6.0 EFFECTS OF PLANT OPERATION

This chapter provides descriptions of the potential impacts of the operation of GREC on the physical, natural, and socioeconomic environment on and in the vicinity of the Site. To the extent practicable, the potential impacts of the operations are quantified and assessed in terms of duration (i.e., long- or short-term) and character (i.e., adverse or beneficial and significant or minimal). In addition, the impact assessments in this chapter provide reasonable assurance that the operation of GREC will comply with all applicable regulations and standards and that any potential adverse impact will be minimized or avoided through the use of proven, state-of-the-art project design, equipment, and pollution control systems and measures.

6.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM

As described in Section 4.5, a four-cell mechanical draft cooling tower will be used to dissipate the heat from the steam condenser. The annual average flow rate of the cooling tower blowdown will be approximately 0.18 MGD, which will be treated and reused or processed in the ZLD system with a brine concentrator/crystallizer facility. Therefore, no effluent from the heat dissipation system will be discharged to surface water.

6.1.1 TEMPERATURE EFFECT ON RECEIVING BODY OF WATER

As described in Subsection 6.1, cooling tower blowdown will be treated and reused or routed to the ZLD system, which produces no effluent. Therefore, the heat dissipation system at the proposed facility will have no temperature effects on a receiving body of water.

6.1.2 EFFECT ON AQUATIC LIFE

As described in Subsection 6.1, cooling tower blowdown will be treated and reused or routed to the ZLD system, which produces no effluent. Therefore, the heat dissipation system at the proposed facility will have no effect on aquatic life.

6.1.3 BIOLOGICAL EFFECT OF MODIFIED CIRCULATION

As described in Subsection 6.1, cooling tower blowdown will be treated and reused or processed in the ZLD system, which produces no wastewater discharge. The proposed heat dissipation system will not modify the circulation of the ambient surface water and will not affect the biota and other surface water resources in the vicinity of the Site.

6.1.4 EFFECTS OF OFFSTREAM COOLING

6.1.4.1 Blowdown Discharge Effects

Since cooling tower blowdown will not be discharged from the GREC Site, no adverse offstream cooling impacts will occur to any surface waters.

6.1.4.2 Cooling Tower Fogging/Drift Effects

GREC will include one four-cell mechanical draft cooling tower equipped with high-efficiency drift eliminators. The cooling tower will be located at the eastern edge of the GREC power block area approximately 3,200 ft from the nearest major highway (U.S. 441).

Because of direct contact between the cooling water and ambient air, a small portion of the recirculating cooling water is entrained in the air stream and discharged from the cooling tower as drift droplets. These water droplets contain the same concentration of dissolved solids as found in the recirculating cooling water. Large water droplets quickly settle out of the cooling tower exhaust stream and deposit near the tower. The remaining smaller water droplets may evaporate prior to being deposited in the area surrounding the cooling tower. These evaporated droplets represent potential PM/PM_{10} emissions because of the fine PM/PM_{10} formed by crystallization of the dissolved solids contained in the droplet. The GREC cooling tower high-efficiency drift eliminators will result in estimated cooling tower PM and PM_{10} emissions of 1.5 and 1.0 tpy, respectively.

Cooling towers transfer heat from plant processes to the atmosphere through the evaporation and dispersion of cooling water. Depending on the meteorological conditions, warm, moist air leaving a tower may become cooled to the point of saturation, causing the water to condense forming a visible plume. Ground level fogging and/or icing may occur if this plume does not rise after being emitted from the cooling tower. The drift from a tower carries dissolved and suspended solids (mostly salt), which are deposited locally and may have the potential to affect soils and vegetation. Evaluation of these potential environmental impacts for the GREC cooling tower is provided in the following subsections.

Plume Visibility

When a visible plume is formed from a cooling tower, the extent to which it will disperse and dissipate will vary depending on the prevailing meteorological conditions. The location of a visible plume may vary significantly from hour to hour, thereby reducing the duration of fogging events.

The GREC mechanical draft cooling tower will consist of four cells, each having a diameter of 36.8 ft. The cooling tower will be arranged in a north-south orientation and will have a deck height of 40 ft. The height to the top of the outlet stacks will be 53 ft. The air flow exiting the cooling tower will be approximately 40,400 cfs per cell. Water droplet drift from the cooling tower will be minimized by drift eliminators having a drift loss rate of only 0.0005 percent.

Due to the generally moderate temperatures that occur in north-central Florida and the significant distance to the nearest major highway, the GREC cooling tower will not cause any adverse impacts with respect to fogging/icing on U.S. 441 or other offsite locations. This conclusion is consistent with current GRU DGS operations, which include two larger mechanical draft cooling towers situated much closer to U.S. 441 than the GREC cooling tower. The DGS cooling towers have been in operation for more than 30 years without causing any fogging/icing issues.

Deposition Analysis

The amount of salt deposition is directly related to the TDS concentration found in the cooling tower recirculation water. The GREC cooling tower recirculation water will have an estimated TDS concentration of 1,700 ppm. As noted previously, GREC cooling tower estimated PM and PM_{10} emissions are 1.5 and 1.0 tpy, respectively.

Direct salt damage to vegetation is due to the absorption of salt from drift that is deposited on a plant's leaves. Another mechanism for the impact of saline drift on plants is through the absorption of salt accumulation in the soil. Accumulation will occur as the annual deposition of salt exceeds the rate at which salt is washed from the soil by rainfall. The absorbed salt can cause immediate damage or accumulate in the woody tissue of perennial plants until it reaches toxic levels. Due to the low cooling tower PM emission rates, salt deposition due to the GREC cooling tower will have no adverse effect on off-site natural vegetation or soils in the vicinity of the GREC facility.

6.1.5 MEASUREMENT PROGRAM

As described in Subsection 6.1, the proposed cooling tower blowdown will be treated and reused or routed to the ZLD system, which produces no discharge. Therefore, monitoring of either the cooling tower blowdown or ambient surface water is not required for GREC.

6.2 EFFECT OF CHEMICAL AND BIOCIDE DISCHARGES

6.2.1 INDUSTRIAL WASTEWATER DISCHARGES

All industrial wastewater created by the proposed facility will be treated and reused or processed in the ZLD system, which produces no liquid discharge. Therefore, GREC will have no chemical nor biocide effects on the ambient surface water.

6.2.2 COOLING TOWER BLOWDWON

The cooling tower blowdown will be treated and reused or processed in the ZLD system, which produces no liquid discharge, and therefore will have no chemical or biocide effects on the ambient surface water.

6.2.3 MEASUREMENT PROGRAMS

The proposed facility will not contribute any chemical or biocide to the ambient surface water; therefore, a monitoring program is not required for the surface water.

6.3 IMPACTS ON WATER SUPPLIES

6.3.1 SURFACE WATER

The proposed facility will not use any surface water as source water for plant process, heat dissipation, or drinking water. Therefore, it will have no impacts on surface water supplies.

6.3.2 GROUNDWATER

In accordance with the FDEP Application Instruction Guide (FDEP, September 1, 2009), the focus of Subsection 6.3.2 is on waste disposal systems and evaluation of potential impacts from any such waste disposal systems. All GREC waste streams are characterized and described in detail in Chapter 4 of this SCA. The GREC facility is designed such that there will be no permanent onsite liquid or solid waste disposal systems or facilities. Liquid and solid wastes that are produced during operation and maintenance activities will be temporarily stored onsite within appropriate containment facilities until the wastes are transported offsite by a licensed hauler for disposal at properly permitted, offsite facilities. Through use of the ZLD system, GREC will have no industrial wastewater discharges to surface or groundwaters. As such, there will be no wastewaters to cause water quality impacts or hydrologic mounding or any other hydrologic effects, which precludes the need for groundwater monitoring associated with waste disposal systems. Therefore, GREC onsite waste disposal systems will have no impacts on groundwater resources.

If, for any reason, the facility were to contaminate the shallow groundwater, theoretical analysis and empirical evidence suggest that contaminant migration would be limited to relatively short distances. The onsite hydrogeologic parameter values suggest an average linear groundwater flow velocity of 15 ft/yr toward the west in the SAS at the GREC Site. The rate of contaminant migration would typically be much less than the groundwater flow velocity due to dilution, diffusion, and adsorption. The silts and clays present in the SAS at the GREC Site would tend to retard the migration of organic constituents and cationic metals, respectively.

The groundwater quality data for the GREC and DGS site areas (Subsection 3.3.2.1) show that several analytes have elevated concentrations; however, none of the analytes exceed a primary drinking water quality standard at the existing DGS property boundaries (i.e., inclusive of the GREC Site). The secondary groundwater standards do not apply to the existing GRU DGS site pursuant to FDEP Rule 62-520.310(14), F.A.C., because DGS is an existing installation as defined in FDEP Rule 62-520.200(10),F.A.C.

GREC is not expected to cause violations of drinking water quality standards. Hypothetically, if GREC were to cause adverse effects on the shallow groundwater, most constituents in the groundwater would not migrate more than a few hundred feet horizontally from the theoretical source area before the groundwater quality criteria are achieved. There is virtually no possibility that such theoretical impacts would move to surface water, because the nearest stream is located approximately 0.5 mile southwest of the power block area at the GREC Site. Further, it is highly unlikely that any such theoretical impact would migrate downward from the SAS to the UFA. Comparisons of the groundwater quality data for the SAS and the UFA collected by GRU on the DGS property (Subsection 3.3.2.1) suggest that the intermediate confining layer is effective at preventing downward migration of impacts from the SAS to the UFA, as is further described in Subsection 6.3.3.2.

The effects of the proposed groundwater use (average 1.4-MGD withdrawal from the UFA) for the GREC facility are described in Subsection 6.3.3.

6.3.3 DRINKING WATER

Groundwater is the primary source of drinking water in the GREC area. Existing water uses in the area of the GREC facility are described in Subsection 3.3.3.2. As described, more than 90 percent of the groundwater wells in this region use the UFA, whereas less than 10 percent of the wells use the IAS. None of the wells identified use the SAS as a water supply source. The GREC Site area geology and hydrology, subsurface hydrology, and site water budget and area users are described in the Subsections 3.3.1, 3.3.2, and 3.3.3, respectively. Please refer to those sections for a complete description of the hydrogeologic setting

Groundwater use is proposed at an annual average withdrawal rate of 1.4 MGD at the GREC facility. The source of this water is the UFA. SRWMD regulates the use of water in this region.

Further, to conserve groundwater resources in the region and minimize potential impacts of the proposed use in the vicinity of the Site, GREC LLC and GRU have agreed that GRU will reduce its existing groundwater use approval for DGS by 1.4 MGD after site certification approval and prior to the start of operations of GREC (see Attachment 4 in Appendix 10.8). Therefore, the approved groundwater use in the immediate site area will not be increased by the proposed water use for GREC.

6.3.3.1 Groundwater Models and Results

Groundwater Models

Appendix 10.8 of this SCA provides the GREC water use permit (WUP) application information, which also includes several attachments. Attachment 2 to the WUP application is a document titled Groundwater Flow Modeling and Impacts Assessment. The overall objective of this study is to assess potential impacts from the requested groundwater withdrawals at the GREC facility in accordance with the SCA, the WUP requirements of SRWMD, and other agency requirements. Within that document, Section 3.0 describes the methods used for various groundwater modeling applications and presents the results of the groundwater models, and Section 4.0 provides discussion and interpretation of the various groundwater modeling results and provides conclusions regarding the assessment of potential impacts from the proposed groundwater withdrawals. The most relevant elements from that document are summarized in the following paragraphs.

Two groundwater models were applied for this assessment of potential impacts from the proposed GREC groundwater withdrawals. These include the SRWMD regional groundwater flow model for evaluation of most types of potential impacts and the nonsteady or steady state coupled (NSSCOU) aquifer analytical model for evaluation of potential impacts to localized surface features such as onsite wetlands.

The SRWMD model was created by SRWMD as a permitting and groundwater resource assessment tool (Schneider *et al.*, 2008). The SRWMD model is a calibrated, steady-state simulation using the Modular Three-Dimensional Finite Difference Groundwater Flow Model (MODFLOW) developed at USGS by McDonald and Harbaugh (1988, 1996, and 2000). ECT acquired the Groundwater Vistas version of the SRWMD model, as revised August 2008, from the SRWMD Web site (http://www.srwmd.state.fl.us/index.aspx?NID=125) for use in this impact analysis. The SRWMD model is a five-layer model. Table 6.3.3-1 presents a summary of the model layer elevations, thicknesses, hydraulic conductivities, and transmissivities in the model cell representing the GREC Site location.

The SRWMD model scale is not appropriate for evaluating impacts to immediately local features due to the model cell size of 5,000 by 5,000 ft. Based on discussions with SRWMD staff, the NSSCOU model was determined to be most appropriate for evaluation of drawdown impacts in relation to localized surface features, such as wetlands. Therefore, the NSSCOU analytical model was used as part of this modeling analysis. The NSSCOU aquifer model is based on coupled semiconfined aquifer conditions using a series of equations programmed by Motz (1978 and 1996). The published analytical methods of Motz (1978 and 1996) and Denis and Motz (1998) were developed into a FORTRAN program and used to predict the local drawdowns in water levels.

Two NSSCOU simulations were completed for this analysis. The Case 1 NSSCOU simulation uses aquifer parameter values as defined in the SRWMD model for the GREC Site location. The Case 2 NSSCOU simulation, however, uses site-specific transmissivity values of 15 ft^2/day for the SAS and 40,000 ft^2/day for the UFA (this value probably is significantly lower than the actual transmissivity, since it is based on testing that included only a small fraction [approximately 20 percent] of the total aquifer thickness, as described in Subsection 3.3.2.1). These transmissivites are much lower than those in Case 1. The much lower transmissivity values used in Case 2 cause it to be much more

Table 6.3.3-1. Aquifer Parameters Defined in the SRWMD Model at the GREC Site Location

Model Layer	Top Elevation (ft-NVGD)	Bottom Elevation (ft-NGVD)	Hydrogeologic Unit	Unit Thickness (ft)	Kx (ft/day)	Ky (ft/day)	Kz (ft/day)	Aquifer Transmissivity (ft^2/day)
1	173	84.5	SAS	88.5	21.56	21.56	7.19	1,908
2	84.5	0.0	IAS	84.5	0.00805	0.00805	0.0027	0.68
3	0.0	-925	FAS	925.0	4,377	4,377	1,459	4,048,725
4	-925	-935	FAS	10.0	4,377	4,377	1,459	43,770
5	-935	-1,455	FAS	520.0	4,377	4,377	1,459	2,276,040

Note: GREC pumping well located in model cell R114, C147.
The MCU is missing in the vicinity of the proposed site; therefore, the UFA and LFA together comprise the FAS.
K = hydraulic conductivity.
Kz = set to a constant ratio of Kx divided by 3.
LPF package used, model using Kz and thickness to calculate vertical conductance.

Source: Scheider *et al.*, 2008.

conservative toward predicting higher drawdowns locally than would Case 1. Table 6.3.3-2 presents a summary of the aquifer parameter values used to define the NSSCOU input parameters for both Cases 1 and 2.

Attachment 2 to the WUP application information (in Appendix 10.8) provides more details regarding these groundwater models.

Results from the Groundwater Models

Using the SRWMD model, Figure 6.3.3-1 depicts the steady-state potentiometric surface drawdown estimated in the UFA (Layer 3) based on a constant pumping rate of 1.4 MGD. The estimated drawdowns are less than 0.05 ft everywhere. Because the middle confining layer is absent in the site area, the aquifer characteristics of the middle confining layer (Layer 4) and the Lower Floridan aquifer (LFA) (Layer 5) are equal, and these aquifers (layers) are all in contact. Therefore, the drawdown predicted by the steady-state model in Layers 4 and 5 are the same as observed in the UFA (Layer 3) and are less than 0.05 ft everywhere. The SRWMD model results show similarly insignificant drawdowns are predicted to occur in the overlying aquifers; the model estimates drawdowns of less than 0.044 ft everywhere in both the IAS (Layer 2) as shown in Figure 6.3.3-2 and the SAS (Layer 1) as shown in Figure 6.3.3-3.

Using the NSSCOU analytical model, Table 6.3.3-3 summarizes the predicted water level drawdown results for both Case 1 and 2. For the surficial aquifer, the NSSCOU simulation using the regional parameters in Case 1 predicts 0.0007 ft of drawdown at a distance of 100 ft from the well. The much more conservative Case 2 predicts 0.07 ft of drawdown in the SAS at a distance of 100 ft from the withdrawal well.

The SRWMD model was also used to evaluate the impact of the proposed 1.4 MGD groundwater withdrawal on the minimum flows and levels (MFL) set for the Upper Santa Fe River, specifically, the MFL established for the gauges near Graham and at Worthington Springs regarding flows. Table 6.3.3-4 presents a summary of the calculated change in river flow for the target portion of the Upper Santa Fe River.

Table 6.3.3-2. Summary of NSSCOU Groundwater Modeling Parameters

Hydrogeological Data	Case 1 SRWMD Model Parameter Values	Case 2 Site-Specific Transmissivity Values
SAS		
Transmissivity (ft^2/day)	1,908	15.0
Annual average ET rate (inches/yr)	-	41.7
Annual average water table elevation change (ft)	-	5.0
Etr or leakance (1/day)	1.90E-03	1.90E-03
Specific yield-steady-state	0.00E+00	0.00E+00
IAS		
Vertical hydraulic conductivity (ft/day)	0.0027	0.0027
Thickness (ft)	84.5	84.5
Leakance (1/day)	3.2E-05	3.2E-05
UFA		
Transmissivity (ft^2/day)	4,048,725	40,000
Storage—steady-state	0.00E+00	0.00E+00

Sources: SRWMD model (Groundwater Vistas).
ECT, 2009.

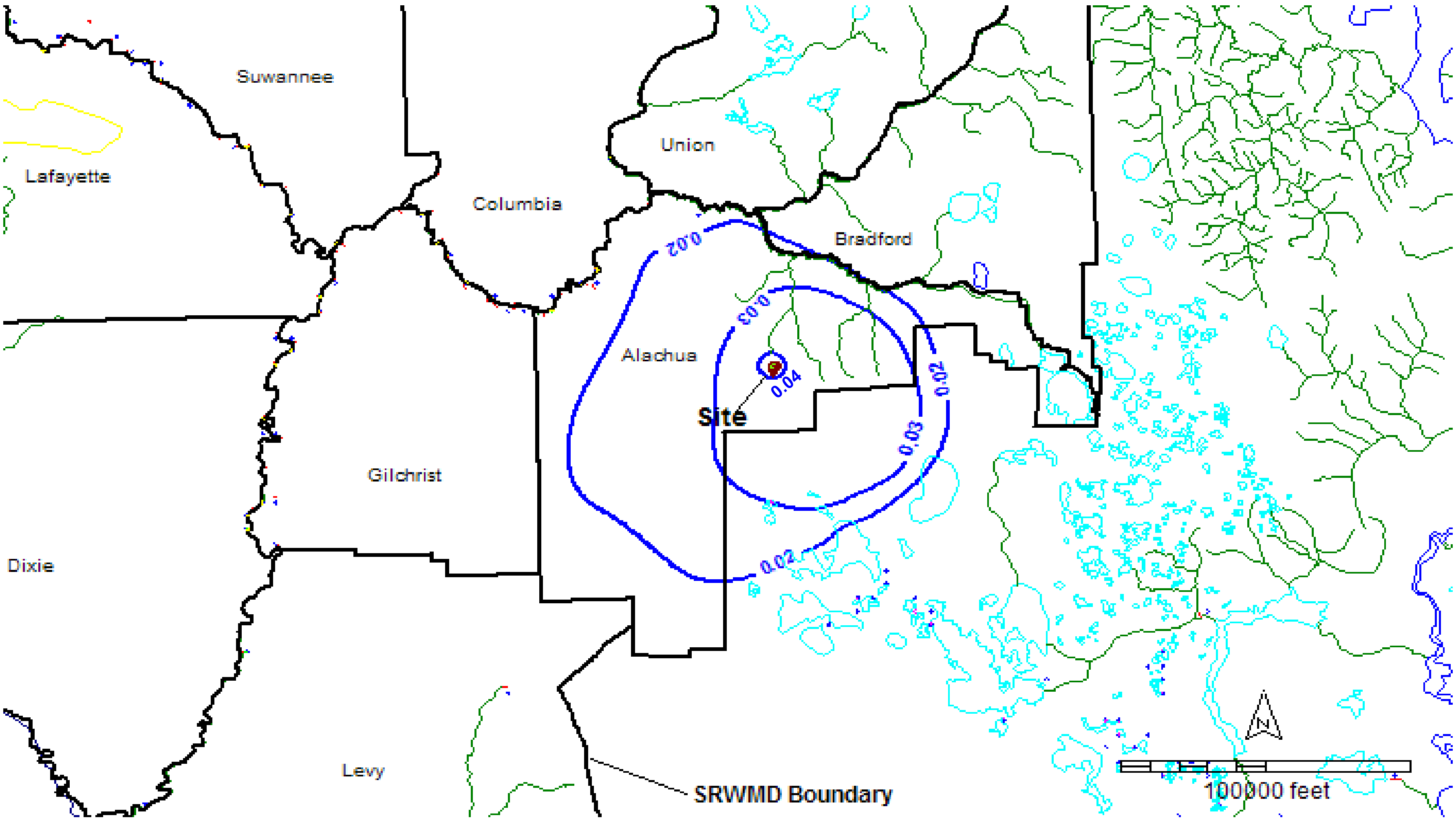

FIGURE 6.3.3-1.

STEADY-STATE DRAWDOWN (FT) IN UFA (LAYER 3) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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An American Renewables Company

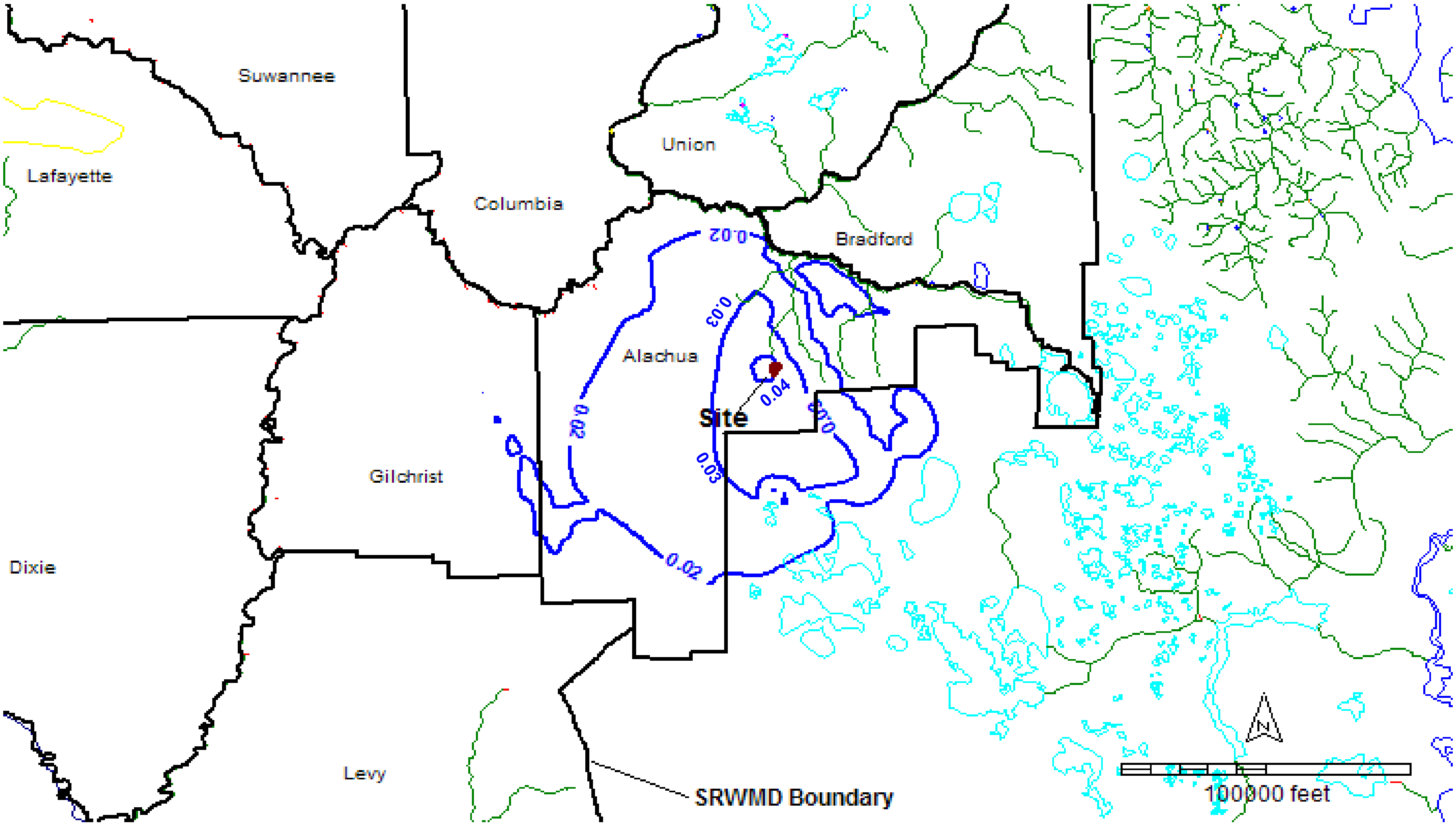

FIGURE 6.3.3-2.

STEADY-STATE DRAWDOWN (FT) IN IAS (LAYER 2) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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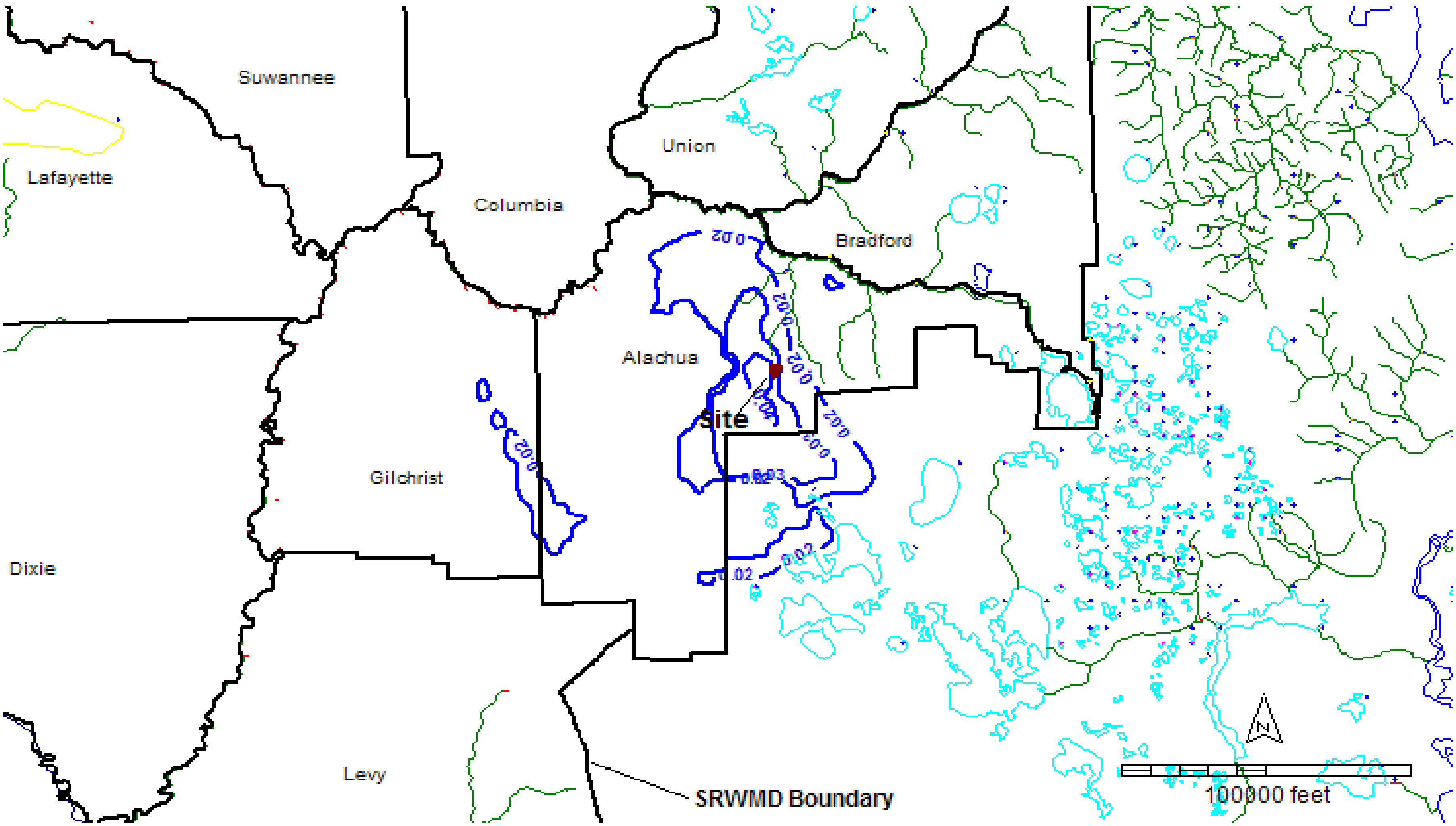

FIGURE 6.3.3-3.

STEADY-STATE DRAWDOWN (FT) IN SAS (LAYER 1) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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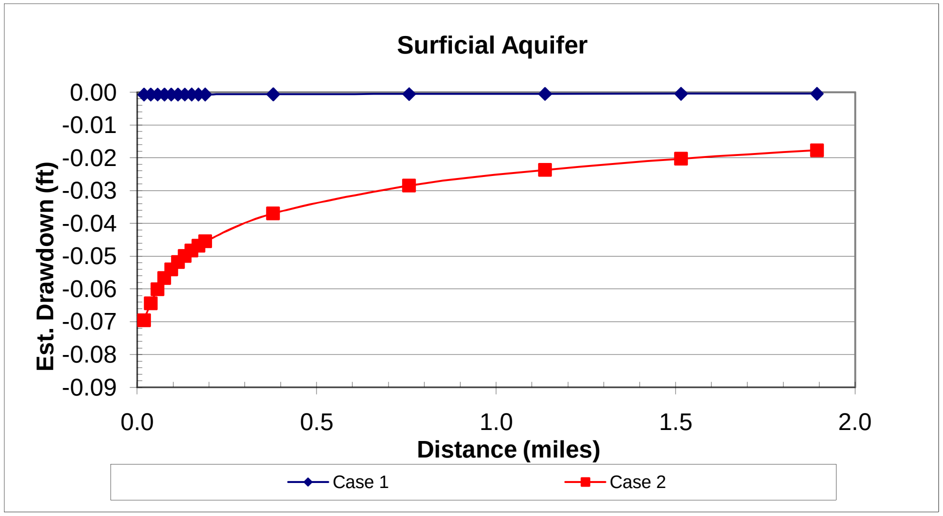
Table 6.3.3-3. Summary of Predicted Steady-State NSSCOU Drawdown For GREC

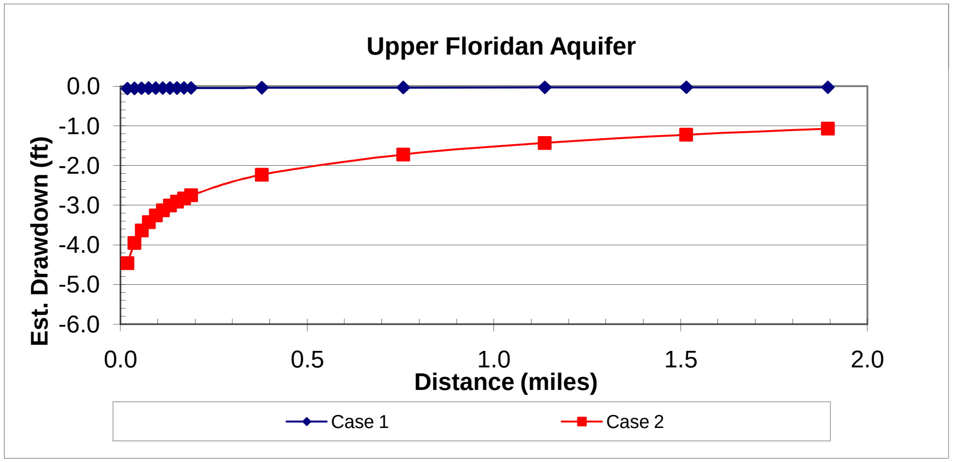
Case 1: Uses SRWMD District Model Parameter Values.

Case 2: Uses Lower Transmissivity for Surficial (15.0 ft^2/day) and Upper Floridan (40,000 ft^2/day).

Radial Distance - R		Surficial Aquifer Estimated Drawdown (ft)	
ft	miles	Case 1	Case 2
100	0.0	-7.17E-04	-6.96E-02
200	0.0	-7.14E-04	-6.44E-02
300	0.1	-7.11E-04	-6.01E-02
400	0.1	-7.08E-04	-5.67E-02
500	0.1	-7.03E-04	-5.40E-02
600	0.1	-6.99E-04	-5.18E-02
700	0.1	-6.95E-04	-4.99E-02
800	0.2	-6.90E-04	-4.83E-02
900	0.2	-6.85E-04	-4.68E-02
1,000	0.2	-6.80E-04	-4.55E-02
2,000	0.4	-6.33E-04	-3.70E-02
4,000	0.8	-5.61E-04	-2.85E-02
6,000	1.1	-5.13E-04	-2.37E-02
8,000	1.5	-4.78E-04	-2.03E-02
10,000	1.9	-4.51E-04	-1.77E-02



Radial Distance - R		Upper Floridan Aquifer Estimated Drawdown (ft)	
ft	miles	Case 1	Case 2
100	0.0	-6.11E-02	-4.46E+00
200	0.0	-5.60E-02	-3.95E+00
300	0.1	-5.30E-02	-3.64E+00
400	0.1	-5.09E-02	-3.43E+00
500	0.1	-4.92E-02	-3.26E+00
600	0.1	-4.79E-02	-3.13E+00
700	0.1	-4.68E-02	-3.01E+00
800	0.2	-4.58E-02	-2.91E+00
900	0.2	-4.49E-02	-2.83E+00
1,000	0.2	-4.41E-02	-2.75E+00
2,000	0.4	-3.90E-02	-2.23E+00
4,000	0.8	-3.39E-02	-1.72E+00
6,000	1.1	-3.10E-02	-1.43E+00
8,000	1.5	-2.88E-02	-1.22E+00
10,000	1.9	-2.72E-02	-1.07E+00



Note: NSSCOU - Coupled Aquifer Drawdown Program (Denis & Motz, 1998).

Source: ECT 2009.

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Table 6.3.3-4. Change in Upper Santa Fe River Flow Based on 1.4-MGD Upper Floridan Withdrawal

Location	Baseline Cell Flux* (cfs)	Cell Flux Based on 1.4 MGD Pumping (cfs)	Change in River Flow (Baseline - Pumping) (cfs)
Total flow from the headwaters of the Santa Fe River to Gauge 02320700 near Graham	-0.31732	-0.31727	-0.00005
Total Lake Hampton and tributary flow to the Santa Fe River	-0.02229	-0.02218	-0.00011
Grand Total from Santa Fe River headwaters to Gauge 02320700 near Graham	**-0.33961**	**-0.33945**	**-0.00016**
Total Santa Fe River flow from Gauge 02320700 near Graham to Gauge 02321500 at Worthington Springs	4.06398	4.06497	-0.00099
Total Santa Fe River North Tributary (Sampson River) flow	-0.43662	-0.43659	-0.00003
Total Santa Fe River South tributaries (includes Rocky Creek) flow	-1.46415	-1.46317	-0.00098
Total New River and tributaries flow to the Worthington Springs Gauge 02321500	-9.30128	-9.30002	-0.00125
Grand total flow from the Santa Fe River headwaters to Gauge 02321500 at Worthington Springs	**-7.47768**	**-7.47427**	**-0.00341**

*Negative cell flux = flow from aquifer to river.
Positive cell flux = flow to aquifer from river.

Source: ECT, 2009.

6.3.3.2 Impacts Assessment

This section provides discussion and interpretation of the various groundwater modeling results presented previously, and it provides conclusions regarding the assessment of potential impacts from the proposed GREC groundwater withdrawal of 1.4 MGD.

The SRWMD model results predict extremely small drawdowns will occur in the UFA, IAS, and SAS (see Figures 6.3.3-1, 6.3.3-2, and 6.3.3-3, respectively); less than 0.05 ft of drawdown is predicted everywhere in all aquifers. This miniscule hydrological influence will not cause any significant changes in groundwater flow rates or directions in any aquifer; it is probable that any such changes will be too small to measure. Therefore, it is highly improbable that the miniscule hydraulic influence induced by the requested withdrawal will have any significant influence on changes in water quality or water quantity in any aquifer or surface water, as further described in the following subsections.

Saline Water

Based on the small magnitude of the predicted drawdown, as well as the inland location of the GREC Site, lateral saltwater intrusion will not be induced into any aquifer to any measurable degree.

Similarly, saline water upconing is not likely to occur to any significant degree. FAS groundwater quality data as a function of depth is available from the deep injection test well constructed at the GRU DGS facility in 1977. Select data results for chloride, TDS, and sulfate are summarized here in mg/L as a function of depth in ft bls (G/ACRESUB, 1977):

Depth (ft bls)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
700	8	338	48
1,000	13	490	115
1,260	74	646	133
1,500	17	583	165
1,600	22	1,514	575
1,776	455	—	575

The base of the FAS occurs at a depth of 1,550 ft bls, which corresponds with the top of the Cedar Keys formation that is part of the SFCU (Schneider *et al.*, 2008). SRWMD's July 16, 2009, Draft Water Use Permitting Guide defines fresh water as an aqueous solution with a chloride concentration equal to or less than 250 mg/L (whereas the term "saline water/brackish water" applies to water with greater than 250 mg/L chloride). On that basis, the entire thickness of the FAS is considered fresh water at the GREC Site. Consequently, it is highly probable that the miniscule hydraulic influence from the requested withdrawals will not induce saline water upconing.

This view is further supported by recent data from the adjacent DGS facility. The DGS groundwater supply wells have been in operation for more than 30 years, with groundwater withdrawal rates much higher than the GREC requested rate of 1.4 MGD. The chloride concentration at DGS supply well No. 4 was recently reported at 10 mg/L (Table 3.3.2-13). Therefore, it is evident that the DGS groundwater withdrawals have not induced upconing of saline water, and it logically follows that the much lower GREC withdrawal rates will not induce upconing of saline water.

Groundwater Quality—Relations Within and Between the SAS and UFA

The UFA is capable of producing an appropriate quality of water for GREC, which is the lowest quality water that is locally feasible for its intended use. Local groundwater quality is described in detail within Subsection 3.3.2.1. Various alternate water supply sources were considered, as described in Attachment 3 of the WUP application information (Appendix 10.8). It was determined that none of the alternate water supply sources are feasible for GREC at this time.

The groundwater quality data for the GREC and DGS site areas (Subsection 3.3.2.1) show that several analytes have elevated concentrations; however, none of the analytes exceed a primary groundwater quality standard at the existing DGS property boundaries (i.e., inclusive of the GREC Site). The secondary groundwater standards do not apply to the existing GRU DGS site pursuant to FDEP Rule 62-520.310(14), F.A.C., because DGS is an existing installation as defined in FDEP Rule 62-520.200(10), F.A.C.

As shown in Figure 3.3.2-3, the apparent direction of groundwater flow is primarily westward in the SAS, with a northwesterly flow direction indicated for the extreme northeastern portion of the GREC Site. It also shows that the water table elevation is typically approximately 7 ft higher on the east (upgradient) side of the GREC Site as compared with the west (downgradient) side. The SAS groundwater elevation data also suggest the presence of a local groundwater divide; as such, the direction of groundwater flow in western portions of the adjacent DGS property appears to be primarily toward the south and southwest in the SAS. The onsite hydrogeologic parameter values suggest an average linear groundwater flow velocity of 15 ft/yr toward the west in the SAS at the GREC Site.

The local NSSCOU model results (see Table 6.3.3-3) predict that almost no drawdown will occur in the SAS from the 1.4-MGD UFA groundwater withdrawal. The miniscule drawdown in the SAS will cause no perceptible change in the local groundwater flow directions. That is, considering that the water table slopes approximately 7 ft across the site, the predicted drawdowns (less than 0.07 ft everywhere) will cause no perceptible shift in the water table elevation contours. Accordingly, there will be no significant influence on the migration of any water quality impacts in the SAS.

Therefore, the proposed GREC use of 1.4 MGD of groundwater from the UFA will have no perceptible influence on water quality anywhere in the SAS.

As shown in Figure 3.3.2-3, the water table of the SAS at the GREC Site typically exists at elevations ranging from approximately 173 to 180 ft-NGVD. In contrast, the potentiometric surface of the FAS typically exists at elevations ranging from approximately 38 to 48 ft-NGVD beneath the GREC Site. As such, the hydraulic head difference between the SAS and the FAS is typically approximately 130 ft; this is due to the presence of the IAS, which separates the overlying SAS from the underlying UFA. This indicates that the IAS serves as an effective confining unit locally. The onsite hydrogeologic parameter values suggest an average rate of downward vertical movement of groundwater of 0.6 ft/yr through the IAS at the GREC Site (Subsection 3.3.2.1).

Comparisons of the groundwater quality data for the SAS and the UFA collected by GRU on the DGS property (Section 3.3.2.1) further suggest that the intermediate confining unit is effective at preventing downward migration of impacts from the SAS to the UFA. Those laboratory data results show the UFA water is of potable quality. The difference between the SAS and the UFA groundwater quality data suggests that the UFA underlying the site is not affected by the levels of certain analytes reported in the site's shallow groundwater (SAS). This is due to the presence of the IAS that effectively separates the SAS from the UFA, along with the natural attenuation and adsorption typically affected by clayey sediments like those that comprise the local confining unit.

The GRU DGS groundwater supply wells have been in operation for more than 30 years, with groundwater withdrawal rates much higher than the GREC requested rate of 1.4 MGD. The SAS water quality impacts have apparently not been induced or migrated downward to impact the UFA. Therefore, it logically follows that the much lower GREC withdrawal rates will not induce the SAS water quality impacts to migrate downward to impact the UFA water quality.

Therefore, the proposed GREC use of 1.4 MGD of groundwater from the UFA will have no significant influence on water quality in the UFA. Criteria for degradation of water sources are described in Subsection 3.1.11 of SRWMD's July 16, 2009, Draft Water Use Permitting Guide. The requested use of 1.4 MGD of groundwater from the UFA will not degrade the source aquifer.

Groundwater Quantity Evaluations

The water source is groundwater from the UFA (locally, the entire FAS). The FAS is approximately 1,450 ft thick and is highly transmissive in the area of the GREC Site, as described in Subsection 3.3.2. The UFA is clearly capable of physically producing the requested 1.4 MGD. Various alternate water supply sources were considered, as described in Attachment 3 of the WUP application information (Appendix 10.8). It was determined that none of the alternate water supply sources are feasible for this project.

Existing water uses in the area of the GREC facility are described in Subsection 3.3.3.2. As described, more than 90 percent of the groundwater wells in this region use the UFA, whereas less than 10 percent of the wells use the IAS. None of the wells identified use the SAS as a water supply source. The locations of existing wells in the region of the GREC Site are shown in Figures 3.3.3-1 and 3.3.3-2, and water well details are included in Table 3.3.3-1.

According to Subsection 3.1.13 in SRWMD's July 16, 2009, Draft Water Use Permitting Guide, "… interference (with an existing legal use of water) is considered to occur when the requested use would impair the withdrawal capacity of an existing legal use to a degree that the existing use would require modification or replacement of the withdrawal facilities." Considering the proposed 1.4-MGD withdrawal from the UFA, the SRWMD model results for the UFA predict less than 0.05 ft of drawdown everywhere (Figure 6.3.3-1). Similarly, the SRWMD model results for the IAS predict less than 0.044 ft of drawdown everywhere (Figure 6.3.3-2). These extremely small drawdowns will not cause interference with any existing legal use of water.

Regarding the surficial aquifer, the SRWMD model results predict less than 0.044 ft of drawdown everywhere (Figure 6.3.3-3). Similarly small drawdowns are predicted locally by the NSSCOU model for the surficial aquifer (Table 6.3.3-3); at a distance of 100 ft away from the pumping well, Case 1 predicts only 0.0007 ft of drawdown, and Case 2 predicts 0.07 ft of drawdown. These extremely small drawdowns in the surficial aquifer:

- Will not adversely impact any surface feature.
- Will not influence flooding in any manner.
- Will not harm or adversely impact any type of offsite land uses.
- Will not constitute harm or adversely impact any wetland, or other surface waters.

As previously mentioned, the SRWMD model was also used to evaluate the impact of the proposed 1.4-MGD groundwater withdrawal on the MFLs established for the Upper Santa Fe for the gauges near Graham and at Worthington Springs regarding flows. The results in Table 6.3.3-4 show that the grand total change in surface water flow predicted by the SRWMD model from the headwaters of the Upper Santa Fe River to the gauge near Graham (02320700), including the upstream Lake Hampton and tributary, is a net reduction of 0.00016 cfs. This miniscule change in flow complies with the MFLs specified at Rules 40B 8.061(1)(a) through (d), F.A.C. It also complies with Rules 40B 8.061(1)(e) through (g), F.A.C., because the predicted impacts are de minimis (immeasurably small). Similarly, the grand total change in surface water flow predicted by the SRWMD model from the headwaters of the Upper Santa Fe River to the gauge at Worthington Springs (02321500), including all upstream tributaries, is a net reduction of 0.00341 cfs. This miniscule change in flow complies with the MFLs specified at Rules 40B 8.061(2)(a) through (d), F.A.C. It also complies with Rules 40B 8.061(2)(e) through (g), F.A.C., because the predicted impacts are de minimis (immeasurably small).

Therefore, on an individual basis, the requested 1.4-MGD withdrawal from the UFA for GREC will comply with the MFLs. Based on discussions with SRWMD staff, these predicted changes in flow may be too small to even be considered in SRWMD's cumulative evaluation of impacts, because the results are lower than the precision and accuracy limits of the SRWMD model.

These calculated changes in flows are considered extremely small and are probably immeasurable in the actual river flow. For comparison purposes, the net reductions of 0.00016 cfs at the gauge near Graham and 0.00341 cfs at the Worthington Springs gauge represent flow rates of 0.07 and 1.5 gpm, respectively. Whereas the average garden hose flows at 10 to 16 gpm, and a bathroom faucet flows at 3 gpm; thus, the 1.5-gpm flow reduction at Worthington Springs is approximately one-tenth of the flow rate from an average garden hose or one-half of the flow rate from a bathroom faucet.

The effects of the proposed use of 1.4 MGD of groundwater from the UFA will not cause water quantity adverse impacts of any kind.

6.3.4 LEACHATE AND RUNOFF

There will be no solid waste stored outside on the GREC Site; therefore, there will be no leachate generated. No adverse impacts to water quality are expected to occur from runoff at the GREC Site. Stormwater runoff will be managed in accordance with the applicable regulations cited in Subsection 4.8.1. As described in detail in Section 4.8 and Appendix 10.4.2, the stormwater management design includes three independent systems to provide water quality treatment and attenuation.

As described in Section 4.3, the primary fuel for GREC will be clean, woody biomass of various types. The facility will not use as fuel any form of treated or coated wood, municipal solid waste, construction or demolition debris, coal, petroleum coke, or tires. Further, the ground areas under the biomass fuel 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 to the facility's stormwater runoff collection system, which will provide water quality treatment and attenuation.

6.3.5 MEASUREMENT PROGRAMS

Chapter 4.0 characterizes and describes in detail the GREC waste streams. The GREC facility is designed such that there will be no permanent onsite liquid or solid waste disposal systems or facilities. Through use of the ZLD system, GREC will have no industrial wastewater discharges to surface or groundwaters. As such, there will be no wastewaters to cause water quality impacts, or hydrologic mounding or any other hydrologic effects, which precludes the need for groundwater monitoring associated with waste disposal.

As described in Section 4.5, the source of water supply for GREC operations will be groundwater from the UFA, and the total water requirement will be approximately 1.4 MGD on an annual average basis. Actual groundwater withdrawal rates will be metered and reported in accordance with SRWMD requirements.

The proposed operational activities for the GREC Site do not warrant any other type of groundwater monitoring program with regard to potential impacts on water supplies.

As described in Subsections 3.3.1 and 3.3.2, previous baseline monitoring has been conducted to establish existing conditions with regard to groundwater levels, groundwater quality, and other hydrogeologic parameters.

6.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

6.4.1 SOLID WASTE

The types and quantities of solid wastes to be produced during the GREC operations are described in Section 4.7. As discussed in Section 4.7, these solid wastes will temporarily be properly collected and staged on the Site prior to removal by a licensed transporter for offsite disposal at an appropriately permitted waste management facility. Some of these wastes may be transported to the Alachua County Transfer Station and then trucked to the New River Regional Landfill, which is located in Union County. 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. 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.

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 silvicultural soil supplement, to the extent possible, with the remainder disposed at an offsite, properly permitted landfill.

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.

Used oil and sludges collected from the oil/water separator; spent lubricating oils; used oil filters; and related used petroleum products will be collected in appropriate containers, staged, and transported for recycling or proper disposal by a licensed outside contractor.

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.

During operations, GREC will participate in appropriate recycling programs made available by the City of Gainesville and Alachua County.

6.4.2 HAZARDOUS WASTE

Based on the nature of the plant, only minimal quantities of hazardous wastes will be generated during routine operations. Typical hazardous wastes generated during operations include laboratory wastes, batteries, fluorescent lamps, paint-related materials, etc. These wastes will be collected, handled, and temporarily stored in designated hazardous waste storage areas in accordance with applicable hazardous waste regulations. GREC LLC will contract with an approved waste handling company to transport and dispose of the small quantities of hazardous waste at licensed facilities in accordance with applicable state and federal regulations. Specialty contractors conducting activities, such as metal cleaning, will be responsible for proper removal of waste products resulting from their contracted activities. As applicable, a hazardous waste management plan will be developed for the facility, which sets forth the operational framework for the proper handling, storage, and disposal of all hazardous waste generated at the facility in accordance with FDEP and EPA hazardous waste regulations.

6.5 SANITARY AND OTHER WASTE DISCHARGES

The proposed GREC facility will have 44 fulltime employees during operation. The GREC sanitary wastes will be delivered through a new force main pipeline to interconnect with GRU's existing sanitary sewer system at the DGS facilities.

The cooling tower blowdown and all low-volume waste (e.g., floor drains, demineralizer system blowdown, boiler blowdown, etc.) will either be reused or treated by a ZLD treatment system, which does not produce any liquid discharges. The sludge material produced by the ZLD system will be disposed at an approved offsite location.

6.6 AIR QUALITY IMPACTS

6.6.1 IMPACT ASSESSMENT

6.6.1.1 Introduction

Dispersion modeling analyses were conducted to estimate potential GREC air quality impacts. These analyses are described in detail in the PSD permit application provided in Appendix 10.2.5 of this SCA. This section presents a summary of the approach used and the results obtained. The results demonstrate that the operation of GREC will not cause or contribute to an exceedance of any PSD increment or AAQS. In addition, GREC impacts on Class I area air quality-related values (AQRVs) will be insignificant. Finally, other environmental impacts, such as impacts on soils and vegetation, were found to be acceptable.

6.6.1.2 Regulatory Applicability and Overview of Impact Analyses

Under federal PSD review requirements, all major new or modified sources of air pollutants regulated under the Clean Air Act (CAA) must be reviewed and approved by EPA or by the state agency if PSD review authority has been delegated. A *major* stationary source is defined as any 1 of 28 named source categories that have the potential to emit 100 tpy or more, or any other stationary source that has the potential to emit 250 tpy or more, of any pollutant regulated under the CAA. *Potential to emit* means the capability at maximum design capacity to emit a pollutant after the application of control equipment.

GREC will have potential emissions greater than 250 tpy of a PSD pollutant. Accordingly, GREC will be classified as a *major* facility subject to the PSD NSR requirements of Section 62-212.400, F.A.C., for those pollutants that are emitted at or above the specified PSD significant emission rate levels. Table 6.6.1-1 summarizes the GREC proposed annual emissions and compares the projected totals to the significant emission rate thresholds for PSD review. GREC potential emissions of NO_x, CO, PM, PM_{10}, SO_2, and VOC are each projected to exceed the applicable PSD significant emission rate level. These pollutants are, therefore, subject to the PSD NSR requirements of Section 62-212.400, F.A.C.

Emissions of air pollutants that could impact air quality will result from a number of activities and emission sources once GREC becomes operational. These emission sources include biomass fuel deliveries, processing, handling, and storage activities, the biomass-fired BFB boiler, ash storage and handling systems, emergency diesel engines, and a mechanical draft cooling tower. The BFB boiler represents the most significant source of emissions.

PSD review is used to determine whether significant air quality deterioration will result from a new or modified source. Florida PSD review requirements are contained in Chapter 212.400, F.A.C., Prevention of Significant Deterioration. Major sources may be required to undergo the following reviews related to PSD for each pollutant emitted in significant amounts:

- Control technology review.
- Air quality analysis (monitoring).
- Source impact analysis.
- Source information.
- Additional impact analyses.

The control technology review includes determination of BACT for each applicable pollutant. BACT emission limits cannot exceed applicable emission standards (e.g., NSPS). The air quality analysis (monitoring) portion of PSD review may require preconstruction ambient air monitoring data to be collected in the impact area of the proposed source. PSD review includes thorough assessments of potential facility impacts on air quality. The source impact analysis requires demonstration of compliance with federal and state

Table 6.6.1-1. Projected GREC Emissions Compared to PSD Significant Emission Rates

Pollutant	Projected Maximum Annual Emissions (tpy)	PSD Significant Emission Rate (tpy)	PSD Applicability
NO_x	418.1	40	Yes
CO	715.6	100	Yes
PM (filterable)	130.4	25	Yes
PM_{10} (filterable and condensable)	281.2	15	Yes
SO_2	243.9	40	Yes
Ozone/VOC	78.1	40	Yes
Lead	0.12	0.6	No
Mercury	0.0084	0.1	No
Total fluorides*	Not present	3	No
H_2SO_4 mist	5.9	7	No
Total reduced sulfur (including hydrogen sulfide)	Not present	10	No
Reduced sulfur compounds (including hydrogen sulfide)	Not present	10	No
Municipal waste combustor acid gases (measured as SO_2 and hydrogen sulfide)	Not present	40	No
Municipal waste combustor metals (measured as PM)	Not present	15	No
Municipal waste combustor organics (measured as total tetra- through octa-chlorinated dibenzo-p-dioxins and dibenzofurans)	Not present	3.5×10^{-6}	No
For the pollutants listed above, and for major stationary sources locating within 10 km of a Class I area having an impact equal to or greater than 1 μg/m^3, 24-hour average.	N/A	Any amount	No

*Excludes hydrogen fluoride.

Sources: Rule 62-210.200(280), F.A.C.
GREC LLC, 2009.
Metso, 2009.
ECT, 2009

AAQS and allowable PSD increments. Projected ambient impacts on designated nonattainment areas and federally promulgated PSD Class I areas must also be addressed, if applicable. Source information, including process design parameters and control equipment information, must be submitted to the reviewing agencies. Additional analyses of the proposed source's impact on soils, vegetation, and visibility, especially pertaining to PSD Class I areas, must be performed, as well as analysis of impacts due to growth in the area associated with the proposed source. Air quality impact assessments completed for GREC are summarized in the following paragraphs.

6.6.1.3 Analytical Approach

Air Quality Models

The most recent version of the American Meteorological Society (AMS)/EPA regulatory model (AERMOD) modeling system (Version 09292—October 19, 2009), together with 5 years of preprocessed hourly meteorological data obtained from FDEP were used in the Class II area impact analysis. AERMOD was used to obtain impact predictions for both short-term (i.e., periods equal to or less than 24 hours) and annual averaging periods.

Regulatory agency-recommended procedures for conducting air quality impact assessments are contained in EPA's Guideline on Air Quality Models (GAQM). The GAQM is codified in Appendix W of 40 CFR 51. In the November 9, 2005, Federal Register, EPA approved use of AERMOD as a GAQM Appendix A-preferred model effective December 9, 2005. AERMOD is recommended for use in a wide range of regulatory applications, including both simple and complex terrain. The AERMOD modeling system contains meteorological and terrain preprocessing programs (AERMET and AERMAP, respectively) and the AERMOD dispersion model.

Impacts were evaluated for all Class I areas within 300 km of GREC; i.e., at the Okefenokee, Chassahowitzka, Bradwell Bay, Wolf Island, and St. Marks National Wilderness Areas (NWAs). The Everglades National Park is located more than 400 km south of GREC. Based on an initial screening analysis (i.e., Q/D or 10D Rule), the calculated Q/D ratios for each of these Class I areas were found to be below the Federal Land Managers'

Air Quality Related Values Workgroup (FLAG) threshold of 10. Therefore, Class I AQRV analyses were not required in accordance with the FLAG guidance.

Based on the initial screening results, the GREC analysis with respect to the PSD Class I increments addressed the two nearest PSD Class I areas; i.e., the Okefenokee and Chassahowitzka NWAs. GREC air quality impacts at the more distant PSD Class I areas will be lower than those predicted for the Okefenokee and Chassahowitzka NWAs. The Class I impact analysis was performed using the current regulatory version of CALPUFF (Version 5.8 dated June 23, 2007), a transport and puff model that advects *puffs* of material from an emission source. These puffs undergo various dispersion and transformation simulation processes as they are transported from an emission source to a receptor of interest. The simulation processes include wet and dry deposition and chemical transformation. CALPUFF typically uses the gridded meteorological data created by the CALMET program. The distribution of puffs by CALPUFF explicitly incorporates the temporal and spatial variations in the meteorological fields thereby overcoming one of the main shortcomings of steady-state dispersion models. Further technical discussion of the CALPUFF model can be found in Section 2 of the User's Guide for the CALPUFF Model dated January 2000.

CALPUFF generates output files consisting of hourly concentrations for each receptor. These CALPUFF output files are subsequently processed by the CALPOST program to provide impact summaries for the pollutants and averaging periods of interest.

Meteorological Data

For the Class II modeling performed using AERMOD, meteorological data for use in the ambient air impact analysis was obtained from FDEP. The nearest source of surface meteorological data is the NWS site (Weather-Bureau-Army-Navy [WBAN] Station No. 12816) located at the Gainesville Regional Airport (GRA) approximately 10 miles southeast of GREC. The nearest source of upper air meteorological data is the NWS site (WBAN Station No. 13889) located at the Jacksonville International Airport (JIA) approximately 66 miles northeast of GREC. Based on the proximity of the GRA and JIA meteorological stations and in accordance with FDEP guidance, the most recent 5 years (i.e., 2001 through 2005) of readily available surface and upper air meteorological data from GRA and JIA were selected for the GREC air quality impact analysis.

Since surface characteristics influencing dispersion within 1 km of the GRA meteorological station differ from GREC, two sets of meteorological data were prepared. Each dataset contains 5 consecutive years (i.e., 2001 through 2005) of GRA surface and JIA upper air meteorological data. The first set used the surface characteristics of the GRA site, while the second set employed GREC surface characteristics. Both 5-year sets of GRA/JIA meteorological data, in conjunction with the AERMOD dispersion model, were used to determine maximum GREC air quality impacts.

For the modeling performed for the Class I areas using CALPUFF, meteorological data prepared by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) was used. VISTAS developed a 3-year (2001 through 2003) CALMET dataset for a fine, 4-km, subregional domain that covers all of Florida and the adjacent Class I areas of interest to Florida. The VISTAS 2001 through 2003 meteorological data were reprocessed by USFWS using the current EPA regulatory version of CALMET (Version 5.8, Level: 070623). This reprocessed fine-grid CALMET dataset (containing more than 250 gigabytes [GB] of data) was obtained from FDEP and was used in the GREC Class I impact assessments.

Emission Source Input Data

The Class II modeled emission sources for GREC included the BFB boiler, material handling point emission sources (i.e., baghouses), mechanical draft cooling tower, emergency diesel engines, and fugitive emission sources associated with material handling and truck traffic roadway emissions. The BFB boiler and emergency diesel engines will emit pollutants associated with fuel combustion. The remaining GREC emission sources will all emit only PM/PM_{10}.

Excluding startups and shutdowns, the BFB boiler will operate between 70 and 100 percent of full load. Emissions from the BFB boiler will decrease with reduced load. However, the BFB boiler exhaust flow rate and stack exit velocity will also decrease. The interaction of these two variables could potentially result in higher impacts at reduced boiler load. According, the BFB boiler was modeled at the minimum (70 percent) and maximum (100 percent) steady-state operating loads.

All GREC emissions sources were assessed for PM_{10} impacts. For evaluating NO_x and SO_2 impacts, detailed modeling was only performed for the BFB boiler stack. While the emergency diesel engines also emit these pollutants, the engines will operate infrequently (up to 96 hr/yr for routine testing and maintenance) and will combust ULSD fuel oil. Accordingly, emergency diesel engine annual average NO_2 and SO_2 impacts will be insignificant. Short-term SO_2 impacts will also be insignificant due to the low SO_2 emission rates resulting from the use of ULSD fuel oil; e.g., the emergency generator diesel engine maximum SO_2 emission rate is only 0.0078 lb/hr. When operated for routine testing and maintenance, the emergency diesel engines may operate for a period of up to 2 hours in a 24-hour period. According, assessment of GREC CO impacts included the emergency diesel engines as well as the BFB boiler.

With respect to Class I area impacts, only the GREC BFB boiler stack was included. The other GREC point sources, fugitive material handling, and cooling tower emission sources will have minor PM_{10} emission rates and low release heights. Accordingly, these emission sources will have negligible impacts at the distant Class I areas.

6.6.1.4 <u>Summary of Air Quality Impacts</u>

<u>Class II Area Impacts</u>

Comprehensive dispersion modeling using the EPA AERMOD dispersion model demonstrates that the GREC emission sources will result in ambient air quality impacts that are below the PSD Class II significant impact levels (SILs) for all modeled PSD pollutants (i.e., NO_x, SO_2, PM_{10}, CO) and all averaging periods with the exception of PM_{10}. Accordingly, a multisource cumulative assessment of NAAQS attainment and PSD Class II increment consumption was only required for PM_{10}. Table 6.6.1-2 provides the results of GREC PSD Class II impacts.

Table 6.6.1-2. GREC Criteria Pollutant Maximum PSD Class II Area Impacts

Pollutant	Averaging Time	Maximum GREC Impact ($\mu g/m^3$)	PSD Significance Level ($\mu g/m^3$)
NO_2	Annual	0.4	1
PM_{10}	Annual	5.3	1
	24-Hour	20.4	5
SO_2	Annual	0.3	1
	24-Hour	3.3	5
	3-Hour	5.6	25
CO	8-Hour	159.9	500
	1-Hour	420.5	2,000

Source: ECT, 2009.

Cumulative modeling to address the offsite PM_{10} emission sources was performed to demonstrate compliance with the PM_{10} NAAQS and PSD Class II increments. The maximum predicted PM_{10} impacts from GREC and all other significant PM_{10} emission sources located within 60 km of GREC for the 24-hour and annual averaging periods were 16.4 and 6.1 $\mu g/m^3$, respectively. Conservatively, all of the offsite PM_{10} emission sources were assumed to consume PSD increment. These cumulative PM_{10} impacts are less than the 24-hour and annual average PSD Class II increments of 30 and 17 $\mu g/m^3$, respectively.

Conservative background PM_{10} air quality values of 63 $\mu g/m^3$ (24-hour average) and 17 $\mu g/m^3$ (annual average) based on nearby FDEP ambient monitoring data were added to the model predicted concentrations for comparison to the 24-hour and annual average PM_{10} NAAQS of 150 and 50 $\mu g/m^3$, respectively. Total cumulative PM_{10} impacts (i.e., model plus background) were 79.4 and 25.1 $\mu g/m^3$ for the 24-hour and annual averaging periods, respectively. These total cumulative concentrations are well below the PM_{10} NAAQS.

The cumulative modeling analysis demonstrates that total PM_{10} air quality impacts for the GREC and offsite emission sources will be below the NAAQS and PSD Class II increments. Accordingly, no further modeling analysis with respect to the PSD Class increments or NAAQS was required.

Class I Area Impacts

All GREC predicted Class I impacts were less than the PSD Class I SILs at the Okefenokee and Chassahowitzka NWAs. Table 6.6.1-3 provides GREC modeling results for Class I impacts.

6.6.1.5 Other Air Quality-Related Impacts

Impacts Due to Associated Growth

GREC will require an additional 44 operational workers. The workforce needed to operate the proposed power plant represents a small fraction of the population already present in the immediate area, City of Gainesville, and Alachua County. Thus, no measurable

Table 6.6.1-3. GREC Criteria Pollutant Maximum Class I Area Impacts

Pollutant	Averaging Period	Okefenokee NWA Impact ($\mu g/m^3$)	Chassahowitzka NWA Impact ($\mu g/m^3$)	PSD Significance Level ($\mu g/m^3$)
NO_2	Annual	0.0025	0.0015	0.1
PM_{10}	Annual	0.0029	0.0021	0.2
	24-Hour	0.057	0.051	0.3
SO_2	Annual	0.0023	0.0015	0.1
	24-Hour	0.051	0.044	0.2
	3-Hour	0.23	0.15	1.0

Source: ECT, 2009.

growth in population nor any associated air quality impacts are expected to result from GREC operation.

A new or expanded industrial facility can also sometimes generate growth in other industrial or commercial operations needed to support the new/expanded facility. Given the long-time use of the existing GRU DGS site for power generation and its proximity to the Gainesville, the existing commercial infrastructure should be more than adequate to provide any support services that the proposed facility might require. Therefore, no air quality impacts due to associated industrial/commercial growth are expected.

Impacts on Visibility and on Soils, Vegetation, and Wildlife

No visibility impairment at the local level is expected due to the types and quantities of emissions projected from the GREC emission sources. The opacity of the BFB boiler stack flue gas will typically be 10 percent or less. Emissions of primary particulates and sulfur oxides due to combustion will also be low due to the predominant use of low-sulfur biomass and BFB boiler technology, and installation of emission control systems including a fabric filter. The contribution of GREC emissions to the potential for haze formation in the area is expected to be minimal.

Certain air pollutants in acute concentrations or chronic exposures can impact soils, vegetation, or wildlife resources. Soils impacts can result from SO_2 and NO_x deposition creating an acidic reaction or lowering of soil pH. In this case, the site soils are naturally acidic and GREC SO_2 and NO_x emissions are not expected to adversely affect soils in the plant vicinity.

Vegetation is sometimes affected by acute exposures to high concentrations of pollutants often resulting in foliar damage. Lower dose exposure over longer periods of time (chronic exposure) can often affect physiological processes within plants causing internal and external damage. Based on an evaluation of the literature for effects from SO_2, acid rain (H_2SO_4 mist), NO_x, CO, and combinations of these pollutants (synergistic effects), insignificant impacts to regional vegetation are anticipated due to the estimated emissions from GREC.

Releases of air pollutants can also affect wildlife through inhalation, exposure through skin, or ingestion. However, based on comparatively low emission levels and resulting insignificant impacts from GREC, natural dispersion of emissions, and mobility of wildlife, insignificant impacts to regional wildlife resources are expected.

Based on this assessment, emissions from GREC are not expected to cause harm to soils, vegetation, or wildlife.

6.6.2 MERCURY IMPACTS

6.6.2.1 Mercury Emissions

Mercury is a naturally occurring impurity contained in biomass fuels in trace amounts. When the biomass fuels are combusted in the BFB boiler, the resulting high combustion temperatures in the vicinity of 1,500°F vaporize the mercury in the biomass fuel to form gaseous elemental mercury. Subsequent cooling of the BFB boiler flue gas may result in a portion of the mercury being converted to other forms. The three forms of mercury that may be present include:

- Elemental mercury (Hg^0).
- Compounds of oxidized mercury (Hg^{2+}).
- Particle-bound mercury (Hg_p).

Oxidized mercury compounds in the BFB boiler flue gas may include mercuric chloride, mercuric oxide, and mercuric sulfate. These oxidized mercury compounds are also referred to as ionic mercury or reactive gaseous divalent mercury (RGM). Prior to being discharged from the BFB boiler stack, some of the elemental mercury may undergo gas-phase oxidation to form gaseous RGM, most of which is believed to be mercuric chloride. Research indicates that fuels with relatively high sulfur and chloride contents will produce more RGM than fuels with relatively low sulfur and chloride contents. Biomass fuels have relatively low sulfur and chloride levels compared to fossil fuels such as coal. The expected average chloride content of the GREC biomass fuels is 20 parts per million by weight (ppmw). In contrast, bituminous coals may contain up to 2,000 ppmw chloride, or 100 times higher than biomass fuels. Similarly, the sulfur content of the GREC biomass fuels is expected to be approximately 0.02 weight percent or more than 100 times lower than a typical medium sulfur-content coal containing 2.5-weight-percent sulfur. The GREC BFB boiler will be equipped with a low dust SCR control system that will be located downstream of the fabric filter. In addition to reducing NO_x emissions, the SCR catalyst would also be expected to oxidize approximately 30 percent of the elemental mercury to the RGM form assuming sufficient sulfur and chloride species are present. Due to the low levels of sulfur and chloride in biomass fuels, the SCR is expected to convert much less than 30 percent of the elemental mercury to RGM.

Both gaseous elemental mercury and RGM can potentially be adsorbed on fly ash and collected in a downstream PM control device such as a fabric filter. Due to the high PM capture efficiencies of fabric filters, this control systems is also effective in removing particulate mercury. The primary mechanism for mercury adsorption by fly ash is believed to occur on the unburned carbon present in fly ash. Boilers equipped with low-NO_x burners have higher levels of unburned carbon in the fly ash and therefore offer a higher potential for mercury adsorption.

As previously noted, the combustion of fuels containing mercury may result in emissions of elemental mercury, RGM, and/or particle-bound mercury. Particle-bound mercury is emitted in particulate form, while both elemental mercury and RGM are released in the gaseous state. The deposition characteristics of each of these three mercury species differ. Elemental mercury has a long residence time in the atmosphere and travels long distances (i.e., greater than 50 km) before it is ultimately deposited on the Earth's surface. The other two forms of mercury, RGM and particle-bound mercury, will deposit locally (i.e., within 50 km) and regionally (i.e., from 50 to several thousand kilometers). The dispersion of elemental mercury is evaluated on regional and global scales and, therefore, was not considered for the analysis of local mercury deposition due to GREC.

The total annual mercury emission rate from the GREC BFB boiler is estimated to be 16.7 lb/yr. Mercury emitted from the BFB boiler is expected to be primarily elemental mercury with only trace amounts of particulate mercury. For the GREC mercury impact analysis, BFB boiler mercury emissions were conservatively assumed to be 70-percent elemental mercury (i.e., 11.7 lb/yr) and 30-percent RGM (5.0 lb/yr). The estimates of the BFB boiler mercury emissions conservatively assumed that all mercury present in the biomass fuels will be emitted; i.e., the estimates did not include any removal by the BFB boiler fabric filter.

Total annual anthropogenic (human-caused) United States mercury emissions are 145 tons based on a recent (2005) estimate by EPRI. Of this total, approximately 48 tons (approximately one-third) was due to power plant emissions. On a global basis, EPRI estimates worldwide anthropogenic mercury emissions at 2,523 tpy, with approximately 50 percent originating in Asia. In 1999, mercury emissions from Florida coal-fired power plants were 1,923 pounds. Accordingly, the estimated GREC mercury emissions (i.e., 0.0084 tpy) will comprise 0.0058 percent of total United States anthropogenic mercury emissions, 0.018 percent of United States power plant mercury emissions, 0.00033 percent of global anthropogenic mercury emissions, and 0.87 percent of 1999 Florida coal-fired mercury emissions. There are also natural sources of mercury. EPA estimates that natural sources of mercury, such as volcanic eruptions and emissions from the ocean, contribute approximately a third of current worldwide mercury air emissions, with anthropogenic (human-caused) emissions account for the remaining two-thirds.

6.6.2.2 Mercury Impacts

Dry, wet, and total RGM deposition for GREC was estimated using the wet and dry algorithms contained in the current version of the EPA AERMOD dispersion model with RGM-specific parameters drawn from EPA and literature references. The general modeling procedures and options specified in the current versions of the AERMOD User's Guide (EPA, 2004b) and the GAQM were followed. Modeling was conducted in a manner consistent with EPA guidance and standard practices, including the use of regulatory default options, as appropriate. The specific modeling procedures are the same as those described in Section 6.0 of the PSD air construction permit application with respect to building downwash, terrain elevations, receptor grids, and meteorological data.

The results of the GREC mercury deposition assessment are presented in Table 6.6.2-1. The predicted GREC maximum annual areal average (i.e., average RGM deposition for

Table 6.6.2-1. AERMOD Model Results—GREC Mercury Deposition and Concentration Impacts: Santa Fe River Basin

Maximum and Average Annual Impacts	2001	2002	2003	2004	2005
<u>Maximum Impacts</u>					
Total deposition (µg/m^2/yr)	1.499	1.517	1.523	1.672	1.519
Dry deposition (µg/m^2/yr)	1.435	1.422	1.450	1.558	1.390
Wet deposition (µg/m^2/yr)	0.0638	0.0945	0.0728	0.1140	0.1293
Receptor UTM easting coordinate (meter)*	365,930	363,930	365,930	364,930	364,930
Receptor UTM northing coordinate (meter)*	3,294,500	3,293,500	3,294,500	3,294,500	3,294,500
Distance from GREC (meter)	1,164	1,111	1,164	704	704
Direction from GREC (Vector o)	53	254	53	354	354
Concentration (ng/m^3)	0.00188	0.00205	0.00215	0.00183	0.00173
Receptor UTM easting (meter)	365,930	363,930	365,930	364,930	364,930
Receptor UTM northing (meter)	3,294,500	3,293,500	3,294,500	3,294,500	3,294,500
Distance from GREC (meter)	1,164	1,111	1,164	704	704
Direction from GREC (Vector o)	53	254	53	354	354
<u>Aerial Average Impacts†</u>					
Total deposition (µg/m^2/yr)	0.0334	0.0349	0.0332	0.0390	0.0370
Dry deposition (µg/m^2/yr)	0.0311	0.0318	0.0307	0.0365	0.0344
Wet deposition (µg/m^2/yr)	0.0023	0.0031	0.0026	0.0025	0.0026
Concentration (ng/m^3)	0.000062	0.000064	0.000069	0.000066	0.000063

*Location of maximum total deposition impact.
†Average impacts for the Santa Fe River basin.

Source: ECT, 2009.

receptors located throughout the Santa Fe River basin) total (dry and wet) RGM deposition rate is 0.0390 microgram per square meter per year (µg/m^2/yr) for the 5 years of historical meteorological data evaluated (i.e., 2001 through 2005). The dry and wet RGM deposition components of this total deposition rate are 0.0365 (93.5 percent of total) and 0.0025 µg/m^2/yr (6.5 percent of total), respectively. Although maximum RGM concentrations and deposition rates predicted for a single receptor are considered less meaningful than the areal average values, the GREC single point maximum annual average deposition and concentration values are also provided in Table 6.6.2-1.

There are no observational data for total mercury deposition to provide context for the estimated values. However, observational data do exist for wet deposition of mercury (which, except in highly polluted urban atmospheres where particulate mercury can be important, is largely driven by RGM scavenging) and ambient RGM concentrations (to which RGM dry deposition is directly related). Using such data, the estimated wet and dry components of total deposition can be assessed separately to provide context for the estimated values. The nearest National Atmospheric Deposition Program (NADP) Mercury Deposition Network (MDN) ambient monitoring station is located in the Chassahowitzka NWA (Station No. FL05; 117 km from GREC) NADP MDN data for 2006 shows an average wet mercury deposition rate of 15.7 µg/m^2/yr for the Chassahowitzka NWA monitoring station. This is more than 6,000 times greater than the estimated wet RGM deposition rate for GREC. Accordingly, the GREC estimated maximum annual areal average wet RGM deposition rate of 0.0025 µg/m^2/yr is only 0.016 percent of the observed wet deposition rate at the Chassahowitzka NWA monitoring station.

Since observed dry RGM deposition data are not available, a comparison was made between the predicted GREC maximum annual areal average ambient air RGM concentrations and measurements of RGM air concentrations that have been conducted in Florida. The predicted GREC maximum annual areal average RGM ambient air concentration is 0.000069 nanogram per cubic meter (ng/m^3). Florida-observed RGM ambient air concentrations include values of 0.015 and 0.005 ng/m^3 for sampling sites located in the Everglades and Pompano Beach, respectively (Malcolm and Keeler, 2002; Malcolm *et al.*, 2003). It is noted that the observed data are for 1-month sampling campaigns and are not directly comparable to the estimated annual average. Nevertheless, they provide some perspective on the GREC estimated values, which are small in comparison (i.e., 0.46 to 1.4 percent of the observed concentrations).

GREC mercury emissions will be insignificant for the following reasons:

- The GREC BFB boiler will be fired with biomass fuels containing minute levels of mercury, sulfur, and chlorides. The principal form of mercury resulting from biomass fuel combustion will be elemental mercury. RGM is estimated to be less than 30 percent of total GREC mercury emissions. An engineering assumption of 30-percent RGM was conservatively used for the GREC mercury impact assessment. Accordingly, at least 70 percent of the GREC mercury emitted will be in the elemental form, though the actual percentage is likely to be larger. RGM, in contrast to elemental mercury, is the emitted form of mercury, which exhibits the greatest potential for *local* deposition (e.g., within 50 km, or approximately 30 miles).
- Localized hotspots of elevated mercury deposition have not been identified in situations where mercury emissions were known to be much greater (approximately 350 to 2,100 lb/yr; Sullivan, 2005) in comparison to the mercury emissions projected for GREC (16.7 lb/yr).
- EPA promulgated the Clean Air Interstate Rule (CAIR) in 2006, which will reduce electric utility SO_2, NO_x, and PM/PM_{10} emissions. Emission reductions required by CAIR will have a cobenefit of reducing mercury emissions from existing coal-fired electric utilities.
- The dry-plus-wet deposition rate for mercury emitted by GREC is estimated to be no greater than 0.0390 $\mu g/m^2/yr$ averaged over the Santa Fe River basin, based upon the most recent 5 years of meteorological data. This quantity of mercury deposition is more than 400 times less than the existing annual wet-only deposition rate recorded at the nearest location within the NADP MDN located 68 miles from GREC (i.e., 15.7 $\mu g/m^2/yr$ at the Chassahowitzka NWA).

In summary, mercury emissions from GREC will be low (i.e., 16.7 lb/yr) and will not represent a health or environmental concern. For comparison, the recently constructed Suwannee American cement plant estimated a total mercury emission rate of 97 lb/yr with elemental, particulate, and RGM mercury fractions of 80, 10, and 10 percent, respectively. Based on extensive evaluation of mercury impacts, and following agency review, it was concluded that mercury impacts due to Suwannee American cement plant emissions would not be detectable or measurable.

6.6.3 MONITORING PROGRAMS

No monitoring of ambient air quality is planned, nor is ambient monitoring warranted given the low impacts on air quality predicted for GREC.

GREC will be subject to several NSPS including Subpart Da (Electric Utility Steam Generating Units), Subpart OOO (Nonmetallic Mineral Processing Plants), and Subpart IIII (Stationary Compression Internal Combustion Engines). Emissions monitoring will be performed as required by each of these NSPS.

The GREC BFB boiler will also be subject to the requirements of the Acid Rain Program and CAIR. Monitoring of emissions will be conducted in accordance with the requirements of these federal programs including continuous emissions monitoring of NO_x, SO_2, and CO_2. Continuous monitoring of NO_x, SO_2, and CO_2 will be conducted in accordance with the provisions of 40 CFR 75, Acid Rain Program.

Initial and periodic compliance testing of pollutants emitted by GREC will be conducted pursuant to FDEP requirements as specified in the PPSA conditions of certification and PSD air construction permit. FDEP compliance test methods are specified in Section 62-297.401, F.A.C.

6.7 NOISE

During operation of GREC, the primary continuous sources of noise will include noise emanating from the main stack; boiler house and steam turbine generator building; biomass handling equipment such as truck unloading shed, conveyors, and transfer houses;

cooling towers; and rotating equipment such as pumps and fans. Other intermittent sources of noise will include boiler steam relief valves, emergency diesel generator, emergency firewater pump, and mobile material handling equipment such as bulldozers and trucks. The noise standard contained in Chapter 15, Noise, in the City of Gainesville Municipal Code is the applicable noise standard for GREC. This noise standard limits the noise emanating from a commercial source land use property to 66 dBA (daytime*) and 60 dBA (nighttime*) when measured at a distance of 200 ft or greater from the real property line of the source of the sound. In addition, the operations will comply with applicable OSHA requirements for onsite worker noise protection.

To assess noise impacts from GREC operations, a noise modeling analysis was performed. The purpose of this noise modeling analysis is to predict the noise levels at various locations 200 ft or greater from the GREC real property line to ensure compliance with the City of Gainesville noise standard. The following subsections describe the noise model used, noise modeling inputs, and results.

6.7.1 NOISE MODEL

The noise model used was Computer Aided Noise Abatement (CadnaA) Version 3.7, developed by DataKustik, Greifenberg, Germany. This noise model is a state-of-the-art noise prediction software for outdoor noise sources based on International Organization for Standardization (ISO) Standard 9613, Parts 1 and 2. ISO 9613-1 relates to atmospheric attenuation, while ISO 9613-2 specifies an engineering method for calculating environmental noise from a variety of noise sources by accounting for various attenuation effects observed during outdoor sound propagation. ISO 9613-2 conservatively uses meteorological conditions favorable to sound propagation; i.e., downwind propagation with wind velocities between 1 and 5 m/s.

*For the purposes of compliance with the City of Gainesville noise standard, daytime is defined as those hours between 8 a.m. and 10 p.m. on the same day. Nighttime is defined as those hours between 10 p.m. and 8 a.m. the following day.

6.7.2 NOISE MODEL INPUTS

6.7.2.1 Noise Source Data

The GREC site map was imported into CadnaA to identify the locations of the major noise sources and property fenceline. Most noise sources were input as point sources, which means that noise emanating from these sources will diverge hemispherically; i.e., in all directions. Noise sources input as point sources include the main stack, pumps, fans, and dust collectors. Sources located at grade were assigned a source height of 1.5 meters (5 ft), while sources such as dust collectors located on top of a silo or structure were given a source height equal to the height of the silo or structure. Source height for noise emanating from the main stack was assigned a source height equal to the stack height of 230 ft. Although the cooling tower cells were input as point sources, a vertical divergence factor was used to simulate the noise emanating vertically from each cooling tower cell. The boiler house and the baghouse were input as vertical area sources. The four sides of both structures was input and assigned an overall structure height. The total sound power level for each noise source was then distributed equally across the entire surface area. This results in noise emanating perpendicular to the surface and a more realistic noise divergence from these two sources.

Sound power level data for the noise sources was obtained from the equipment manufacturers, when available, and from typical equipment sound power levels from similar projects. Sound power levels at octave band center frequencies were used for the all noise sources, if available. If sound power levels at octave band center frequencies were not available, the overall sound power level (L_{wA}) of the source was used. This L_{wA} was assigned the default octave band center frequency of 500 Hertz (Hz). Table 6.7.2-1 presents a summary of the noise sources used in this noise analysis and their respective L_{wA}.

Several noise sources, which were used in the noise analysis, will not operate continuously through the entire 24-hour day. For example, it is anticipated that biomass fuel delivery will only occur for a 15-hour period each day; i.e., from approximately 5 a.m. until approximately 8 p.m. Therefore, all noise sources associated with biomass fuel delivery (i.e., truck dumpers, disc screen/wood hog, and associated dust collector) were only operated for 15 hours per day during daytime hours.

Table 6.7.2-1. Sources and Sound Pressure Levels Used in Noise Modeling Analysis

Source Description	SPL (dB) at Octave Band Center Frequency (Hz) 31.5	63	125	250	500	1000	2000	4000	8000	SPL (dBA)
Main boiler stack	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
Boiler house	NA	NA	NA	NA	NA	NA	NA	NA	NA	125
Steam turbine generator	60	60	69	73	82	78	74	73	69	85
Cooling tower 1	112	115	115	112	109	105	102	99	91	111
Cooling tower 2	112	115	115	112	109	105	102	99	91	111
Cooling tower 3	112	115	115	112	109	105	102	99	91	111
Cooling tower 4	112	115	115	112	109	105	102	99	91	111
ID fan #1	90	98	90	93	88	82	82	76	71	100
Boiler feed pump 1	83	85	87	89	91	91	91	87	82	94
Boiler feed pump 2	83	85	87	89	91	91	91	87	82	94
Circulating water pump 1	84	82	84	85	84	83	82	79	76	88
Circulating water pump 2	84	82	84	85	84	83	82	79	76	88
Baghouse	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
Fly ash silo aeration blower*	59	72	82	89	95	98	99	99	97	105
Stacker reclaimer	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
Silo No. 1 dust collector	95	103	95	98	93	87	87	88	76	95
Silo No. 2 dust collector	90	98	90	93	88	82	82	83	71	90
Truck dumper 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	102
Truck dumper 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	102
Truck dumper 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	102
Disc screen/wood hog	NA	NA	NA	NA	NA	NA	NA	NA	NA	110
Disc screen/wood hog dust collector	102	110	102	105	100	94	94	88	83	102

*Sound pressure levels at octave band center frequencies were generated by CadnaA based on overall SPL (dBA).

Note: SPL = sound pressure level.

Sources: Metso, 2009.
Wolf, 2009.
ECT, 2009.

Intermittent sources that operate infrequently were not included in the noise analysis. These sources include safety and startup valves, emergency diesel generator, and firewater pump engines. Mobile sources such as material delivery trucks and equipment used for storage pile loading/unloading and shaping were not included in the noise analysis based on their intermittent operation.

6.7.2.2 Attenuation Data

CadnaA calculates sound pressure levels based on attenuating factors from geometrical divergence, atmospheric absorption, ground effects, screening, and miscellaneous factors such as industrial sites and foliage. The major attenuating factor in this modeling study is due to geometric divergence; i.e., the reduction in sound pressure levels due to distance from the noise receiver to the noise source. Atmospheric absorption was based on default values of 10 degrees Celsius (50°F) ambient temperature and 70-percent relative humidity. The default ground absorption value of 1.0 was used and assumed porous soil.

A line of trees, approximately 40 ft wide, was placed between the stormwater basins and the northern property fenceline. Additional foliage was placed in the northwestern portion of the GREC Site. This vegetation matches current and expected future conditions.

Attenuation data was estimated for the acoustical benefit of thermal insulation on the boiler house and the baghouse. A 10-decibel (dB) reduction in the sound power level was conservatively estimated.

Although there will be buildings or structures located between some noise sources and the noise receivers, there was no attenuation taken for any effects of screening.

6.7.2.3 Noise Receivers

Noise receivers were placed along the northern, western, and extreme southern portions of the GREC property boundary. In addition, noise receivers were placed at locations 200 ft beyond the property fenceline. This is due to the fact that the applicable City of Gainesville noise standard states that noise levels cannot be exceeded “when measured at a distance of 200 ft or more from the real property line of the source of the sound." All noise receivers were place at a height of 1.5 meters or 5 ft. The entire eastern portion of the property boundary, and property boundary in between, is shared with the existing DGS power plant. Since GREC and the DGS power plant are a contiguous industrial site, noise receivers were not placed along this property fenceline.

Figure 6.7.2-1 presents a graphical representation of the site layout, noise receiver locations, and area designated as foliage for noise attenuation purposes.

6.7.3 RESULTS

Table 6.7.3-1 presents the predicted noise levels from GREC operations at various noise receiver locations along the property fenceline as well as at noise receiver locations 200 ft beyond the property fenceline. The maximum predicted noise level along the fenceline was 53 dBA and occurred at the noise receiver located in the northeastern corner of the property adjacent to the GRU DGS site. The maximum predicted noise level at a location 200 ft beyond the property fenceline was 51 dBA and occurred at a noise receiver location 200 ft beyond the north entrance. This location is undeveloped, and the land is owned by GRU. Both of these maximum noise levels occurred during the daytime. Predicted noise levels at nighttime were either equal to or only 1 dBA less than the daytime noise levels. All predicted noise levels are well below the applicable City of Gainesville maximum noise levels of 66 dBA (daytime) and 60 dBA (nighttime).

It should be noted that the predicted noise levels assume no noise from any other sources at each of the noise receivers. In general, the noise from GREC operations will be audible at the property line but may not be the most dominant noise source. For example, a noise receiver is located at the main entrance off of U.S. 441. During the 24-hour ambient noise monitoring, the measured noise level was 61 dBA. The predicted noise level from the modeling analysis for this noise receiver was 42 dBA. This would indicate that other noise source(s), most likely highway traffic, is the major contributor at this location. The closest residential development to the GREC property boundary is located southwest of U.S. 441. Therefore, GREC operations will not have any significant impact on the nearest residential development to the GREC Site.

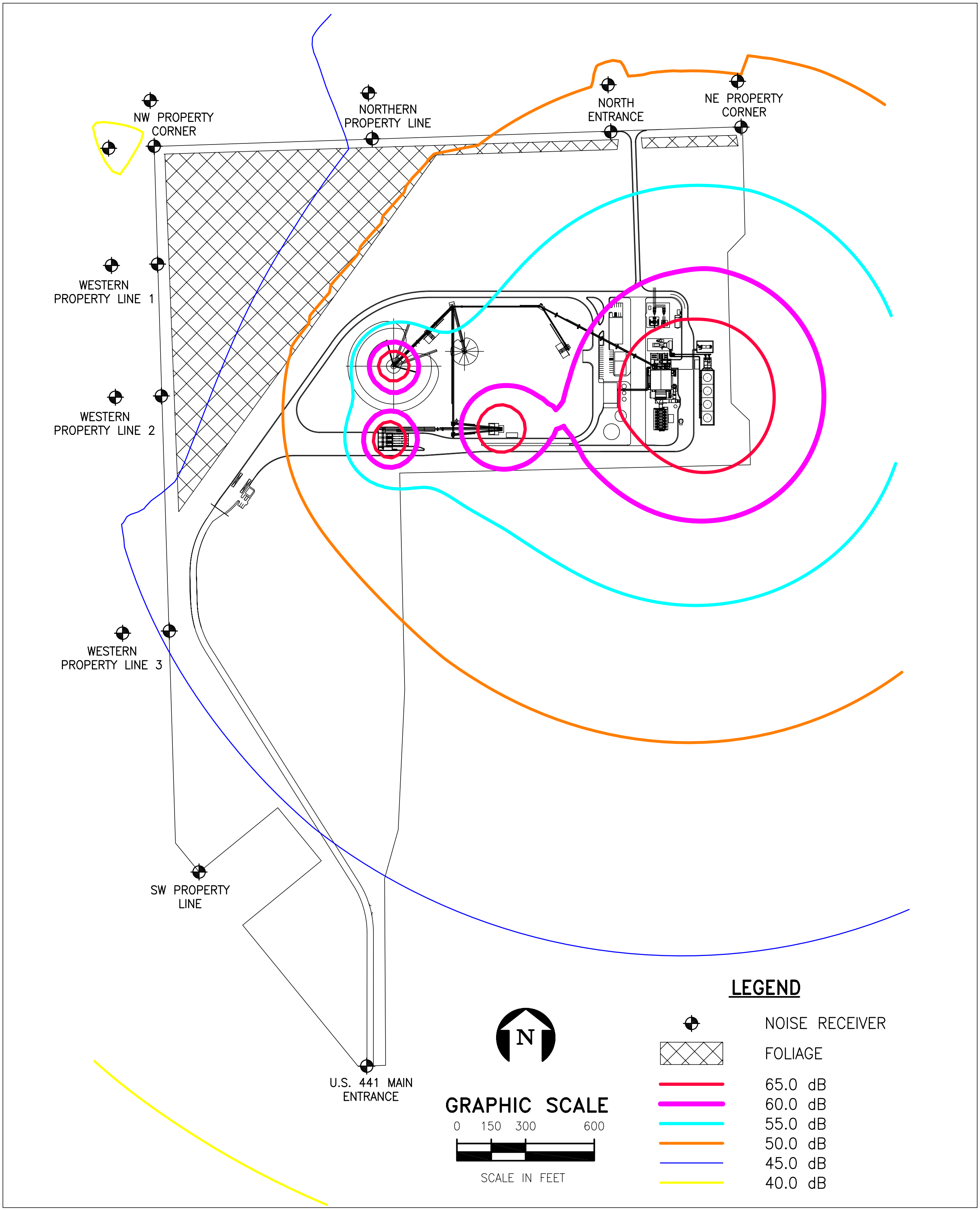

FIGURE 6.7.2-1.

GREC NOISE MODELING RESULTS

Source: ECT, 2009.

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Table 6.7.3-1. Results of Noise Modeling Analysis

Noise Receiver Location	Sound Pressure Level (dBA)	
	Daytime*	Nighttime*
City of Gainesville maximum sound level†	66	60
<u>Fenceline Noise Receivers</u>		
Northeast property corner	53	52
North entrance	52	52
Northern property line	46	46
Northwest property corner	41	40
Western property line 1	42	41
Western property line 2	43	42
Western property line 3	45	45
Southwest property line	43	43
U.S. 441 main entrance	42	42
<u>Noise Receivers Located 200 feet Beyond Fenceline</u>		
Northeast property corner	50	50
North entrance	51	51
Northern property line	47	47
Northwest property corner—north	41	41
Northwest property corner—west	40	40
Western property line 1	41	40
Western property line 2	42	42
Western property line 3	45	44

*Daytime is defined as those hours between 8 a.m. and 10 p.m. on the same day. Nighttime is defined as those hours between 10 p.m. and 8 a.m. the following day.
†Maximum sound levels based on noise emanating from commercial source land use category.

Source: ECT, 2009.

This noise modeling analysis demonstrates that the operations at GREC will meet the maximum noise levels stipulated in the City of Gainesville noise standard and will not affect the ambient noise levels at the nearest residential development.

6.8 CHANGES IN NONAQUATIC SPECIES POPULATIONS

6.8.1 WILDLIFE

Operational impacts of GREC on wildlife may include direct impacts (mortality) and indirect impacts (noise, human presence, air emissions, and cooling system operation, including any necessary groundwater withdrawals). As stated in Section 6.6 of this SCA, no significant impacts to either onsite or local/regional plant or wildlife communities are anticipated from the air emissions or cooling system operation associated with the GREC power plant operation. Vehicular traffic on the Site as a result of commuting employees and delivery of biomass fuel and supplies may result in occasional road kills of less motile organisms such as reptiles, amphibians, and small mammals. These losses are expected to be small relative to the total onsite population of these species.

Human presence and the noise and activity associated with plant operation will result in the withdrawal of some species from the immediate environs of the plant and access roads. However, a significant amount of undisturbed habitat will remain on the Site and in nearby offsite locations with similar habitats. The amount of available habitat is expected to be sufficient to accommodate displaced wildlife.

6.8.2 VEGETATION

The potential effects to Site and regional vegetation due to air emissions will be minimal due to the use of state-of-the-art air emissions control technology. The potential for impact to vegetation on the Site and environs is addressed in detail in the PSD application provided in Appendix 10.2.5 to this SCA.

Although all vegetation communities on the Site could be affected by groundwater withdrawals necessary for operation of the plant, the wetlands that will not be directly impacted by Site construction would be most vulnerable to the possible effects of water table drawdown. The proposed process water supply wells are located at least 300 ft from any wetlands that will remain on the Site following construction. At a distance of 300 ft away from the pumping well, drawdowns predicted by the NSSCOU model for the surficial aquifer are 0.0007 ft for Case 1 and 0.06 ft for Case 2.

Based on the assessment of technical reports and other literature, the likelihood of effects due to declines in the surficial water system caused by groundwater withdrawal is considered low if the drawdown is less than 1 ft (Kinser & Minno, 1995). In a more recent study, Kinser *et al.* (2003) revised the general likelihood of low effects to a drawdown of less than 0.35 ft, although the drawdown constraint for cypress swamps was listed as 0.55 ft, mixed forest as 0.35 ft, freshwater marsh as 0.55 ft, and mixed scrub-shrub as 0.75 ft. SWFWMD (2001) published a decrease in stage of between 1.8 and 1.9 ft below the unaltered pool elevation as the level below which could cause significant harm. The worst-case drawdown scenario for GREC of 0.06 ft is well below the threshold for adverse impacts, even under the most conservative case. Therefore, these extremely small drawdowns in the surficial aquifer will not adversely impact any wetlands.

6.8.3 MONITORING

No monitoring programs are proposed since impacts to nonaquatic species populations associated with plant operation are expected to be negligible.

6.9 OTHER PLANT OPERATION EFFECTS

To evaluate the potential impacts of operational traffic for GREC, a detailed LOS analysis based on the plant operations period was conducted by Genesis. A copy of the traffic impact analysis report is provided in Appendix 10.7.1, and the findings are summarized in the following subsections.

Once GREC is completed and under operation by the end of 2013, the total fulltime staff is projected to be 44 employees (approximately 31 employees working per day). In addition, there will be truck traffic for fuel deliveries that will be transporting biomass fuel and nonfuel deliveries that will be transporting sand for the boiler bed, aqueous ammonia, and other chemicals to the facility as well as removing fly ash and other materials from the facility. The following is a summary of the anticipated traffic impacts of plant operations.

6.9.1 TRIP GENERATION

Trip generation was calculated using rates from similar power plant projects, actual directional split counts from the existing DGS power plant, and engineering judgment. Table 6.9.1-1 provides a summary for the average daily, a.m., and p.m. peak hour trip generation during plant operations.

6.9.2 TRIP DISTRIBUTION

For plant operations, project traffic entering and exiting the primary driveway as calculated in the trip generation analysis was distributed manually on U.S. 441. As was done for the peak plant construction period, a daily distribution was used for the roadway analysis and the a.m. and p.m. peak hour distribution was used for the intersection analysis. To estimate the distribution for the plant operations period, plant operators were distributed based on the turning movement count taken at the DGS on June 16, 2009. The proposed biomass facility will use forest residue, mill residue, and urban wood from the region. Fuel deliveries for the plant operations period were distributed based on information provided by a certified forestry consultant. Nonfuel deliveries were distributed according to known locations of resources. Figure 6.9.2-1 shows the distribution of forestry fuel deliveries, while Figure 6.9.2-2 illustrates the distribution of mill residue and urban wood fuel deliveries along with nonfuel deliveries. Overall, 251 daily trips were assumed to enter/exit the Site on U.S. 441 from the northwest and 127 daily trips from the southeast. Figure 6.9.2-3 displays the overall distribution at the Site during plant operations.

6.9.3 ROADWAY ANALYSIS

Daily plant operations traffic was added to the estimated 2014 background traffic along the studied segment of U.S. 441 between Northwest 23rd Street and the GMA boundary. The highest single point loading of project traffic is 251 trips that enter/exit the Site on U.S. 441 to the northwest. The resultant 2014 volume along the studied segment is 22,099 with an available service volume of 13,601. The LOS on the segment of U.S. 441

Table 6.9.1-1. Plant Operations Trip Generation

	Enter	Exit	Total
Daily	189	189	378
a.m.	45	18	63
p.m.	18	45	63

Source: Genesis, 2009.

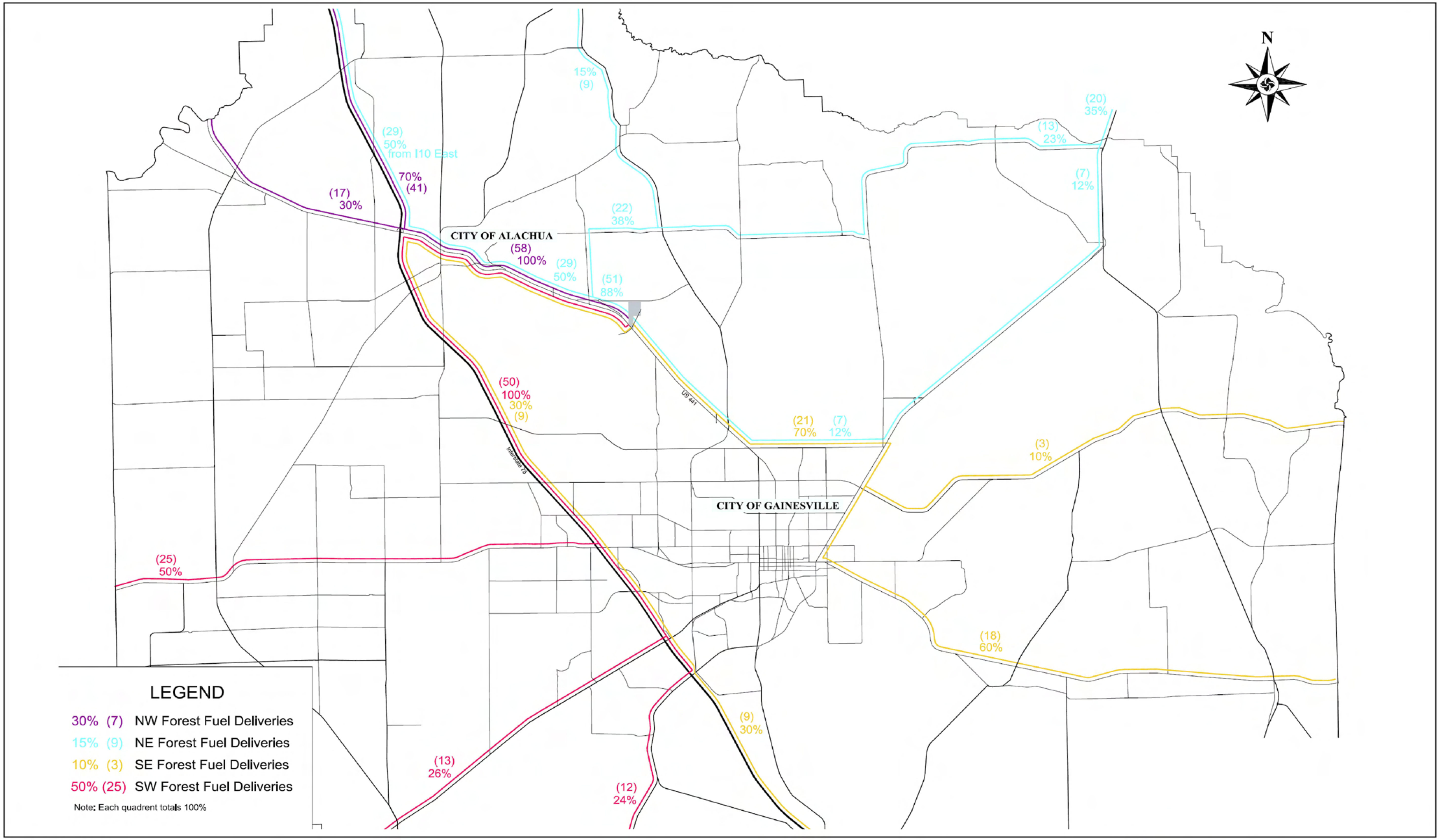

FIGURE 6.9.2-1.

FORESTRY FUEL DELIVERIES: PERCENT DISTRIBUTION AND DAILY TRIPS

Source: Genesis, 2009.

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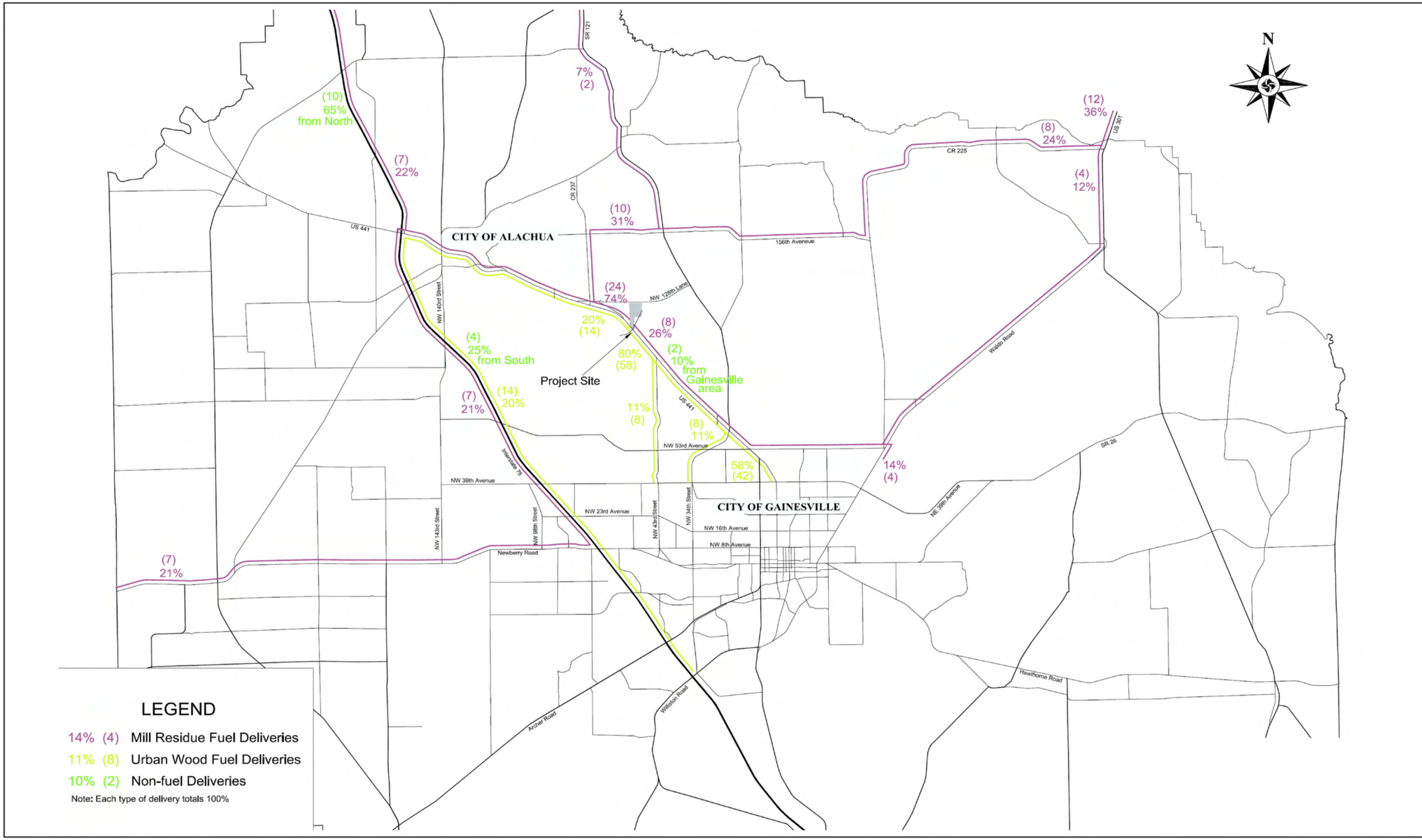

FIGURE 6.9.2-2.

MILL AND URBAN WOOD FUEL DELIVERIES AND NONFUEL DELIVERIES: PERCENT DISTRIBUTION AND DAILY TRIPS

Source: Genesis, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

PLANT OPERATIONS

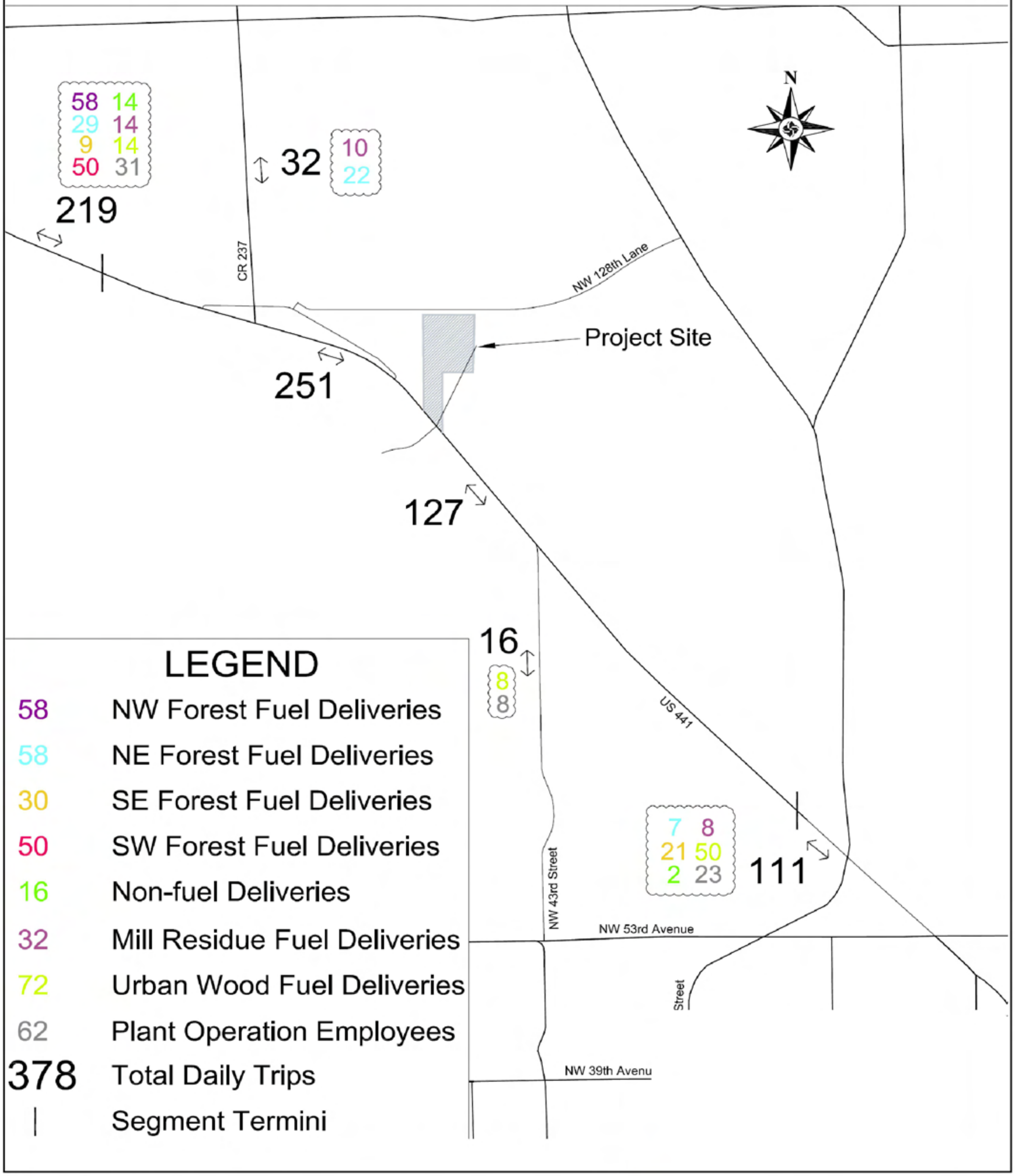

FIGURE 6.9.2-3.

PLANT OPERATION DAILY TRIPS

Source: Genesis, 2009.

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would remain at B. Appendix 10.7.1 of this SCA provides additional details on the roadway LOS analysis for the operations period.

6.9.4 INTERSECTION ANALYSIS

The intersection of U.S. 441 and Northwest 43rd Street was studied to assess impacts from the plant operations traffic for the a.m. and p.m. peak hours. The a.m. and p.m. peak hour project trips were distributed similarly to the distribution applied for the roadway analysis. Figure 6.9.4-1 displays the distribution. The project trips were added to the projected 2014 background traffic volumes. Using Synchro transportation analysis software, results show that after applying a growth rate and plant operations traffic, the intersection maintains the same LOS as the existing conditions (i.e., LOS B during the a.m. peak hour and LOS C during the p.m. peak hour). Again, Appendix 10.7.1 of this SCA provides additional details for the traffic analysis and results.

6.9.5 TURN LANE ANALYSIS AT THE SITE ENTRANCE

6.9.5.1 Turn Lane Storage Calculation

The storage length for the southeastbound left turn lane was calculated using guidelines from FDOT's Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (Florida Greenbook). Storage length is not required for the northwestbound right turn lane. At unsignalized intersections, the storage length, exclusive of taper, may be based on the number of turning vehicles that are likely to arrive in an average 2-minute period within the peak hour. Based on knowledge of the size and type of delivery vehicles accessing the site, 70 ft of storage per vehicle has been assumed. Based on the following formula, the storage length is calculated as follows:

$$\begin{aligned}\text{Storage length (S)} &= [(\text{\# turning vehicles/hour/60 min}) \times 2 \text{ minutes}] \times 70 \text{ ft}\\ &= [(30 \text{ vph*}/60 \text{ min}) \times 2 \text{ min}] \times 70 \text{ ft (vehicle length)} = 70 \text{ ft}\\ S &= 70\text{-ft vehicle storage}\end{aligned}$$

*a.m. left turn volume greater than p.m. left turn volume.

PLANT OPERATIONS

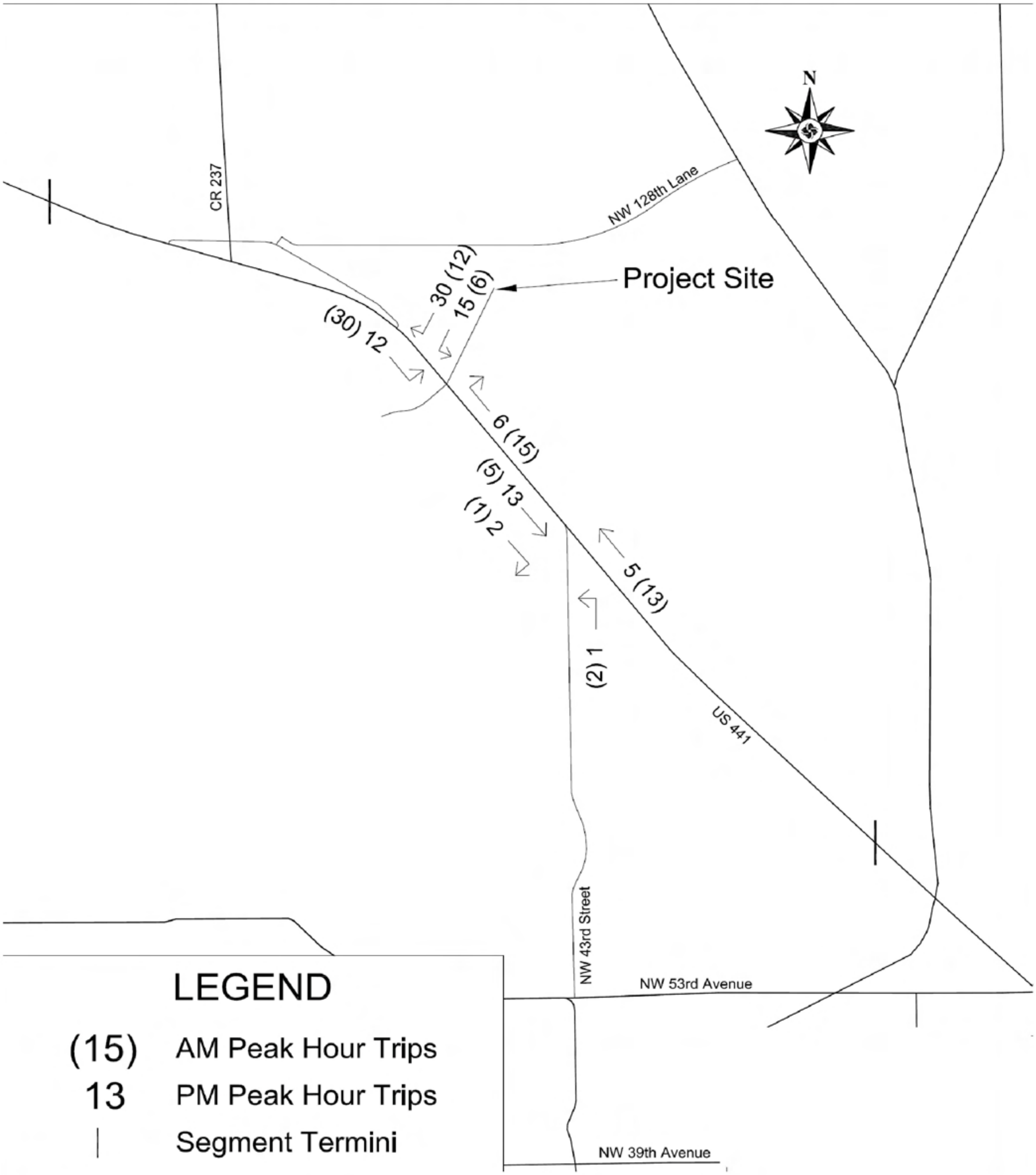

FIGURE 6.9.4-1.

PLANT OPERATION: a.m. AND p.m. PEAK HOUR TRIPS

Source: Genesis, 2009.

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6.9.5.2 Deceleration/Taper Lengths

The deceleration and taper lengths for both turn lanes were determined based on Index #301, Turn Lanes from FDOT's Roadway and Traffic Design Standards (2010). For a single left turn lane, a taper of 50 ft is required. With a posted (entry) speed of 60 miles per hour (mph), a design speed of 65 mph was used, which corresponds with a clearance distance (L1) of 170 ft (including taper) and a brake-to-stop distance (L2) of 290 ft. Therefore, the total deceleration length (L) is 460 ft (including taper).

6.9.5.3 Turn Lane Length Summary

The total length of the left turn lane is the sum of the storage and deceleration lengths. For this location with its maximum estimated southeastbound left turning demand of 30 peak hour vehicles, the total lane length is calculated to be 530 ft (70 ft of storage + 460 ft for deceleration distance). Using the same deceleration and taper lengths, the northwestbound right turn lane would need to be 460 ft.

6.9.5.4 Turn Lane Recommendations

Existing southeastbound left turn lane and northwestbound right turn lanes are 510 ft and 200 ft in length, including tapers, respectively. According to potential project traffic and posted speeds on U.S. 441, the existing southeastbound left turn lane could be extended 20 ft to accommodate storage and deceleration length calculations. However, with low volumes on a four-laned roadway, ample sight distance, and opportunity in the median for additional stacking, it may not be necessary to extend the existing turn lane. The northwestbound right turn lane is recommended to be extended from 200 ft in length to 460 ft.

6.9.6 SUMMARY AND RECOMMENDATIONS

The analysis provided in the Genesis traffic impact analysis report demonstrates that the effects of the proposed GREC on U.S. 441 and at the intersection of U.S. 441 and Northwest 43rd Street are not significant. Peak construction and plant operation time periods were reviewed for impacts. U.S. 441 currently has a large amount of available capacity that will be able to accommodate the added project trips. The effects at the intersection of

U.S. 441 and Northwest 43rd Street are extremely minor due to the fact that GREC will be a low trip generator.

Turn lane lengths were calculated on U.S. 441 at the primary access based on plant operations traffic. It was determined that the existing 510-ft southeastbound left turn lane could be required to be extended 20 ft; however, conditions may allow this extension to not be necessary. The northwestbound right turn lane is recommended to be extended from 200 to 460 ft. The peak construction traffic was not used for turn lane length calculations because the impacts will be short term and can be handled through maintenance of traffic.

6.10 ARCHAEOLOGICAL SITES

Based on the results of the cultural resources assessment conducted for DGS and a confirmation letter from FDHR (see Appendix 10.7.3), no significant archaeological sites are expected to be found on the GREC Site. Therefore, no onsite, postconstruction monitoring is planned or required. As previously described in Section 5.9, if encountered, the applicant will take appropriate measures to preserve or mitigate potential impacts to archaeological sites after review by a certified archaeologist and consultation with FDHR.

6.11 RESOURCES COMMITTED

The major irreversible and irretrievable commitments of state and local resources due to the operation of GREC are as follows:

- Use of land.
- Consumptive use of water.
- Consumption of air quality increments.

The proposed use of land for GREC, while irreversible, will be a small impact to Alachua County, especially since the land is already a part of the DGS property, which is used for electrical power generation.

Water evaporated in the cooling tower as part of the heat rejection process represents a consumptive use of water. This consumptive use will be minimized by recycling water, to the extent feasible.

The air quality increments consumed by air pollutant emissions from GREC will be negligible. The emissions from GREC will create no impediment to any additional growth in the area, nor will the emissions have significant impacts on the area's air quality.

GREC will use biomass as its fuel source. The selection of biomass fuels will be based on the availability of sources that can be economically obtained and transported to the Site. Use of biomass represents a commitment of a resource for the beneficial production of electricity. However, since biomass is a renewable resource, its use is not considered a major irreversible commitment of state and local resources.

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