical draft cooling tower, a ZLD treatment system, and two diesel engines that will be used for the emergency fire water pump and the generator. Descriptions of the major GREC process areas are provided in the following subsections.

2.3.1 BIOMASS FUEL HANDLING, PROCESSING, AND STORAGE

The biomass fuel receiving, processing, handling and storage system will consist of three truck dumpers, two sets of screens and hogs (i.e., machines used to size wood chips), and automatic and manual stacker/reclaimers to maintain an average 15- to 20-day supply of biomass fuel for the BFB boiler based on full-load operation and average biomass fuel moisture content. Figures 2-6 and 2-7 show flow diagrams of the biomass fuel handling, processing, and storage systems.

The GREC biomass fuels will be initially chipped/ground and processed at offsite locations and then transported to the Site by truck. Between 130 and 150 fuel truck deliveries per day are expected based on the maximum BFB boiler biomass fuel consumption

Table 2-2. 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: HHV = higher heating value.
Btu/ft^3 = British thermal units per cubic foot.
gr/100 dscf = grain per 100 dry standard cubic foot.

Source: ECT, 2009.

Table 2-3. 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.
HHV = higher heating value.

Source: ECT, 2009.

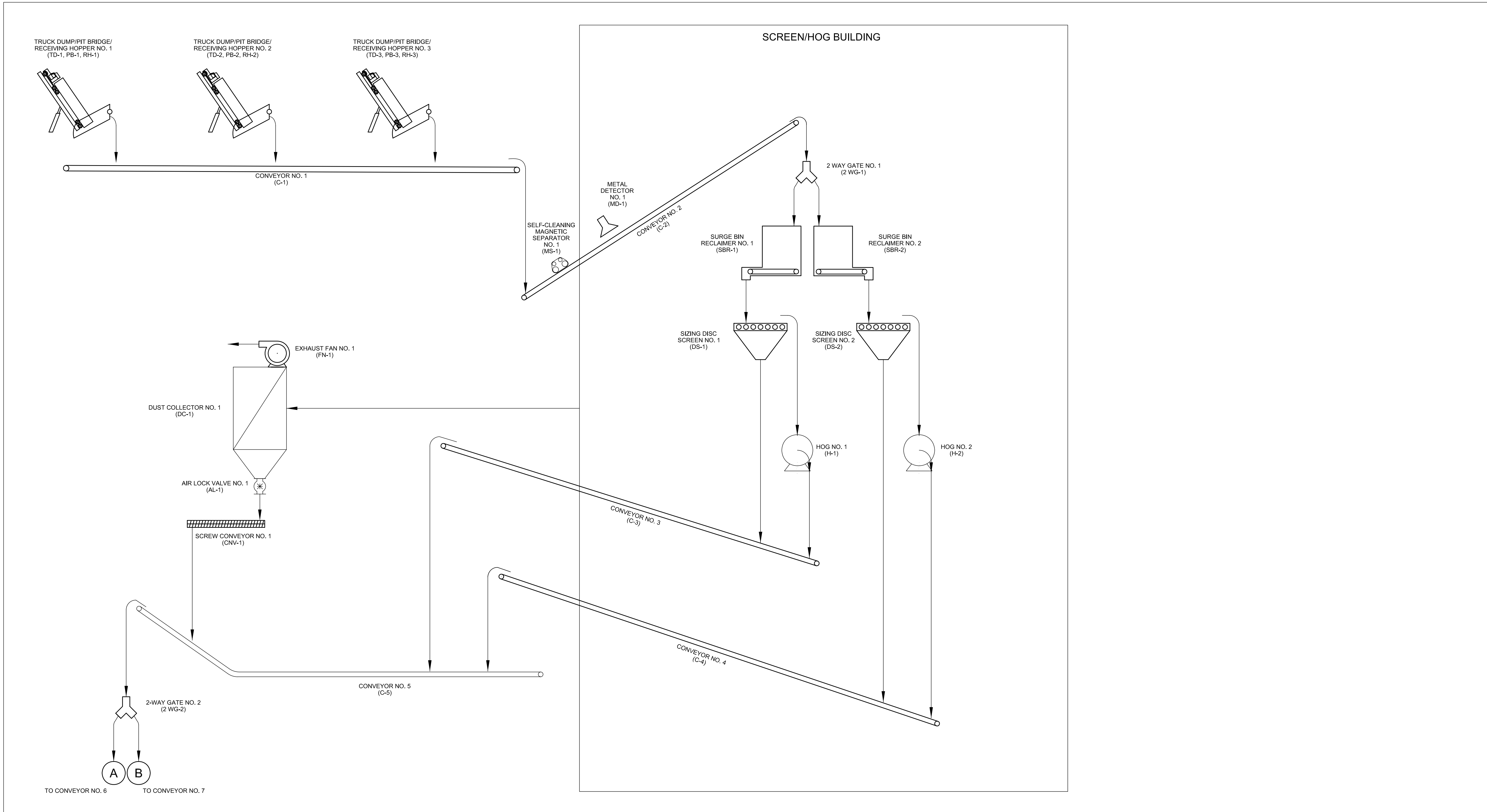

FIGURE 2-6.

BIOMASS FUEL DELIVERY, UNLOADING, AND PROCESSING SYSTEM

Source: Zachry, 2009; ECT, 2009.

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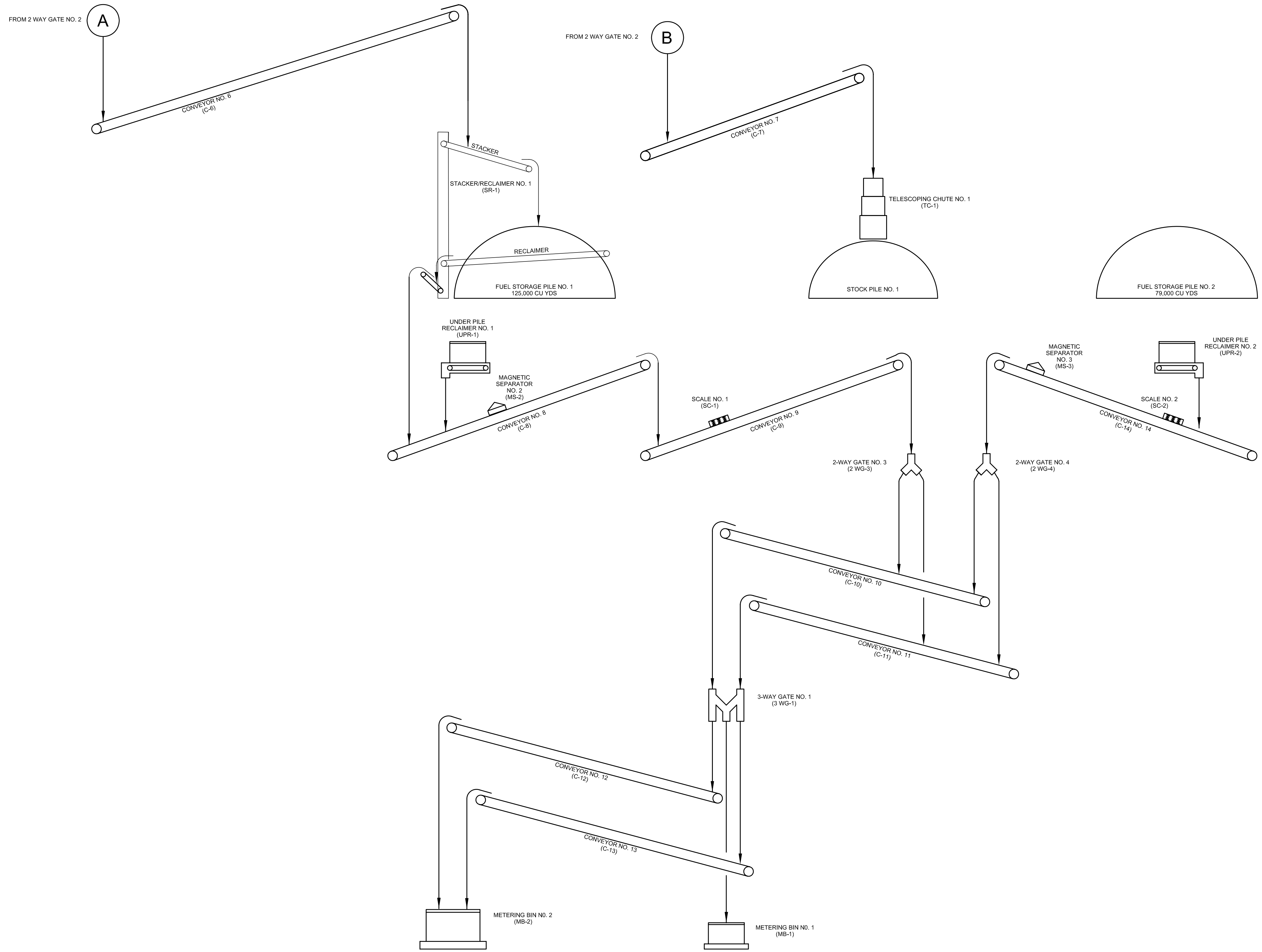

FIGURE 2-7.

BIOMASS FUEL HANDLING
AND STORAGE SYSTEM

Source: Zachry, 2009; ECT, 2009.

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rate/average moisture content and a 6-day-per-week delivery. During peak delivery periods, the delivery facilities will be capable of unloading 24 truckloads of fuel per hour. The GREC biomass fuel handling system will include scales to weigh each truck entering and departing to determine the 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. Three truck dumpers will be located within the single three-sided (two walls and a roof) receiving structure that the trucks will enter from one end and exit from the other. The three truck dumpers are a drive-through design with a 63-degree (°) tilt. Within the receiving structure, a hydraulic dumper will tilt each truck to cause its contents to drop into belowgrade receiving hoppers, which will be covered by hydraulic lids when not in use. The truck will dump into the in-pit receiving hopper, which has a chain conveyor to move the material onto the conveyor that will transport the fuel to the biomass fuel processing system. Some of the biomass fuel that is presized, such as sawdust, will be delivered by self-unloading trucks and unloaded directly in the storage area.

Prior to entering the fully enclosed biomass fuel processing building, the biomass fuel will first pass under a metal detector and magnet to remove ferrous metals. A metal detector located above the conveyor will be used to detect ferrous metals, upstream of the disc screen/hammer hog sizing system. The biomass fuel will then be fed onto one of two disc screens at a rate of up to 300 tons per hour (tph). Fuel that is 3 inches or less in size will drop through the disc screen and onto a conveyor below. A small fraction (typically less than 15 percent) of the biomass fuel will be oversized and will not pass through the disc screen slots and will travel over the end of the screen for additional sizing by one of the two electric motor driven 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. The properly sized biomass fuel and the fuel resized in the hogging system will be transferred from the fuel processing building by conveyor for delivery to either the automatic stacker/reclaimer or the fixed stacker fuel yard storage areas. The fully enclosed biomass fuel processing building will be vented to a baghouse for abatement of PM/PM_{10} emissions. The biomass fuel will be stored in one of four storage areas. The first (Storage Pile No. 1) 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 60° and rotate up to 300° horizontally. During the reclaim process, the over-pile reclaim conveyor will transfer the fuel onto a stationary belt conveyor for delivery to the BFB boiler. The second storage area (Stock Pile No. 1) will consist of a conical-shaped pile that is fed with a fixed stacker, which includes a telescoping chute to minimize the distance the fuel will drop when the pile is empty. 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) will be used to remove fuel from the fixed stacker pile and deliver it to the third manual reclaim storage pile (Storage Pile No. 2). 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 BFB boiler feed conveyor system. The main storage piles will have the capacity to store sufficient fuel for an average of 15 to 20 days of plant operations.

In addition to the chipped/ground biomass fuel, moist sawdust (typically obtained from sawmill operations) will be received at the Site for use as a supplementary fuel in the BFB boiler. Sawdust will be delivered with self-unloading trucks and deposited in an open area adjacent to Storage Pile 2 in a fourth, small pile. The front-end loaders used to manually reclaim fuel from Storage Pile 2 will also be used to reclaim sawdust. The reclaimed sawdust will be blended with the chipped/ground biomass fuel and transferred to the BFB boiler fuel bins. The sawdust storage pile will be watered, as necessary, to control wind-blown fugitive PM/PM_{10} emissions.

The reclaimed biomass fuel from Storage Piles 1 and 2 will be transferred via a series of covered conveyors and hoppers to the main conveyor belt that will transfer the biomass fuel to the BFB boiler fuel bins. The biomass fuel conveyor belts will be covered and transfer points enclosed, as practicable, to reduce fugitive PM/PM_{10} emissions. Telescoping chutes will be employed on both the automatic and fixed stackers to reduce fugitive PM/PM_{10} emissions during the transfer of biomass fuel to the storage piles. 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 sprays to further control potential wind-blown fugitive PM/PM_{10} emissions dust, as needed. Generally, GREC will operate on a first-fuel-in, first-fuel-out basis to minimize potential odor and spontaneous combustion fire issues. The storage facilities will also be equipped with a manual fire protection system consisting of hoses and hydrants.

The two BFB boiler biomass fuel bins will each provide storage of biomass fuel sufficient to fuel the boiler for approximately 45 minutes. The BFB boiler biomass fuel bins will be equipped with bin vent filters for control of PM/PM_{10} emissions.

2.3.2 BFB BOILER

Biomass fuel will be transferred from the fuel bins and combusted in the BFB boiler to generate steam. The selection of BFB boiler technology will allow the use of a wide range of biomass fuels. In a BFB boiler, combustion of biomass fuel takes place in the dense, fluidized sand bed located at the bottom of the furnace as well as above the bed. In addition to biomass fuel, the fluidized bed consists of sieved natural sand maintained in suspension by a fluidizing air system. Figure 2-8 provides a schematic of the BFB boiler.

Fluidizing (primary) air is introduced into the BFB boiler through a water-cooled, grate air-beam distribution system. Staging (overfire) air is introduced through air openings located in the furnace walls. Fluidization results in an expanded combustion zone with high turbulence, intimate solids-to-gas contact, and a high heat transfer rate within the bed. Smaller fuel particles will burn rapidly above the fluidized bed, while the larger particles will be entrained within the bed where they are dried and gasified. Combustion of residual char will occur mainly in the fluidized bed. Combustion of volatile material will occur both within and above the fluidized bed.

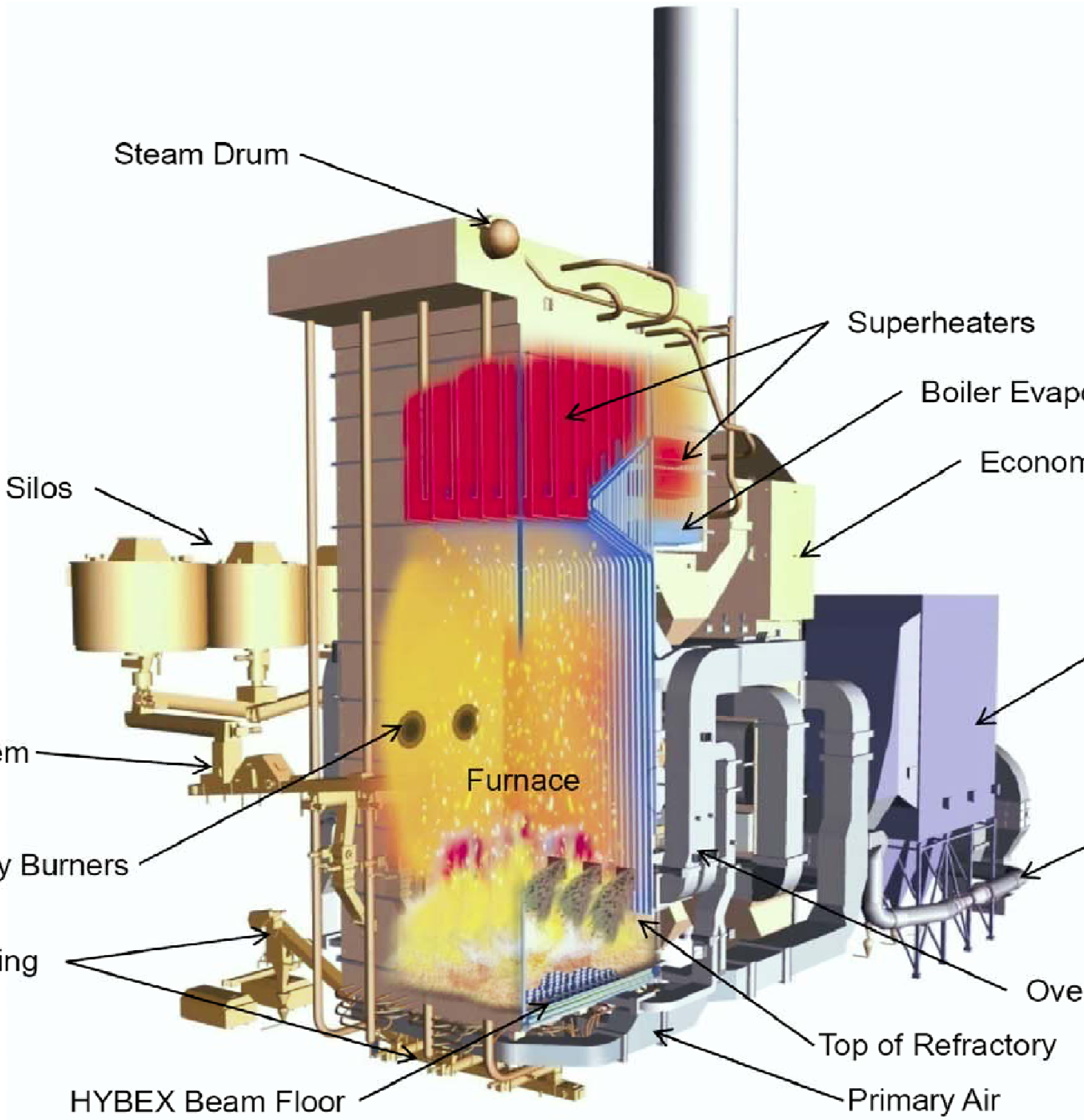

FIGURE 2-8.

SCHEMATIC OF BFB BOILER

Source: Metso, 2009.

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Overfire air is introduced into the furnace above the fluidized bed where final combustion and flue gas oxygen content are controlled. Fuel quality, boiler capacity, and fluidized bed temperature determine air distribution requirements. During the combustion of biomass fuels, the fluidized bed temperature will normally vary between 1,350 and 1,700°F. Overfire air is injected into the furnace to complete the combustion of volatile gases (such as CO and VOCs) in the zone above the fluidized bed. The furnace temperature is approximately 200°F higher above the fluidized bed where the overfire air is introduced. NO_x emissions are limited by staging the combustion in the fluidized 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. Peak flame temperatures will increase when lower moisture content biomass fuels are combusted and during low load boiler operations. During these periods, flue gas recirculation (FGR) will be employed to lower the peak flame temperatures.

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 boiler will be reduced to low 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 DSI and naturally occurring calcium in the biomass ash to reduce SO_2, H_2SO_4 mist, hydrogen chloride, and hydrogen fluoride emissions.
- Fabric filter baghouse for control of PM/PM_{10} emissions.

Steam generated by the BFB boiler will be sent to a STG for the production of electricity. Electricity will be transmitted from the STG to a switchyard located at the GREC facility, which will be used to increase the voltage. The electricity then will be transmitted through aerial transmission lines to a GRU switchyard for transmission to the electric grid.

The BFB boiler will normally operate between 70- and 100-percent load, with commensurate STG load.

2.3.3 FLY ASH AND BOTTOM ASH HANDLING AND STORAGE

The majority of ash created by the combustion of biomass fuel will exit the BFB boiler as fly ash with only a small amount leaving as bottom ash. Fly ash from the boiler convective pass and fabric filter hoppers will be collected dry and transported pneumatically to a single fly ash storage silo by means of two vacuum blowers. The transferred fly ash will first pass through a receiver/collector that separates the fly ash from the conveying air stream. The separated fly ash will then flow through an air lock valve into the storage silo, which will be vented through a baghouse for control of PM/PM_{10} emissions. The clean, filtered outlet air of the fly ash vacuum blowers will be discharged to the atmosphere.

From the silo, the fly ash will either be stabilized using water in a pugmill 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 covered trucks and then hauled offsite for reuse or disposal. During the dry transfer of fly ash, an enclosed process will be utilized 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.

Bottom ash from the bed will primarily consist of noncombustible material (i.e., rocks, glass, sand, metal) contained in the biomass fuel. The coarse bottom ash will be removed from the BFB boiler through ash hoppers and chutes. Coarse material will fall from the bed into the ash hoppers, which form a gas tight seal with the furnace bottom. The coarse material will be sieved in a rotating screen prior to being conveyed to the bottom ash container. Suitable sand fractions recovered by the rotating screen will be transferred pneumatically to the sand silo with the remaining coarse material conveyed to the bottom ash container. The contents of the bottom ash container will be taken offsite for disposal in a properly licensed landfill.

2.3.4 BFB BOILER SAND AND DSI SORBENT HANDLING AND STORAGE

The BFB boiler will use sieved natural sand as a fluidization and heat transfer media. Sand will be delivered to the Site by truck and pneumatically conveyed to a sand storage silo. The sand silo will be vented to the boiler to control PM/PM_{10} emissions.

Hydrated lime will be used as the absorbent in the DSI system to reduce BFB boiler acid gas emissions. The sorbent will be delivered to the Site by truck and pneumatically conveyed to a sorbent storage silo. The sorbent silo will be equipped with a bin vent filter to control PM/PM_{10} emissions.

2.3.5 AQUEOUS AMMONIA HANDLING AND STORAGE

Liquid aqueous ammonia for use in the BFB boiler SCR NO_x emission control system will be delivered to the Site by truck. The aqueous ammonia, containing 19-percent ammonia by volume will be stored in one outdoor 30,000-gallon tank designed and fabricated in accordance with U.S. Department of Labor Chapter 29, Part 1910.111, Code of Federal Regulations (CFR), 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 aqueous ammonia storage 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.

Aqueous ammonia will be transferred to the storage tank by pumps located on the delivery truck trailer. Aqueous ammonia flow rate at full BFB boiler load is estimated to be approximately 350 pounds per hour (lb/hr). On a weekly basis, approximately two trucks (6,500 gallons per truck) of 19-percent aqueous ammonia will be delivered to the Site.

From the storage tank, the liquid aqueous ammonia will be pumped 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 BFB boiler 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 BFB boiler NO_x emission levels increase or decrease, the ammonia supply pump output level changes accordingly.

2.3.6 COOLING TOWER

The GREC cooling tower will be a four cell, counter-flow mechanical draft type tower. The structure will be made from fiberglass material and will have high efficiency fill and drift eliminators. Each cell will contain a fan with an electric drive motor. The structure will be erected over a concrete basin. Water obtained from the two onsite Floridan aquifer deep wells will provide makeup water to replace cooling tower evaporation, drift, and blowdown.

Cooling tower evaporation loss at maximum load is estimated to be 1.34 million gallons per day (MGD). A blowdown of approximately 0.18 MGD will result in approximately nine cycles of concentration and a maximum total dissolved solids (TDS) concentration in the cooling tower recirculating water closed loop system of 1,700 milligrams per liter (mg/L). 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 system (RO) and a brine concentrator/crystallizer. The remainder of the treated cooling tower blowdown will be recycled as makeup to the cooling tower.

PM/PM_{10} emissions from the GREC cooling tower will be controlled using high efficiency drift eliminators. The cooling tower will achieve a drift loss rate of no more than 0.0005 percent of the cooling tower recirculating water flow.

2.3.7 EMERGENCY DIESEL ENGINES

An emergency diesel engine-driven generator will be provided to supply power to essential service motor control centers during an interruption of 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 emergency generator will have a design generation capacity of approximately 500 kilowatts (kW) and will be driven by an approximate 760 horsepower (hp) diesel engine. 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. The emergency generator diesel engine will fire ULSD fuel and be designed with advanced combustion modifications, including retarded timing, to minimize potential NO_x emissions.

GREC will also include an emergency diesel engine-driven firewater pump to provide water to the plant firewater system in the event of an emergency that makes the primary electric motor-driven firewater pump inoperable. Based on preliminary design criteria, it is estimated that the firewater pump will be driven by a 275 hp diesel engine to provide water at a rate of 2,000 gallons per minute (gpm). The firewater pump diesel engine will be fired with ULSD fuel and will only be used in case of an emergency and for periodic testing. 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.

The emergency generator and firewater pump diesel engines will comply with the applicable emission limits of New Source Performance Standard (NSPS) Subpart IIII for new nonroad compression ignition (CI) engines.

2.4 EMISSIONS AND STACK PARAMETERS

GREC will include the following emission sources:

- Material (i.e., biomass fuel, BFB boiler sand, fly ash, bottom ash, DSI sorbent, aqueous ammonia, and miscellaneous chemicals) truck traffic on paved facility roads (fugitive source of PM/PM_{10})
- Biomass fuel receiving, processing, handling, and storage areas and systems (fugitive and point sources of PM/PM_{10})
- BFB boiler (point source of NO_x, CO, VOC, SO_2, and PM/PM_{10})
- Fly ash handling, storage, and truck loading systems (fugitive and point sources of PM/PM_{10})

- Material (i.e., BFB boiler sand and DSI sorbent) receiving, handling, and storage (point sources of PM/PM_{10})
- Mechanical draft cooling tower (point source of PM/PM_{10})
- Emergency diesel engines (point sources of NO_x, CO, VOC, SO_2, and PM/PM_{10})

Figures 2-9 and 2-10 show the locations of the GREC point and fugitive emission sources, respectively.

The primary GREC emission source will be the BFB boiler. Excluding startups, shutdowns, and malfunctions, the BFB boiler will operate between 70 and 100 percent of its design capacity. The GREC dispersion modeling analysis will evaluate air quality impacts for the BFB boiler at both 70- and 100-percent load conditions.

The primary source of GREC emissions will be the combustion of biomass fuels in the BFB boiler. Principal air contaminants that will be emitted from the BFB boiler stack will include NO_x, SO_2, CO, VOC, PM/PM_{10}, hydrogen fluoride, hydrogen chloride, and H_2SO_4 mist. The BFB boiler will also emit trace amounts of metallic and organic compounds. Table 2-4 provides a summary of maximum criteria pollutant (NO_x, SO_2, CO, VOC, PM/PM_{10}, and lead) emission rates for the BFB boiler. This table provides maximum emission rates for the BFB boiler for the various averaging periods of interest in units of pounds per million British thermal units ($lb/10^6$ Btu), pounds per megawatt-hour (lb/MWh), lb/hr, and tpy.

Table 2-5 provides estimates of main boiler hydrogen fluoride, hydrogen chloride, H_2SO_4, mercury, and ammonia emissions. Although carbon dioxide (CO_2) is currently not a regulated pollutant, estimates of CO_2 emissions are also included in Table 2-5 for informational purposes. Tables 2-6 and 2-7 provide BFB boiler organic and metallic hazardous air pollutant (HAP) emission rates, respectively.

KEY

P-1	Hog/Screen Building Baghouse
P-2	BFB Boiler Fuel Day Bin No. 1
P-3	BFB Boiler Fuel Day Bin No. 2
P-4	Fly Ash Silo Vacuum Blower No. 1
P-5	Fly Ash Silo Vacuum Blower No. 2
P-6	Fly Ash Silo
P-7	BFB Boiler
P-8A	Cooling Tower Cell No. 1
P-8B	Cooling Tower Cell No. 2
P-8C	Cooling Tower Cell No. 3
P-8D	Cooling Tower Cell No. 4
P-9	Emergency Fire Water Pump Diesel Engine
P-10	Emergency Generator Diesel Engine
P-11	Sorbent Silo

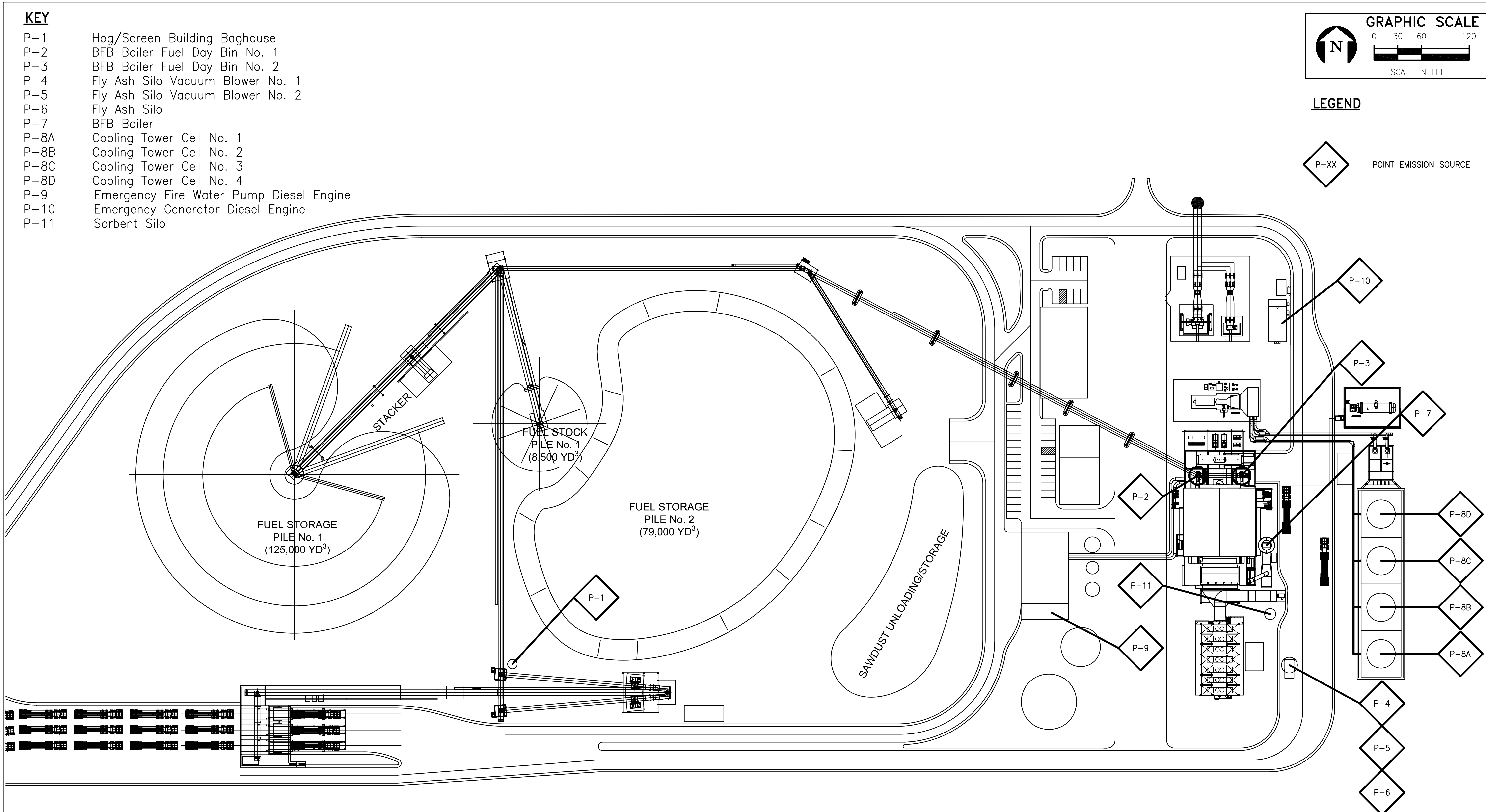

FIGURE 2-9.

LOCATIONS OF POINT (STACK) EMISSION SOURCES

Sources: Zachry Engineering, 2009; ECT, 2009.

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An American Renewables Company

KEY

FUG-1	Biomass Fuel Truck Unloading Shed
FUG-2	Transfer from Conveyor No. 3 to Conveyor No. 5
FUG-3	Transfer from Conveyor No. 4 to Conveyor No. 5
FUG-4	Transfer from Conveyor No. 5 to Conveyor No. 6
FUG-5	Transfer from Conveyor No. 5 to Conveyor No. 7
FUG-6	Transfer from Conveyor No. 6 to Stacker No. 1
FUG-7	Transfer from Stacker No. 1 to Storage Pile No. 1
FUG-8	Storage Pile No. 1
FUG-9	Dozer Operations on Storage Pile No. 1
FUG-10	Automated Reclaim from Storage Pile No. 1 – Transfer from Reclaimer to Conveyor No. 8
FUG-11	Manual Reclaim from Storage Pile No. 1 – Transfer from Dozer to Drag Chain Hopper
FUG-12	Manual Reclaim from Storage Pile No. 1 – Transfer from Drag Chain to Conveyor No. 8
FUG-13	Transfer from Conveyor No. 8 to Conveyor No. 9
FUG-14	Transfer from Conveyor No. 9 to Conveyor No. 10
FUG-15	Transfer from Conveyor No. 9 to Conveyor No. 11
FUG-16	Transfer from Conveyor No. 7 to Stock Pile No. 1
FUG-17	Stock Pile No. 1
FUG-18	Dozer Operations on Stock Pile No. 1
FUG-19	Storage Pile No. 2
FUG-20	Dozer Operations on Storage Pile No. 2
FUG-21	Transfer from Trucks to Sawdust Pile
FUG-22	Sawdust Storage Pile
FUG-23	Dozer Operations on Sawdust Pile
FUG-24	Manual Reclaim from Storage Pile No. 2 or Sawdust Pile – Transfer from Dozer to Drag Chain Hopper
FUG-25	Manual Reclaim from Storage Pile No. 2 or Sawdust Pile – Transfer from Drag Chain to Conveyor No. 14
FUG-26	Transfer from Conveyor No. 14 to Conveyor No. 10
FUG-27	Transfer from Conveyor No. 14 to Conveyor No. 11
FUG-28	Transfer from Conveyor No. 10 to Conveyor No. 12
FUG-29	Transfer from Conveyor No. 11 to Conveyor No. 13
FUG-30	Biomass Fuel Truck Traffic on Paved Plant Roadways
FUG-31	By-Product and Miscellaneous Materials Truck Traffic on Paved Plant Roadways

GRAPHIC SCALE
0 30 60 120
SCALE IN FEET

LEGEND

FUG-XX FUGITIVE EMISSION SOURCE
C-XX CONVEYOR

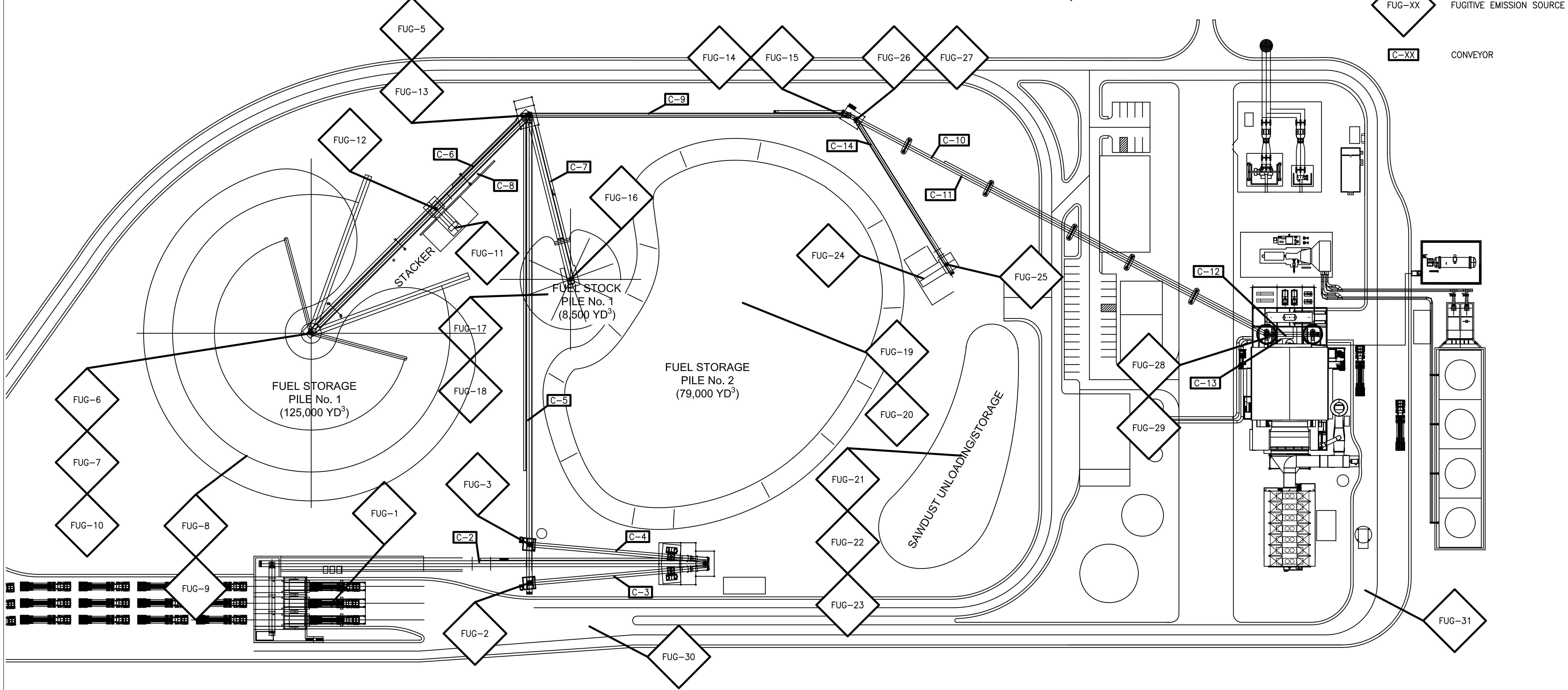

FIGURE 2-10.

LOCATIONS OF FUGITIVE PM/PM_{10} EMISSION SOURCES

Sources: Zachry Engineering, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

Table 2-4. BFB Boiler—Criteria Pollutant Emission Rates

Parameter	Averaging Period	Units	Maximums
Operating hours	Annual	hr/yr	8,760
Output (100-percent load)	Maximum hourly	MW, gross	116
Heat input (100-percent load)	Maximum hourly	10^6 Btu/hr (HHV)	1,358
NO_x	24-Hour and annual	lb/10^6 Btu	0.070
		lb/MWh	0.82
		tpy	416.4
		lb/hr	95.1
		g/s	12.0
SO_2	24-Hour and annual	lb/10^6 Btu	0.041
		lb/MWh	0.48
		tpy	243.9
		lb/hr	55.7
		g/s	7.0
CO	24-Hour and annual	lb/10^6 Btu	0.120
		lb/MWh	1.4
		tpy	713.8
		lb/hr	163.0
		g/s	20.5
VOC	3-Hour and annual	lb/10^6 Btu	0.013
		lb/MWh	0.15
		tpy	77.3
		lb/hr	17.7
		g/s	2.2
PM/PM_{10} (filterable)	3-Hour and annual	lb/106 Btu	0.015
		lb/MWh	0.18
		tpy	89.2
		lb/hr	20.4
		g/s	2.6

Table 2-4. BFB Boiler—Criteria Pollutant Emission Rates (Page 2 of 2)

Parameter	Averaging Period	Units	Maximums
PM/PM_{10} (condensable)	3-Hour and annual	$lb/10^6$ Btu	0.027
		lb/MWh	0.32
		tpy	160.6
		lb/hr	36.7
		g/s	4.6
PM/PM_{10} (total)	3-Hour and annual	$lb/10^6$ Btu	0.042
		lb/MWh	0.49
		tpy	249.8
		lb/hr	57.0
		g/s	7.2
Lead	3-Hour and annual	$lb/10^6$ Btu	0.000021
		lb/MWh	0.00025
		tpy	0.12
		lb/hr	0.029
		g/s	0.0037

Note: 10^6 Btu/hr = million British thermal units per hour.
$lb/10^6$ Btu = pound per million British thermal units.
lb/MWh = pound per megawatt-hour.
tpy = ton per year.
lb/hr = pound per hour.
g/s = gram per second.

Sources: GREC, 2009.
ECT, 2009.

Table 2-5. BFB Boiler—Hydrogen Fluoride, Hydrogen Chloride, H_2SO_4 Mist, Mercury, and CO_2 Emission Rates

Parameter	Averaging Period	Units	Maximums
Hydrogen fluoride	3-Hour and annual	lb/10^6 Btu	0.012
		lb/MWh	0.14
		tpy	71.4
		lb/hr	16.3
		g/s	2.1
Hydrogen chloride	3-Hour and annual	lb/10^6 Btu	0.0060
		lb/MWh	0.070
		tpy	35.7
		lb/hr	8.1
		g/s	1.0
H_2SO_4 mist	3-Hour and annual	lb/10^6 Btu	0.0010
		lb/MWh	0.012
		tpy	5.9
		lb/hr	1.4
		g/s	0.18
Mercury	Annual	lb/10^6 Btu	0.0000014
		lb/MWh	0.000016
		tpy	0.0084
		lb/yr	16.7
Ammonia	Annual	lb/10^6 Btu	0.0063
		lb/MWh	0.073
		tpy	37.3
		lb/hr	8.5
CO_2	Annual	lb/10^6 Btu	195
		lb/MWh	2,283
		tpy	1,159,868
		lb/hr	264,810

Sources: GREC, 2009.
ECT, 2009.

Table 2-6. BFB Boiler—Organic Hazardous Air Pollutant Emission Rates

Pollutant	Units	Maximums
Heat input (100-percent load)	10^6 Btu/hr (HHV)	1,358
Acetaldehyde	lb/10^6 Btu	1.44×10^{-5}
	lb/hr	0.0196
	tpy	0.0857
Acrolein	lb/10^6 Btu	8.52×10^{-6}
	lb/hr	0.0116
	tpy	0.0507
Benzene	lb/10^6 Btu	1.23×10^{-4}
	lb/hr	0.1670
	tpy	0.7316
Dibenzofurans	lb/10^6 Btu	1.62×10^{-9}
	lb/hr	0.0000022
	tpy	0.0000096
Dioxins (equivalent)	lb/10^6 Btu	2.38×10^{-9}
	lb/hr	0.0000032
	tpy	0.0000142
Ethylbenzene	lb/10^6 Btu	9.52×10^{-6}
	lb/hr	0.0129
	tpy	0.0566
Formaldehyde	lb/10^6 Btu	2.70×10^{-4}
	lb/hr	0.3667
	tpy	1.6060
Methyl chloroform	lb/10^6 Btu	1.30×10^{-5}
	lb/hr	0.0177
	tpy	0.0773
Methylene chloride	lb/10^6 Btu	4.90×10^{-5}
	lb/hr	0.0665
	tpy	0.2915

Table 2-6. BFB Boiler—Organic Hazardous Air Pollutant Emission Rates (Continued, Page 2 of 2)

Pollutant	Units	Maximums
o-Xylenes	lb/10^6 Btu	1.57×10^{-5}
	lb/hr	0.0213
	tpy	0.0934
16-PAH (POM)	lb/10^6 Btu	2.16×10^{-5}
	lb/hr	0.0293
	tpy	0.1285
Toluene	lb/10^6 Btu	2.10×10^{-5}
	lb/hr	0.0285
	tpy	0.1249
Xylenes	lb/10^6 Btu	5.59×10^{-6}
	lb/hr	0.0076
	tpy	0.0332

Note: 16-PAH = acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(e)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(ah)anthracene, fluoranthene, fluorene, ideno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.
POM = polycyclic organic matter.

Sources: GREC, 2009.
EPA, 2002.
ECT, 2009.

Table 2-7. BFB Boiler—Metallic Hazardous Air Pollutant Emission Rates

Pollutant	Units	Maximums
Heat input (100-percent load)	10^6 Btu/hr (HHV)	1,358
Arsenic	lb/10^6 Btu	5.01×10^{-6}
	lb/hr	0.0068
	tpy	0.0298
Beryllium	lb/10^6 Btu	1.57×10^{-6}
	lb/hr	0.0021
	tpy	0.0093
Cadmium	lb/10^6 Btu	3.54×10^{-6}
	lb/hr	0.0048
	tpy	0.0211
Chromium	lb/10^6 Btu	1.28×10^{-4}
	lb/hr	0.1738
	tpy	0.7613
Lead	lb/10^6 Btu	2.10×10^{-5}
	lb/hr	0.0285
	tpy	0.1249
Manganese	lb/10^6 Btu	5.89×10^{-5}
	lb/hr	0.0800
	tpy	0.3503
Mercury	lb/10^6 Btu	1.41×10^{-6}
	lb/hr	0.0019
	tpy	0.0084
Nickel	lb/10^6 Btu	1.35×10^{-5}
	lb/hr	0.0208
Phosphorus	lb/10^6 Btu	3.68×10^{-4}
	lb/hr	0.4997
	tpy	2.1889

Sources: GREC, 2009.
EPA, 2002.
ECT, 2009.

The emergency generator and firewater pump diesel engines will be fired with ULSD fuel oil. Table 2-8 summarizes maximum criteria pollutant emission rates for these emergency diesel engines.

The mechanical draft cooling tower will be equipped with high efficiency drift eliminators. PM/PM_{10}/fine particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$) will also be emitted by the material handling emission sources. Table 2-9 provides a summary of the $PM/PM_{10}/PM_{2.5}$ point and fugitive emissions for the cooling tower and material handling emission sources.

In addition to the emissions that will occur during GREC operation, there will be temporary emissions that will occur during the construction phase of the project. PM/PM_{10} emissions will occur due to earthmoving activities associated with site preparation, wind erosion from disturbed areas, and vehicular traffic on unpaved roadways. The use of diesel engine heavy equipment will result in emissions of diesel fuel oil combustion products including NO_x, SO_2, CO, and VOC.

Reasonable precautions will be taken to minimize construction related emissions including watering of unpaved surfaces, as necessary, and use of ULSD by the heavy equipment. Idling of the heavy equipment, to the extent reasonable, will be minimized. Table 2-10 provides estimates of the construction related emissions.

An overall summary of maximum annual criteria and HAP pollutant emission rates for GREC is provided in Tables 2-11 and 2-12, respectively. Appendix A provides detailed emission rate calculations.

Table 2-13 provides stack parameters for the BFB boiler for 100- and 70-percent loads. Table 2-14 presents stack parameters for the material handling baghouses. Table 2-15 provides stack parameters for the cooling tower and emergency generator and firewater pump diesel engines.

Table 2-8. Emergency Diesel Engines—Criteria Pollutant Emission Rates

Pollutant	Units	Generator Engine	Firewater Pump Engine
Operating hours	hr/yr	500	500
Engine output	kW	564	275
(100-percent load)	bhp	757	205
NO_x	g/bhp-hr	3.4	2.1
	tpy	1.4	0.32
	lb/hr	5.6	1.3
	g/s	0.71	0.16
SO_2	g/bhp-hr	0.0047	0.0051
	tpy	0.0020	0.00078
	lb/hr	0.0078	0.0031
	g/s	0.00098	0.00039
CO	g/bhp-hr	3.5	2.6
	tpy	1.5	0.39
	lb/hr	5.8	1.6
	g/s	0.73	0.20
VOC	g/bhp-hr	1.4	0.90
	tpy	0.60	0.14
	lb/hr	2.4	0.55
	g/s	0.30	0.069
PM/PM_{10}	g/bhp-hr	0.15	0.15
	tpy	0.063	0.023
	lb/hr	0.25	0.091
	g/s	0.032	0.015
Lead	g/bhp-hr	Negligible	Negligible
	tpy	Negligible	Negligible
	lb/hr	Negligible	Negligible
	g/s	Negligible	Negligible

Note: bhp = brake horsepower.
g/bhp-hr = gram per brake horsepower-hour.

Sources: GREC, 2009.
ECT, 2009.

Table 2-9. Cooling Tower and Material Handling/Storage—Annual $PM/PM_{10}/PM_{2.5}$ Emission Rates

Source	Annual Emission Rates (tpy)		
	PM	PM_{10}	$PM_{2.5}$
Cooling tower	1.5	1.0	0.0032
Material transfer Baghouses	29.1	29.1	29.1
Material transfer Biomass fuel	0.17	0.081	0.012
Biomass fuel Storage piles Wind erosion	0.039	0.020	0.0029
Biomass fuel Storage piles Dozer operations	0.44	0.027	0.0037
Truck traffic Paved roads	11.0	2.1	0.32

Sources: GREC, 2009.
ECT, 2009.

Table 2-10. Temporary Construction-Related Emission Rate Summary

Criteria Pollutant	Estimated Annual Emissions (tons)					
	Soil Transfer and Fill	Grading Activities	Traffic on Unpaved Roads	Wind Erosion	Heavy Equipment Diesel Engines	Project Totals
NO_x	N/A	N/A	N/A	N/A	117.1	117.1
CO	N/A	N/A	N/A	N/A	90.6	90.6
VOC	N/A	N/A	N/A	N/A	50.2	50.2
SO_2	N/A	N/A	N/A	N/A	1.3	1.3
PM	0.013	4.1	30.8	0.062	5.2	84.6
PM_{10}	0.0061	1.7	8.8	0.031	5.2	15.7
$PM_{2.5}$	0.00092	0.89	0.88	0.0047	5.2	7.0
Lead	N/A	N/A	N/A	N/A	Negligible	Negligible

Note: N/A = not applicable.

Sources: GREC, 2009.
ECT, 2009.

Table 2-11. Annual Criteria Pollutant Emission Rate Summary

Criteria Pollutant	Potential Annual Emissions (tpy)						
	BFB Boiler*	Material Handling Point Sources	Material Handling Fugitive Sources	Cooling Tower	Generator Diesel Engine	Firewater Pump Diesel Engine	Project Totals
NO_x	416.4	N/A	N/A	N/A	1.4	0.32	418.1
CO	713.8	N/A	N/A	N/A	1.5	0.39	715.6
VOC	77.3	N/A	N/A	N/A	0.60	0.14	78.1
SO_2	243.9	N/A	N/A	N/A	Negligible	Negligible	243.9
PM†	89.2	28.0	11.6	1.5	0.063	0.023	130.4
PM_{10}	249.8	28.0	2.3	1.0	0.063	0.023	281.2
$PM_{2.5}$	249.8	28.0	0.34	0.0032	0.063	0.023	278.3
Lead	0.12	N/A	N/A	N/A	Negligible	Negligible	0.12

Note: N/A = not applicable.

*Based on 8,760 hr/yr at 100-percent load. Annual emissions including shutdown, maintenance outages, and startups will be lower.
†Filterable PM.

Sources: GREC, 2009.
ECT, 2009.

Table 2-12. Annual HAPs Emission Rate Summary

HAPs	Potential Annual Emissions (tpy)			
	BFB Boiler	Generator Diesel Engine	Firewater Pump Diesel Engine	Project Totals
Organic HAPS				
Acetaldehyde	0.086	0.000032	0.00039	0.086
Acrolein	0.051	0.000010	0.000047	0.051
Benzene	0.73	0.00099	0.00047	0.73
1,3-Butadiene	Negligible	0.000050	0.000020	0.000069
Dibenzofurans (total PCDD/PCDF)	0.000010	Negligible	Negligible	0.000010
Dioxins	0.000014	Negligible	Negligible	0.000014
Ethyl benzene	0.057	Negligible	Negligible	0.057
Formaldehyde	1.6	0.00010	0.00060	1.6
Methyl chloroform	0.077	Negligible	Negligible	0.077
Methyl chloride	0.29	Negligible	Negligible	0.29
PAH/POM	0.13	0.00043	0.00013	0.13
Toluene	0.12	0.00036	0.00021	0.12
o-Xylenes	0.093	Negligible	Negligible	0.093
Xylenes	0.033	0.00014	0.00025	0.033
Acid Gases				
Hydrogen chloride	35.7	Negligible	Negligible	35.7
Hydrogen fluoride	71.4	Negligible	Negligible	71.4
Metallic HAPS				
Arsenic	0.030	Negligible	Negligible	0.030
Beryllium	0.0093	Negligible	Negligible	0.0093
Cadmium	0.021	Negligible	Negligible	0.021
Chromium	0.76	Negligible	Negligible	0.76
Lead	0.12	Negligible	Negligible	0.12
Manganese	0.35	Negligible	Negligible	0.35
Mercury	0.0084	Negligible	Negligible	0.0084
Nickel	0.091	Negligible	Negligible	0.091
Phosphorus	2.2	Negligible	Negligible	2.2

Sources: GREC, 2009.
ECT, 2009.

Table 2-13. BFB Boiler Stack Parameters

Parameter	Units	Boiler Load	
		100 Percent	70 Percent
Height above grade	ft	230	230
	meter	70.1	70.1
Exit diameter	ft	12.0	12.0
	meter	3.66	3.66
Stack area	ft^2	113.1	113.1
Flow rate	acfm	520,600	359,900
Exit velocity	ft/sec	76.7	53.0
	m/sec	23.4	16.2
Exit temperature	°F	310.0	302.0
	K	427.6	423.2

Note: ft^2 = square foot.
acfm = actual cubic foot per minute.
ft/sec = foot per second.
m/sec = meter per second.
K = Kelvin.

Sources: GREC, 2009.
ECT, 2009.

Table 2-14. Material Handling Baghouse Stack Parameters

Parameter	Units	Emission Source					
		Screen/Hog Building	BFB Fuel Bin #1	BFB Fuel Bin #2	Fly Ash Silo Blowers (each)	Fly Ash Silo Bin Vent	Sorbent Silo Bin Vent
Height above grade	ft	50	100	100	70	77	51
	meter	15.2	30.5	30.5	21.3	23.5	15.5
Exit diameter	ft	3.3	1.5	1.0	1.5	1.0	1.0
	meter	1.0	0.46	0.30	0.46	0.30	0.30
Stack area	Ft^2	8.3	1.8	0.79	1.8	0.79	0.79
Flow rate	acfm	36,000	4,000	2,000	3,500	2,000	2,000
Exit velocity	ft/sec	72.33	37.7	42.4	33.0	42.4	42.4
	m/sec	22.0	11.5	12.9	10.1	12.9	12.9
Exit temperature	°F	77.0	77.0	77.0	100.0	100.0	100.0
	K	298.2	298.2	298.2	310.9	310.9	310.9

*Per cell.

Sources: GREC, 2009.
ECT, 2009.

Table 2-15. Emergency Diesel Engines and Cooling Tower Stack Parameters

Parameter	Units	Emission Source		
		Generator Diesel Engine	Firewater Pump Diesel Engine	Cooling Tower*
Height above grade	ft	15	10	53.1
	meter	4.6	3.1	16.2
Exit diameter	ft	0.67	0.50	36.8
	meter	0.20	0.15	11.2
Stack area	Ft^2	0.35	0.20	1,061
Flow rate	acfm	3,899	2,250	2,425,000
Exit velocity	ft/sec	186.2	191.0	38.1
	m/sec	56.7	58.2	11.6
Exit temperature	°F	893.0	855.0	93.0
	K	751.4	730.4	307.0

*Per cell.

Sources: GREC, 2009.
ECT, 2009.

2.5 EXCESS EMISSIONS

The GREC BFB boiler may have up to approximately 20 cold startups per year due to forced and unforced outages. Natural gas will be used during the startup cycle to raise the BFB boiler fluidized bed to its minimum effective operating temperature. The duration of each startup will depend on the temperatures of the BFB boiler and STG following the outages. The BFB boiler baghouse will be in service throughout the startup cycle. However, the DSI and SCR control systems cannot be placed in service until the boiler flue gas temperature reaches the minimum operating temperatures required for the effective operation of these emission control technologies. Excess emissions will occur until the BFB boiler attains a steady-state generation load of approximately 70 percent when firing biomass fuels, at which time the unit will be in compliance with all proposed emission limits. Based on a cold startup duration of 14 hours per event, there will be an estimated 280 hr/yr of excess emissions due to startup events. Hourly mass (i.e., lb/hr) emission rates during startup events for all pollutants with short-term AAQS (i.e., SO_2, PM_{10}, and CO) will all be lower than the rates that will occur at 100-percent load. Table 2-16 provides a summary of estimated startup emissions for the BFB boiler.

Similarly, excess emissions associated with BFB boiler shutdowns will also occur due to the temperature constraints of the DSI and SCR control systems. Based on a shutdown duration of 3 hours per event, there will be an estimated 60 hr/yr of excess emissions due to shutdown events. Hourly mass (i.e., lb/hr) emission rates during shutdown events for all pollutants with short-term ambient air quality standards will all be lower than the rates that will occur at 100-percent load. Table 2-17 provides a summary of estimated shutdown emissions for the BFB boiler.

Unless specifically authorized by FDEP for a longer duration, Rule 62-210.700(1), F.A.C., allows excess emissions for up to 2 hours in any 24-hour period provided best operational practices to minimize emissions are adhered to and the duration of excess emissions are minimized. GREC will be a base load unit with an estimated capacity factor of greater than 80 percent. The frequency of unit startups will therefore be low. Each unit startup will also be preceded by a period of time when the unit is offline, during which there will be no emissions from the BFB boiler. Startups of the BFB boiler will be

Table 2-16. BFB Boiler—Cold Startup Emissions*

Pollutant	Units	Value
Number of startups	Annual	20
Duration of startups	hr/event	14
	hr/yr	280
NO_x	lb/hr (average)	113.4
	tpy	15.9
SO_2	lb/hr (maximum)	11.2
	tpy	0.59
CO	lb/hr (maximum)	159.7
	tpy	9.4
VOC	lb/hr (average)	6.0
	tpy	0.84
PM/PM_{10}	lb/hr (maximum)	11.7
	tpy	0.96

*Emissions from initial firing to steady-state operation at 70-percent load firing biomass fuels.

Sources: GREC, 2009.
ECT, 2009.

Table 2-17. BFB Boiler—Shutdown Emissions*

Pollutant	Units	Value
Number of shutdowns	Annual	20
Duration of shutdowns	hr/event	3
	hr/yr	60
NO_x	lb/hr (average)	95.6
	tpy	2.9
SO_2	lb/hr (maximum)	11.2
	tpy	0.29
CO	lb/hr (maximum)	89.9
	tpy	2.4
VOC	lb/hr (average)	7.2
	tpy	0.22
PM/PM_{10}	lb/hr (maximum)	11.7
	tpy	0.31

*Emissions from steady-state operation at 70-percent load to cessation of fuel firing.

Sources: GREC, 2009.
ECT, 2009.

conducted using best operational practices to minimize emissions and duration consistent with process and safety considerations. GREC estimates up to 14 hours of excess emissions per startup. Accordingly, allowances for excess emissions are requested for: (a) startup events for up to 14 hours in any 24-hour period, and (b) shutdown events for up to 3 hours in any 24-hour period.