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9.0 ALTERNATIVES TO THE PROPOSED ACTION

The proposed action is for the NRC to issue a COL to authorize construction and operation of two approximately 1200 gross MWe nuclear power units to address future baseload generation needs.

Chapter 9 describes the alternatives to construction and operation of new nuclear units at the Turkey Point plant property, as well as alternative plant and transmission systems. The descriptions provide sufficient detail to assess the impacts of the alternative generation options or plant and transmission systems relative to those of the proposed action. The chapter includes four subsections:

- No-Action Alternative (Section 9.1)
- Energy Alternatives (Section 9.2)
- Site Selection Process (Section 9.3)
- Alternative Plant and Transmission Systems (Section 9.4)

The Florida Reliability Coordinating Council is a not-for-profit company incorporated in the state of Florida whose purpose is to ensure and enhance the reliability and adequacy of bulk electricity supply in Florida.

As described in Chapter 8, FPL's service territory is located within the Florida Reliability Coordinating Council region.

9.1 NO-ACTION ALTERNATIVE

The no-action alternative is the decision not to proceed with construction and operation of Units 6 & 7 due to such factors as: the denial of the necessary federal, state, regional, and/or local permits; financing; or some other factor unrelated to the need for power. Under the no-action alternative, Units 6 & 7 would not be constructed or operated at Turkey Point, the environmental impacts and benefits from construction and operation of Units 6 & 7 would not occur, and the benefits, including electricity and economic benefits, associated with construction and operation of Units 6 & 7 would be lost.

The no-action alternative also presupposes that no additional conservation measures (e.g., demand side management, renewable energies such as solar energy, etc.) would be enacted to decrease the amount of electrical capacity that would otherwise be required in the FRCC Region.

As described in Chapter 8, there is a demonstrated need for additional baseload generation capacity in the FRCC Region to meet future energy demands. As such, the Florida Public Service Commission (FPSC) granted FPL's Petition to Determine Need for Units 6 & 7 by a final order in April 2008 (FPSC Apr 2008). The FPSC considered the following factors prior to issuance of the order: (1) the need for electric system reliability and integrity; (2) the need for adequate electricity at a reasonable cost; (3) the need for fuel diversity and supply reliability; (4) whether the proposed plant is the most cost effective alternative available; and (5) whether renewable energy sources and technologies as well as conservation measures are used to the extent reasonably available.

The addition of nuclear generation capacity would address these needs and would also support national and international goals to reduce the generation of greenhouse gases as outlined in the Energy Policy Act of 2005 (Public Law 109-58) and the state of Florida's Executive Orders regarding climate change (Executive Order Nos. 7-126, -127, and -128).

Other benefits associated with the operation of Units 6 & 7 would include the direct employment of 403 people. The creation of 403 permanent Units 6 & 7 operations jobs would inject $9,489,828 to $94,898,279 per year into the regional economy. Additionally, for every new operations job, an estimated additional 2.1696 indirect jobs would be created, which means that the 403 direct jobs would result in an additional 874 jobs in the region, for a total of 1277 new jobs.

The environmental impacts of Units 6 & 7 would not occur if the new units were not constructed and operated. However, there would be substantial financial and environmental benefits to the local community, state of Florida, and the nation from the construction and operation of Units 6 & 7. Thus, the no-action alternative is not preferable to the construction and operation of Units 6 & 7, which would provide a net output of approximately 2200 MW of baseload generation.

Section 9.1 References

Florida Reliability Coordinating Council 2007. *2007 Regional Load & Resource Plan,* July 2007. Available at http://www.psc.state.fl.us/utilities/electricgas/10yrsiteplans.aspx, accessed April 2, 2008.

Public Law 109-58, Energy Policy Act of 2005. Available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_public_laws&docid=f:publ058.109.pdf, accessed May 29, 2008.

State of Florida, Office of Governor, Executive Orders 07-126, 07-127, 07-128. Available at http://www.dep.state.fl.us/climatechange/eo.htm, accessed May 29, 2008.

9.2 ENERGY ALTERNATIVES

This section provides an analysis of several energy alternatives relating to the proposed project to determine whether any of these options are competitive. A competitive alternative is defined as one that is feasible, is capable of supplying baseload power, and compares favorably with the proposed project in terms of environmental and health impacts.

Subsection 9.2.1 provides an assessment of alternatives that do not require new generation capacity. This assessment includes the economic and technical feasibility of (1) supplying electrical energy from the proposed units without constructing new generating capacity, or (2) initiating energy conservation measures that would avoid the need for the units.

Subsection 9.2.2 provides an analysis of alternative energy sources that provide new generation capacity which could reasonably be expected to meet the demand from both a load and economic standpoint for additional generating capacity determined for the proposed project. Some of the alternatives that require new generation capacity in Subsection 9.2.2 were eliminated from further consideration and discussion based on their availability in the region, overall feasibility, or ability to supply baseload power.

In Subsection 9.2.3, the alternatives that were not previously eliminated, those determined to be potentially competitive, are investigated in further detail relative to specific criteria regarding environmental and health impacts. If any alternative is deemed to be environmentally preferable to the proposed project, an economic cost comparison is provided.

9.2.1 ALTERNATIVES THAT DO NOT REQUIRE NEW GENERATION CAPACITY

In accordance with NUREG-1555, this subsection is intended to provide an assessment of the economic and technical feasibility to meet the demand for energy without constructing new generation capacity. Potential options are to:

- Purchase power from other utilities or power generators
- Reactivate or extend the service life of existing plants within the power system, or extend the capacity through power uprates or other efficiency improvements
- Implement demand side management actions (including conservation measures)
- Use an existing peaking facility to provide baseload power

Further, as presented in Chapter 8, the structure of the current generating supply system in the relevant region of the proposed project is as follows:

- The Florida Public Service Commission has the power and jurisdiction to supervise and regulate rates and services of Florida's public utilities, including establishing service territories (FS 2007a and FS 2007b).

- FPL is an investor-owned electric utility that generates, transmits, and distributes electric power. FPL is subject to Florida Public Service Commission regulation as a traditional utility (FS 2007b).

- FPL has a state-designated service territory. Customers have no choice of alternative electric service providers, and the state would have approval authority for the need for the electric power to be generated. FPL provides electric service to more than 4.5 million customer accounts in 35 of Florida's counties along the eastern seaboard and the southern and southwestern portions of Florida (FPL Apr 2010).

Florida statutes require that each electric utility in the state of Florida with a minimum existing generating capacity of 250 MW annually submit a ten-year power plant site plan to the Florida Public Service Commission (FS 2007c). Part of the development of this plan includes an integrated resource planning process to determine the need for power.

As part of FPL's efforts to meet its projected resource needs, FPL considered and documented in its 2010 Ten-Year Plan:

- Purchase of power from other utilities

- Existing resources—upgrading and possibly repowering existing units

- Demand side management programs

- New generation sources—these sources are expected to meet objectives outlined in FPL's 2010 Ten-Year Plan, that include, in part:

    — Providing a diverse fuel mix

    — Lowering greenhouse gas emissions to comply with the 2017 carbon dioxide emission targets outlined in the Governor's 2007 Executive Order 07-127

    — Increasing renewable energy contribution

9.2.1.1 Purchase Power from Other Utilities or Power Generators

In formulating plans to meet the determined capacity needs, FPL accounted for purchases from other utilities or power generators. Firm capacity power purchases are an important part of FPL's resource mix. FPL currently has contracts with five qualifying facilities to purchase firm capacity and energy. FPL has a unit power sales contract to purchase 931 MW, with a minimum of 380 MW, of coal-fired generation from the Southern Company (Southern) through May 2010. An additional contract with Southern will result in FPL receiving 930 MW from June 2010 through the end of December 2015. This capacity will be supplied by Southern from a mix of gas-fired and coal-fired units. In addition, FPL has contracts with the Jacksonville Electric Authority for the purchase of 381 MW (summer) and 375 MW (winter) of coal-fired generation from the St. John's River Power Park. However, due to Internal Revenue Service (IRS) regulations, the total amount of energy that FPL may receive from this purchase is limited. FPL currently assumes, for planning purposes, that this limit will be reached in the first half of 2016.

FPL has other firm capacity purchase contracts with a variety of non-qualifying facility suppliers. FPL currently purchases non-firm (as available) energy from several cogeneration and small power production facilities. (FPL Apr 2010)

These capacity purchase amounts are incorporated in FPL's integrated resource planning work. While purchase power will remain a source of power for FPL, it is not adequate to provide the projected baseload capacity required to maintain its summer reserve margin criterion of 20 percent throughout the ten year period. Therefore, purchasing power from other generators is not considered a competitive option to the proposed baseload generation capacity of this project.

9.2.1.2 Reactivate or Extend Service Life of Existing Plants, or Extend the Capacity

The existing FPL generating resources consist of 88 generating units located at 16 generating sites distributed geographically around its service territory and also include partial ownership of one unit located in Georgia and two units located in Jacksonville, Florida. The current generating facilities consist of four nuclear units, three coal units, 14 combined cycle units, 17 fossil steam units, 48 combustion gas turbines, one simple cycle combustion turbine, and one photovoltaic facility (FPL Apr 2010).

Reactivating or extending the service life of existing plants or extending the capacity through power uprates or other efficiency improvements could theoretically reduce the need for a new nuclear power station. FPL has plans to provide power uprates at FPL's four existing nuclear units (Turkey Point Units 3 & 4 and St. Lucie Units 1 & 2). (FPL Apr 2010) The proposed capacity uprates will add approximately 450 MW of capacity to FPL's system in the 2011–2012 time frame. (FPSC May 2010) FPL has committed to extending the capacity of all four of its current nuclear units prior to the in-service dates of 2022 for Turkey Point Unit 6 and 2023 for Turkey Point Unit 7.

Thus, there exists no further opportunity for FPL to extend the capacity of its existing nuclear fleet.

Another potential strategy is repowering one or more of FPL' s existing generating plants. FPL's repowering plan consists, in part, of replacing an existing steam plant with a heat rate of approximately 10,000 Btu/kWh, with a new state-of-the-art advanced combined cycle unit that uses natural gas as the primary fuel, with a heat rate of less than 6600 Btu/kWh. FPL plans to repower two existing generating plants, Cape Canaveral and Riviera Beach, each consists of two older fossil fired steam generating units which will be converted into new highly efficient combined cycle units. The existing two-unit plant at FPL's Cape Canaveral site will be replaced by a new combined cycle unit with a projected output of approximately 1210 MW in 2013. This new unit will be called the Cape Canaveral Next Generation Clean Energy Center. The existing two-unit plant at FPL's Riviera site will also be replaced by a new combined cycle unit with a projected output of approximately 1210 MW in 2014. This new unit will be called the Riviera Beach Next Generation Clean Energy Center. These conversions were approved by the FPSC in September 2008 and were incorporated in FPL's recent integrated resource plan. (FPL Apr 2010) Any repowering of FPL's existing fossil fired generating plants would likely be fossil fueled; i.e., natural gas. As determined in Section 9.2.2, the environmental impact and feasibility of fossil fuel generation is not environmentally preferable to Turkey Point Units 6 & 7. In addition, additional natural gas-fired capacity will further increase FPL's dependence on natural gas. Conversely, Turkey Point Units 6 & 7 will significantly lower FPL's dependence on natural gas.

An evaluation of placing/removing existing facilities from inactive reserve was also included in FPL's 2010 Ten-Year Plan. When FPL developed its integrated resource plan as part of their 2010 Ten-Year Plan, relatively recent developments influenced FPL's resource planning efforts. One of these is the Executive Orders directive issued in 2007 calling for reduction in greenhouse gas emissions and greater contribution from renewable energy sources. The lower resource need projection allowed FPL to include in its resource plan the temporary removal of a number of its existing, older, less efficient generating units from active service starting in 2010. Inactive Reserve units continue to be maintained so that they can be returned to service as needed. The following older, less efficient units will be placed on Inactive Reserve status in 2010: Cutler Units 5 & 6, Port Everglades Units 1 & 2, Sanford Unit 3, and Turkey Point Unit 2. In 2011, Port Everglades Units 3 & 4 are also projected to be placed on Inactive Reserve. FPL's 2010 Ten-Year Plan resource planning indicates that those plants on Inactive Reserve status will begin to be returned to operation starting in 2018. While FPL's 2010 Ten-Year Plan allows for the "temporary retirement" of some of its older, less efficient generating units, these units will begin to be brought back into service in order for FPL to meet its 20 percent summer reserve margin criteria. (FPL Apr 2010) Thus, the return to active service of these existing facilities has been included in FPL's resource plan and along with other measures will still not be adequate to meet its 20 percent reserve margin criteria.

Therefore, reactivating or extending the service life of existing plants or extending the capacity is not considered a potentially competitive option to the proposed baseload non-fossil-fueled generation capacity of the proposed project.

9.2.1.3 Demand Side Management

Demand side management is the practice of reducing customers' demand for energy through programs such as energy conservation, efficiency, and load management so that the need for additional generation capacity is eliminated or reduced. Demand side management can minimize environmental effects by avoiding the construction and operation of new generating facilities.

As described in FPL's 2010 Ten-Year Plan, FPL has sought out and implemented cost-effective demand side management programs since 1978 (FPL Apr 2010). These programs include both conservation/energy-efficiency and load management.

FPL's demand side management efforts through 2009 have resulted in a cumulative summer peak reduction of approximately 4257 MW at the generator and an estimated cumulative energy saving of approximately 51,055 gigawatt hours at the generator. Accounting for reserve margin requirements, FPL's demand side management efforts through 2009 have eliminated the need to construct the approximate equivalent of 13 new 400 MW generating units (FPL Apr 2010).

Representative examples of residential demand side management programs that FPL had implemented to achieve such reductions include:

- Residential building envelope: offers incentives to residential customers to install energy efficient reflective roof and ceiling insulation measures.
- Residential air conditioning: offers incentives to customers to purchase higher efficiency heating, ventilating, and air conditioning equipment.
- Residential load management (On-Call Program): offers load control of major appliances/ household equipment to residential customers in exchange for monthly electric bill credits.
- Residential new construction (BuildSmart): encourages the design and construction of energy efficient homes by offering education to contractors.
- Residential low income weatherization: combines energy audits and incentives to encourage low income housing administrators to retrofit homes with energy efficiency measures.
- Residential conservation service: offers a walk-through energy audit, a computer generated Class A audit, and a customer-assisted energy audit.

Representative examples of business demand side management programs that FPL had implemented include:

- Business heating, ventilation, and air conditioning: offers business customers financial incentives to upgrade to higher efficiency equipment.
- Business efficient lighting: offers business customers financial incentives to install high efficiency lighting measures at the time of replacement.
- Business building envelope: offers incentives to business customers to install high efficiency building envelope measures such as roof/ceiling insulation, reflective roof coatings, and window treatments.
- Business On Call: offers load control of central air conditioning units to both small and non-demand-billed, and medium demand-billed, business customers in exchange for monthly electric bill credits.
- Business energy evaluation: offers free standard level energy evaluations on-site and on-line.
- Business water heating: provides financial incentives to encourage the installation of energy-efficient heat recovery units or heat pump water heaters. (FPL Apr 2009)

FPL has consistently been among the leading utilities nationally in demand side management achievement. For example, according to the U.S. Department of Energy's 2007 data (the last year for which the Department of Energy's data was available), FPL ranked number 1 nationally in energy efficiency demand reduction and number 2 nationally in load management demand reduction. Notwithstanding this effective program, in late 2009, the Florida Public Service Commission imposed new goals for demand side management for the period 2010 through 2019. The Florida Public Service Commission-imposed demand side management goals for FPL were significantly higher (approximately 225 percent) than the amount of demand side management that was projected in 2009. In addition, the Florida Public Service Commission ordered FPL to spend $15.5 million per year to promote demand side management-based applications of solar water heating and photovoltaics. Thus, a rigorous demand side management effort will be in place many years prior to the in-service dates of 2022 for Unit 6 and 2023 for Unit 7. It is not expected that a further increase in demand side management goals would be practicable or cost-effective. Therefore, implementing further demand side management programs is not considered a potentially competitive option to the baseload generation capacity of the proposed project.

9.2.1.4 Use an Existing Peaking Facility to Provide Baseload Power

Baseload facilities are normally used to satisfy all or part of the baseload of the system and, as a consequence, operate at full power continuously throughout the year. Peaking facilities usually run for short periods when demand on the grid exceeds baseload generation capacity in the region. Continuously running a peaking facility to provide baseload power would not reduce the need for a new nuclear power station. Peaking facilities are small facilities, generally fueled by oil or natural gas, that quickly can be turned on and off according to swings in demand. Because they have a relatively low installed capital cost, simple cycle combustion turbines and diesel generators are the most prevalent peaking technologies. Peaking technologies are generally less fuel efficient and release more air pollutants than baseload technologies using similar fuels. Consequently, peaking technologies are more expensive to operate, and their impact on the environment per unit of generation is greater than the impact from baseload technologies using similar fuels. Therefore, using existing peaking facilities to provide baseload power is not considered a potentially competitive alternative for the proposed project.

9.2.1.5 Conclusion

Based on the analysis, there are no potentially competitive alternatives that do not require new generation. That is, in each of the above analyses, there are no alternatives or combinations of alternatives which include purchased power, the reactivation, and extended service life of plants within the regional system that have the potential to supply the required baseload capacity that are feasible, and have the potential to compare favorably with the proposed project.

9.2.2 ALTERNATIVES THAT REQUIRE NEW GENERATION CAPACITY

9.2.2.1 Introduction

In accordance with NUREG-1555, this subsection provides an analysis of alternative energy sources that could reasonably be expected to meet the demand from both a load and economic standpoint for additional generating capacity determined for the proposed nuclear project. This COL Application is premised on the construction and operation of Units 6 & 7 that would serve as large baseload generators. Therefore, as defined in NUREG-1555, any potentially competitive alternative would also need to be able to provide baseload power.

To generate a set of alternative energy sources for analysis, NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* provides a starting point. The NRC analysis of alternative energy sources in NUREG-1437 includes commonly known generation technologies and various state energy plans were consulted to identify alternative generation sources typically being considered by state authorities across the country. Although NUREG-1437 is specific to license renewal, the alternatives analysis contained there can be applied to the proposed nuclear project applying for a COL to determine if an alternative technology represents a reasonable or potentially competitive alternative to the proposed project. Accordingly, the following energy sources were identified as alternatives to the proposed project:

- Wind (Subsection 9.2.2.2)

- Solar — photovoltaic cells (Subsection 9.2.2.3.1)
- Solar — solar thermal systems (Subsection 9.2.2.3.2)
- Hydroelectric power (Subsection 9.2.2.4)
- Geothermal (Subsection 9.2.2.5)
- Fuel cells (Subsection 9.2.2.6)
- Biomass (Subsection 9.2.2.7)
- Municipal solid wastes/landfill gas (Subsection 9.2.2.8)
- Coal (Subsection 9.2.2.9)
- Natural gas (Subsection 9.2.2.10)
- Petroleum (Subsection 9.2.2.11)
- Integrated gasification combined cycle (Subsection 9.2.2.12)
- Combination of alternatives (Subsection 9.2.3.3)

The alternative technologies considered in this analysis have been determined to be consistent with national policy goals for energy use, and are not prohibited by federal, state, or local regulations.

To be considered competitive, an alternative energy source must satisfy the following criteria:

- The alternative energy conversion technology is developed, proven, and available in the relevant region in the life of the proposed nuclear project.
- The alternative energy source provides baseload generating capacity equivalent to the capacity of the proposed nuclear project.
- The alternative energy source does not result in environmental or health impacts in excess of a nuclear plant.

As mentioned, this subsection identifies whether the selected alternative sources of energy could reasonably be expected to meet the demand from a load and economic standpoint in accordance with NUREG-1555. Although environmental and health impacts are assessed in Subsection 9.2.3 for those alternatives deemed potentially competitive, a brief summary of potential environmental impacts is presented in this subsection in accordance with the data needs described in NUREG-1555. Based on the inability to meet one or more of these criteria, several of the alternative energy sources were determined to be noncompetitive and were not considered further. Alternatives that were considered to be potentially competitive are assessed in greater detail with respect to environmental and health impacts in Subsection 9.2.3.

9.2.2.2 Wind

9.2.2.2.1 Overview

The terms *wind energy* or *wind power* describe the process by which wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in wind into mechanical power. A generator can convert this mechanical power into electricity. Wind turbines work in the following fashion: the wind turns the blades, which spin a shaft, which connects to a generator, and makes electricity (U.S. DOE Nov 2006).

The amount of power generated by this process depends on the average wind speed and the area swept by the turbine blades. Areas are classified across the country in reference to their potential to supply wind energy. The energy potential of wind is expressed by wind generation classes that range from one (least energetic) to seven (most energetic). In a Class 1 region, at a height of 164 feet (50 meters), the average wind speed is less than 12.5 mph and offers a wind power of less than 200 watts per square meter. A Class 7 region has an average wind speed of more than 19.7 mph and offers a wind power of more than 800 watts per square meter at a height of 164 feet (AWEA 2008b).

9.2.2.2.2 Current Technology Status

Onshore wind power is a fully commercialized technology. According to the DOE, wind-powered capacity in the United States increased 46 percent in 2007, and had the fastest growing wind-power capacity in the world in 2005, 2006, and 2007. Despite this rapid growth, wind energy only makes up approximately 0.72 percent of the nation’s electricity consumption and 0.77 percent of the net electricity generation (U.S. DOE May 2008).

Wind power systems produce power intermittently because they can only be fully operational when the wind blows at sufficient velocity and duration. Although advances in technology have improved wind turbine reliability to 98 percent, modern utility-scale wind turbines typically operate 65 to 90 percent of the time and often run at less than full capacity (AWEA 2008a and NRRI Feb 2007). Therefore, the capacity factors for wind power systems generally range from 25 to 40 percent (AWEA 2008a). This low capacity factor, resulting from wind’s intermittent ability to produce electricity, prevents wind power from providing baseload power.

For wind energy to supply baseload power, wind power would need to provide continuous power. Wind power systems that combine wind turbine generation with energy storage may overcome these obstacles and provide a source of power that is functionally equivalent to a conventional baseload electric power plant. By storing the power produced from wind power systems and releasing it when the wind facilities are not generating power, energy storage in combination with the wind facilities would be able to generate electricity continuously. Energy storage technologies include batteries, flywheel storage, superconducting magnetic energy storage, compressed air, pumped hydropower, and supercapacitors. However, large-scale energy storage is either not available or not economically viable (Schainker Dec 2006).

Until recently, the offshore wind energy potential in the United States was ignored because vast onshore wind resources have the potential to fulfill the electrical energy needs for the entire country. However, development of onshore wind resources has mainly focused on remote areas of the western United States with Class 6 or greater wind regimes and on a few ridgelines in the eastern United States. The challenge of transmitting the electricity from these remote areas to large load centers may limit wind grid penetration for land-based turbines. Offshore wind turbines can generate power closer to large coastal load centers than land-based turbines. Reduced transmission constraints, steadier and more energetic winds, and European success have made offshore wind energy more attractive for the United States. However, U.S. waters are generally deeper than those on European coasts and will require new technology to use those resources (NREL Jun 2004).

Environmental conditions at sea are more severe than on land, and the sea poses saltwater corrosion concerns and additional loads from waves. In the past, turbine manufacturers have taken conventional land-based turbine designs, upgraded their electrical and corrosion-control systems to facilitate a marine service environment, and placed them on concrete bases or steel monopiles to anchor them to the seabed. This type of approach is only acceptable in water depths of 15 to 40 feet. Experience with offshore wind power development in Europe indicates that the use of conventional land-based turbine designs in a marine environment leads to reliability issues and increased maintenance costs. New turbine designs would be needed to withstand harsh offshore conditions (NREL Jun 2004).

9.2.2.2.3 Ability to Serve Regional Needs

According to the DOE, National Renewable Energy Laboratory, while there are no Class 3 or greater wind energy classes located inland in Florida, Florida has a resource wind energy potential (Class 3) along its coastline (U.S. DOE Jan 2008). Areas designated Class 3 or greater are suitable for most wind turbine applications, whereas Class 2 areas are marginal. Currently, wind regimes of Class 4 or higher are potentially economical for the advanced utility-scale wind turbine technology currently under development.

FPL's strong commitment to renewable energy includes building a new 13.8 MW capacity wind generation facility at FPL's St. Lucie nuclear power plant site on Hutchinson Island, located along Florida's coastline. Hutchinson Island's average annual wind speeds of 13.8 mph are strong enough for FPL's proposed wind farm to generate electricity (FPL Apr 2008b). Florida is not an ideal location for mass wind energy production and sites such as the St. Lucie site are limited in Florida and are not capable of producing the same baseload as the proposed project.

9.2.2.2.4 Potential Environmental Impacts

Wind energy is a renewable energy source that produces electricity without releasing air or water pollutants; however, there are some disadvantages relating to environmental impacts such as aesthetic and noise concerns, large land requirements, potential harm to birds and bats, and radar interference (AWEA 2008c).

NUREG-1437 identifies the large land requirements for wind energy as a potential environmental impact. The land use requirement for utility-scale wind plants in open and flat terrain is approximately 60 acres per MW of installed capacity. Approximately 5 percent (3 acres) of this area is occupied by turbines, access roads, and other equipment. The remaining land area can be used for compatible activities such as farming or ranching (AWEA 2008c).

Another potential environmental impact relating to wind power is its impact on birds. Wind energy production may affect birds in three ways:

- The most widely noted are fatalities resulting from collisions with rotors, towers, power lines, or with other related structures. Electrocution on power lines is also possible.
- Birds may avoid wind turbines and the habitat surrounding them.
- The direct impacts on bird habitat from the footprint of turbines, roads, power lines, and auxiliary buildings.

Measures, such as monitoring, eliminating guy wires, and minimizing lighting, can be taken to prevent/minimize avian and other wildlife impacts at each wind energy project (AWEA May 2004).

There are two potential sources of noise associated with wind plants: the turbine blades passing through the air as the hub rotates and the gearbox and generator. Standing next to the turbine, it is usually possible to hear a swishing sound as the blades rotate and the whir of the gearbox and generator may also be audible. However, as distance from the turbine increases, these effects are reduced. Well-designed wind turbines are generally quiet in operation and, compared to the noise of road traffic, trains, aircraft, and construction activities, the noise from wind turbines is very low. At 130 feet, the noise level from a wind turbine is 50 dBA to 60 dBA or about as noisy as a conversational speech or a busy office. A wind farm at 1640 feet would have a noise level of 35 dBA to 45 dBA (the level of a quiet bedroom) (BWEA 2008).

Experience has shown that wind turbines can degrade performance of air traffic control or air defense radar. The phenomenon can include sudden or intermittent appearance of radar contacts at the location of the wind turbine caused by blade motion or rotation of the turbine to face the wind. Air traffic control radar interference is generally limited to wind turbines that are in the radar line of sight. Studies indicate that this problem may be minimal for turbines more than 5 nautical miles (5.75 miles) from the radar. In September 2006, the Department of Defense report titled *The Effect of Windmill Farms on Military Readiness* identified similar conflicts with air defense radar. According to this report, these conflicts can extend for tens of miles from the radar facility as a result of atmospheric refraction (MTC 2008a).

9.2.2.2.5 Conclusions

Based on this analysis, offshore wind technology has not matured sufficiently to support production for a baseload facility. Although land-based wind energy is developed and proven, it would only be available along Florida's coastline where siting issues exist. Additionally, the capacity factor for wind energy is inadequate to provide baseload power. Because wind power alone cannot generate baseload power, it cannot serve the purpose of the proposed project and therefore is not a potentially competitive alternative. However, land-based wind power could be included in a combination of alternatives to the proposed nuclear project. However, it is questionable how much, if any, of the capacity of wind facilities in Florida would be considered firm capacity due to the intermittent nature of wind resources in Florida. Therefore, wind facility capacity in Florida may contribute little, or not at all, to meeting FPL's reserve margin requirements. Therefore, wind technology is retained for further consideration. Combinations of alternatives, including wind, are described in Subsection 9.2.3.3.

9.2.2.3 Solar Technologies

There are two basic types of solar technologies that produce electrical power: photovoltaics and solar thermal systems, evaluated in Subsections 9.2.2.3.1 and 9.2.2.3.2, respectively.

9.2.2.3.1 Photovoltaic Cells

Overview

Photovoltaic cell technology involves converting sunlight directly into electricity. Photovoltaic cells are primarily made of the semiconductor material silicon. Light particles from the sunlight called photons penetrate the solar cell and knock electrons free from a semiconductor material, usually silicon, to create an electric current. As long as an adequate amount of light flows into the cell, electrons flow out of the cell. The cell does not consume its electrons and lose power like a battery. Instead, it operates as a converter that turns one kind of energy (sunlight) into another (electrical current). Individual photovoltaic cells are typically combined into modules that hold approximately 40 cells, and modules are then mounted into photovoltaic arrays. A large number of arrays can be combined to create a power generation plant (U.S. DOS Apr 2005).

Current Technology Status

Electric power generation from photovoltaic cells has been commercially demonstrated. However, only sunlight of certain energies will work efficiently to create electricity, and much of it is reflected or absorbed by the material that makes up the cell. Consequently, a typical commercial solar cell has an energy conversion efficiency of 15 percent. Low efficiencies mean that larger arrays are required, resulting in higher capital costs (NREL Jul 2008b). Additional research is needed in semiconductor materials, device properties, and fabrication processes to improve the efficiency, stability, and cost of photovoltaic solar energy conversion (NREL Jul 2008a).

Because photovoltaic cells rely on a fuel source that is intermittent, capacity factors are relatively low. The average annual capacity factor for photovoltaic systems is 24 percent, much lower than the 90 percent or better for a baseload plant, such as a nuclear plant (NREL Jul 2002).

Ability to Serve Regional Needs

When sunlight passes through the earth’s atmosphere, a portion of the light is scattered or absorbed by haze, particles, or clouds (NREL Jan 2003). Sunlight can, therefore, be categorized as either direct or diffused. Photovoltaic cells can use any form of sunlight, direct or diffused, to generate power. Photovoltaic systems typically use flat-plate collectors fixed in a tilted position correlated to the latitude of the location. This allows the collector to best capture the available sunlight. The average solar radiation for a flat-plate collector in Florida ranges from 5000 watt-hour to 5500 watt-hour of solar radiation per square meter per day (EERE Feb 2008). Therefore, Florida has a good available resource throughout the state. In fact, FPL has completed construction of the nation's largest photovoltaic power generation facility in the country, the 25 MW DeSoto Next Generation Solar Energy Center. In addition a second photovoltaic power generation facility is also in operation in Brevard County. It is named the Space Coast Next Generation Solar Energy Center and has a nameplate rating of 10 MW. These two facilities are in addition to the Rothenbach Park Solar Array in Sarasota. This photovoltaic facility was commissioned in October 2007 as the first large-scale photovoltaic facility with a nameplate rating of 250 kW. (FPL Apr 2009). However, because of the intermittent nature of the solar resource, FPL currently considers photovoltaic output as non-firm capacity and energy. Therefore, photovoltaic facilities do not contribute to meeting FPL’s reserve margin as do firm capacity resources such as nuclear units, i.e., Turkey Point Units 6 & 7.

Potential Environmental Impacts

The environmental advantages of photovoltaic cells are that they have near-zero emissions and have an unlimited supply of free fuel. Water use is much less than other technologies that require cooling water and is reduced to minimal amounts used to wash dust from panel faces. Environmental disadvantages of photovoltaic cells are sizeable land use requirements, aesthetic intrusion, and potential use of hazardous materials (lead) to store energy.

The amount of land required depends on the available solar insolation and ranges from approximately 3.8 to 7.6 acres per MW for photovoltaic systems (NREL Jul 2002). Assuming an average capacity factor of 24 percent, a photovoltaic facility generating a net output equivalent to the proposed nuclear project of approximately 2200 MW is estimated to require at least 34,599 acres (approximately 54.1 square miles). Because of the relatively large land area requirements, a large photovoltaic facility would pose aesthetic concerns. In addition, retired system components (e.g., batteries) would likely require disposal as hazardous waste.

Conclusions

Based on this analysis, photovoltaic technology is developed and proven, and viable sites with adequate insolation levels are available in Florida at the start of commercial operation of the proposed nuclear project. However, as a result of its intermittent nature, the capacity factor for photovoltaic technology is inadequate to provide firm capacity. Because photovoltaics alone cannot provide firm baseload capacity, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.3.2 Solar Thermal

Overview

Solar thermal systems capture the sun's heat and transform it into electricity or steam. Solar thermal systems include lenses or mirrors that concentrate the thermal power of sunlight into a fluid system to induce motion. The fluid is then routed through a turbine to generate electricity (NREL Jul 2002). This is basically the same type of system that is used to generate electricity from combustion of coal, except the thermal energy comes from the sun instead of from coal combustion. For this reason, solar thermal systems provide easy integration into the transmission grid. Solar thermal systems can also be equipped with a thermal storage tank to store the energy in the heat transfer fluid. This allows a solar thermal plant to provide dispatchable electric power. These plants can be hybridized with fossil fuels because it is heat, not light as in photovoltaic, that powers the plant, and that heat can come from any source of power allowing these plants to operate during periods of peak demand, even when the sun is not shining (NREL Jul 2002).

Current Technology Status

There are three types of solar thermal systems: parabolic trough, dish-Stirling, and power tower. Parabolic trough systems have been deployed in major commercial installations. The other solar thermal technologies have less commercial experience, but all have seen significant pre-commercial development in the past two decades. Parabolic trough plants 30 MW to 80 MW in size are in commercial operation, with a total of 354 MW in the California Mojave Desert demonstrating reliable operation and excellent performance since 1985, which is operated and partially owned by FPL's parent company, NextEra Energy, Inc. (which previously operated as FPL Group, Inc.). Additional trough systems are under development in Arizona, Nevada, and Spain. Dish-Stirling systems are currently in an aggressive commercialization program by industry centered on a 25 kW dish system unit for modular production of over 100 MW plants. Recently, two California utilities signed power purchase agreements for dish-Stirling projects that could provide as much as 1750 MW capacity by 2014. A prototype 10 MW power tower that was successfully operated in California demonstrated efficient thermal energy storage and 24-hour-per-day electric production (WGA Jan 2006).

Generating capacity factors for solar thermal are too low to meet baseload requirements. Current solar thermal systems are as large as 200 MW, with capacity factors that range from 30 to 50 percent (NRRI Feb 2007). This range is relatively low compared to capacity factors of 90 percent or better for a baseload plant, such as a nuclear plant. Furthermore, the intermittent nature of the solar resource in Florida results in solar thermal systems, located in Florida, providing non-firm capacity and energy. Consequently, such systems contribute little, if any, to meeting FPL's reserve margin requirements.

Ability to Serve Regional Needs

Solar thermal plants can only use the direct component of the sunlight but focus the energy to achieve higher temperatures. Solar thermal technologies produce more electricity on clear, sunny days with more intense sunlight and when the sunlight is at a more direct angle (i.e., when the sun is perpendicular to the collector). To work effectively, solar thermal installations require consistent levels of sunlight (solar insolation).

The average amount of solar energy reaching the ground needs to be at least 6 kWh per square meter per day for solar thermal systems (NREL Jul 2002). Solar thermal systems use tracking, concentrating collectors so they always face the sun. For concentrating collectors, Florida could pursue some types of technologies, but large-scale thermal utility systems are not effective with this immature technology because the solar resource map for concentrating collectors shows a maximum of 4.5 kWh per square meter per day for Florida (EERE Feb 2008). Even with the immaturity of the technology, FPL has decided to pursue and has completed construction of a new solar thermal facility located at the Martin plant site. This facility is a "hybrid" energy center, coupling solar thermal technology with an existing combined cycle generation unit and produces steam that replaces steam that would have otherwise have been produced by burning natural gas in one of the existing combined cycle units at the site, Martin Unit 8. This solar thermal facility, named the Martin Next Generation Solar Energy Center, is projected to produce up to 75 MW of steam capability, thus allowing reduced use of fossil fuels by FPL when the solar thermal facility is producing steam. (FPL Apr 2010) As previously mentioned, this solar thermal facility adds no additional firm capacity to FPL's system.

Potential Environmental Impacts

The environmental advantages of solar thermal technology are that it has near-zero emissions and it uses free fuel. Cooling water requirements for solar thermal systems that use wet cooling towers are similar to that of conventional boiler power technology. Parabolic trough plants and power towers use approximately 740 gallons of water per megawatt hour (MWh). Dish-Stirling plants are air-cooled and do not use any water for cooling. All solar thermal technologies require a minimal amount of water, approximately 37 gallons per MWh, to wash dust from mirror surfaces (NREL Apr 2006).

Environmental disadvantages of solar thermal technologies are sizeable land use requirements and the associated aesthetic intrusion. The land area required for solar thermal technologies is around four acres per megawatt for dish-stirling, 5 acres per MW for parabolic trough, and 8 acres per MW for power tower systems (NREL Jul 2002).

Conclusions

Based on this analysis, solar thermal technology is developed and proven (EERE Feb 2008). However, because of its intermittent nature, the capacity factor for solar thermal technology is inadequate to provide firm capacity. Therefore, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.4 Hydroelectric Power

9.2.2.4.1 Overview

Hydroelectric power plants (also called hydropower plants) use the kinetic energy of falling water to produce electricity. The flowing water turns a turbine that is connected to a generator. The amount of power generated by this process depends on several variables: the volume of water, the flow rate, and the distance the water is falling. Hydropower is a proven energy source that can be used to provide baseload power, but its use is limited to locations that have both a large volume of flowing water and a change in elevation.

9.2.2.4.2 Current Technology Status

Hydropower is a fully commercialized technology that has provided baseload power for more than a century. Hydropower is currently the leading renewable energy source used by electric utilities to generate electric power (EIA Jul 2008b). In 2007, hydroelectric power plants accounted for 7.8 percent of the nation's power net summer capacity and 6.0 percent of the power generated (EIA Apr 2009). However, hydropower's estimated capacity factor of 40 to 50 percent is below the nominal nuclear power facilities' capacity factors of 90 percent or better, and the National Hydropower Association forecasts a decline in large-scale hydropower use through 2020 as a result of increased environmental regulation (INL Jul 2005 and U.S. DOE Sep 2005).

There are two types of hydropower facilities: impoundment and diversion. The most common type is an impoundment facility, where river water is contained behind a dam to form a reservoir. The water can be released to meet changing demands for electricity or to maintain the reservoir level. These systems can be very efficient with as much as 90 percent of the energy being converted to electrical power (MDNR Jul 2007). In some cases, impoundment systems are used specifically to store energy. This is done at pumped storage facilities with two separate reservoirs, one positioned at a much higher elevation than the other. Water is released from the upper reservoir to flow through a turbine to produce electricity during peak demand. During off-peak periods, the water is pumped back to the upper reservoir using a different source of power. Pumped storage serves as a load management tool by lowering the amount of power that other generation units must provide during the periods of highest demand (and highest cost) for electricity (NRRI Feb 2007).

Diversion facilities use the flow of a fast-moving river, often near waterfalls, and do not require a dam. A portion of the water is diverted through a canal or set of pipes to a turbine positioned in or to the side of the river. Electricity generation, therefore, varies depending on the flow of the river. These systems cannot store power in the way a dam does and are best applied for smaller-scale local power applications or in remote locations away from main utility power grids (MDNR Jul 2007).

9.2.2.4.3 Ability to Serve Regional Needs

Though Florida is bordered on three sides by water, it is classified as a low-hydropower resource (EIA Aug 2006). A study conducted by the DOE estimates that there are 13 undeveloped potential hydropower sites in Florida. The results for individual site capacities range from 200 kW to 18 MW. The majority (69 percent) of the hydropower sites in Florida are greater than 1 MW, and less than 10 MW. The 13 identified sites are located within one major river basin (Appalachicola River Basin) and several minor river basins (U.S. DOE Dec 1998b). Thus, the available hydropower in the entire state of Florida is well below the approximate 2200 MWe net capacity of the proposed nuclear project.

9.2.2.4.4 Potential Environmental Impacts

Land use impacts for a large-scale hydropower facility using impoundments is likely to be substantial. NUREG-1437 estimates land use of 1 million acres per 1000 MWe generated by hydropower. Based on this estimate, an approximate 2200 MW hydroelectric plant would require approximately 2.2 million acres, 3459 square miles, to be flooded. Associated with this large land loss would be some erosion, sedimentation, dust, potential loss of cultural artifacts, aesthetic impacts, and equipment exhaust from land clearing and excavation. Alterations to terrestrial habitats could increase the risks to threatened and endangered species. The original land uses would be replaced by electricity generation and recreation, and perhaps, residential and business developments that take advantage of the lake environment.

Hydropower facilities can have a substantial effect on the surrounding environment’s ecology. Diverting water out of the stream channel (or storing water for future electrical generation) can dry out streamside vegetation. Insufficient stream flow degrades habitat for fish and other aquatic organisms in the affected river reach below the dam. Water in the reservoir is stagnant compared to a free-flowing river, so waterborne sediments and nutrients can be trapped, resulting in the undesirable growth and spread of algae and aquatic weeds. In some cases, water spilled from high dams may become supersaturated with nitrogen gas and cause gas-bubble disease in aquatic organisms inhabiting the tailwaters below the hydropower plant (U.S. DOE Aug 2005a).

Additionally, changes in water temperature, currents, and amount of sedimentation produce a different aquatic environment above and below the dam. Alterations to aquatic habitats could change the risks to threatened and endangered species (NUREG-1437). The dam can block upstream movements of migratory fish. Downstream-moving fish may be drawn into the power plant intake flow and pass through the turbine. These fish are exposed to physical stresses (pressure changes, shear, turbulence, strike) that may cause disorientation, physiological stress, injury, or death (U.S. DOE Aug 2005a).

9.2.2.4.5 Conclusions

Based on this analysis, although hydropower is a developed and proven technology for baseload power, the potential for future hydropower development in Florida is inadequate to supply the amount of power to be provided by the proposed nuclear project. Because hydropower in Florida is not available in sufficient quantities to supply the power to be provided by the proposed project, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.5 Geothermal

9.2.2.5.1 Overview

Geothermal power plants use naturally heated fluids in underground reservoirs as an energy source for electricity production. Electricity production using geothermal energy is based on conventional steam turbine and generator equipment, in which expanding steam powers the turbine generator to produce electricity. Geothermal energy is tapped by drilling wells into the reservoirs and piping the hot water or steam into a power plant for electricity production.

9.2.2.5.2 Current Technology Status

Geothermal energy has provided commercial baseload power around the world for more than a century (MIT 2006). Geothermal plants have high availabilities and can achieve capacity factors of 97 percent (GEA 2008). The United States is the world leader in online capacity of geothermal energy and the generation of electric power from geothermal energy, with 30 percent of the world total. As of August 2008, the United States had approximately 2958 MW of geothermal generating capacity with seven states generating power from geothermal plants (GEA Aug 2008).

There are four types of geothermal resources: hydrothermal (hot water or steam at moderate depths of 330 feet to 14,800 feet), geopressured (hot water aquifers containing dissolved methane under high pressure in sedimentary formations at depths of 9800 feet to 19,700 feet), hot dry rock (abnormally hot geologic formations with little or no water), and magma (molten rock at temperatures of 1200ºF to 2370ºF) (USGS Mar 2003 and RISE 2008).

At present, only high-grade (shallow, hot, and permeable) hydrothermal reservoirs are used for the generation of electricity. However, recent research indicates that it may be feasible to extract geothermal electric power from hot dry rock systems and geopressured reservoirs using enhanced geothermal systems. Enhanced geothermal systems is a process where geothermal aquifers with low permeability can be stimulated to create a conductive fracture network where the reservoir operates similar to a conventional hydrothermal reservoir (MIT 2006). Enhanced geothermal systems are currently in the early stages of development. The DOE Geothermal Technologies Program is conducting research on enhanced geothermal systems with the goals of demonstrating the feasibility of creating enhanced geothermal system reservoirs capable of producing hot fluids at the high rates needed for commercial development by 2011 and demonstrating the economic feasibility of enhanced geothermal systems by 2018 (U.S. DOE Aug 2005b).

Another emerging technology is hydrocarbon/geothermal coproduction. There is growing interest in producing electricity from the thermal fluid that flows from oil and gas wells. Geothermal coproduction has been predicted to be capable of providing 1000 to 5000 MW to the seven states in the Texas Gulf Coast Plain alone (GEA Aug 2008).

Commercially available geothermal generating technologies include dry steam, flash steam, and binary-cycle power plants. The type of power plant depends on the temperature and pressure of the geothermal reservoir (U.S. DOE Nov 2004).

Dry steam power plants draw from underground reservoirs of steam. The steam is piped directly from wells to the power plant, where it enters a turbine. The steam turns the turbine, which turns a generator. The steam is then condensed and injected back into the reservoir via another well. The geysers in northern California, the world's largest source of geothermal power, use dry steam (U.S. DOE Nov 2004).

Flash steam power plants tap into reservoirs with temperatures of 360°F or higher. This very hot water flows up through the wells under its own pressure. As it flows to the surface, the fluid pressure decreases and some of the hot water boils or "flashes" into steam. The steam is then separated from the water and used to power a turbine generator unit. The remaining water and condensed steam are injected through a well back into the reservoir (U.S. DOE Nov 2004).

Binary-cycle power plants operate with water at lower temperatures of approximately 225°F to 360°F. These plants use heat from the geothermal water to boil a working fluid, usually an organic compound with a lower boiling point. The working fluid is vaporized in a heat exchanger and the vapor turns a turbine. The water is then injected back into the ground to be reheated. The water and the working fluid are confined in separate closed loops during the process, so there are little or no air emissions (U.S. DOE Nov 2004).

9.2.2.5.3 Ability to Serve Regional Needs

Use of geothermal resources for the generation of electricity is currently limited to shallow, high-temperature convective hydrothermal reservoirs. A lower temperature type of geothermal energy is found in parts of the eastern United States. The University of Florida Geophysical Laboratory has investigated heat flow values for the Gulf coastal plain and north-central Florida. Thermal gradients found in the majority of the wells drilled in Florida were below average to average, indicating little promise of a significant geothermal resource (OSTI Nov 1984). A heat flow map of the United States shows Florida with heat flows generally in the 25 to 39 MW-per-square-meter range with a small portion in the 40 to 44 MW-per-square-meter range and an even smaller portion located in the panhandle in the 55 to 59 MW per square meter range (MIT 2006). However, a new geothermal demonstration project is under development in Florida. The Jay Oilfield demonstration project is set to begin in 2008 and will use thermal fluids commonly coproduced from oil and gas wells. The expected capacity of the project is 200 kW but has potential for 1 MW, much less than the proposed project (GEA Aug 2008).

9.2.2.5.4 Potential Environmental Impacts

Land use impacts from geothermal power are potentially substantial. Estimates found in NUREG-1437 estimate that geothermal power generation facilities require between 1 and 8 acres per MW (U.S. DOE Nov 2004). Based on a 95-percent capacity factor, a geothermal power plant with a net output of approximately 2200 MW would require at least 2300 acres (3.64 square miles). Other major environmental concerns associated with geothermal development are the release of small quantities of carbon dioxide and hydrogen sulfide, and disposal of sludge and spent geothermal fluids. Subsidence and reservoir depletion is also a concern when withdrawal of geothermal fluids exceeds natural recharge or injection. Induced seismicity can be a concern when large amounts of geothermal fluids are injected back into the hydrothermal reservoir (U.S. DOE Nov 2004).

9.2.2.5.5 Conclusions

Based on this analysis, geothermal power using high-grade (shallow, hot, and permeable) hydrothermal reservoirs is developed and proven. However, because there are no known shallow, high-temperature hydrothermal resources in Florida, the potential for future geothermal power using currently available technology is inadequate to supply the equivalent power of the proposed nuclear facility. Therefore, geothermal power is not a potentially competitive alternative for baseload power in Florida.

9.2.2.6 Fuel Cells

9.2.2.6.1 Overview

Fuel cells are similar to common batteries. Both have a positive and a negative terminal, rely on chemical reaction, and produce electricity when the circuit is closed. In hydrogen fuel cells, hydrogen passes through an anode catalyst where it is ionized into a positively charged hydrogen ion and a negatively charged electron. The hydrogen ions then pass through a conductive medium and combine with oxygen to form water. The electrons formed by the ionization process create an electrical current (NRRI Feb 2007). Hydrogen fuel can come from a variety of hydrocarbon resources that are gasified by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

9.2.2.6.2 Current Technology Status

Fuel cell power plants are in the initial stages of commercialization and are still an immature technology. Fuel cells are classified by the type of electrolyte used. There are currently five types: (1) alkaline fuel cells, (2) phosphoric acid fuel cells, (3) proton exchange membrane fuel cells, (4) molten carbonate fuel cells, and (5) solid oxide fuel cells. Electric output for proton exchange membrane fuel cells and solid oxide fuel cells range from 5 kW to 250 kW. Phosphoric acid fuel cells are capable of producing 200 kW, and molten carbonate fuel cells can produce anywhere from 250 kW to 2 MW of power (NRRI Feb 2007).

9.2.2.6.3 Ability to Serve Regional Needs

According to the Fuel Cells 2000 Worldwide Stationary Fuel Cell Installation database, nine fuel cell power plants have been installed in Florida and one system is planned by the state of Florida for an undisclosed university (FC2000 2008). These are all stationary fuel cell installations. That is, they generally provide supplemental power and/or backup assurance for critical areas, or they may be installed as a grid-independent generator for onsite service in areas that are inaccessible by powerlines. FPL has also been investigating fuel cell technologies through monitoring of industry trends, discussions with manufacturers, and direct field trials. From 2002 through the end of 2005, FPL conducted field trials and demonstration projects of proton exchange membrane fuel cells with the objectives of serving customer end-uses while evaluating the technical performance, reliability, economics, and relative readiness of the proton exchange membrane technology (FPL Apr 2010). Currently, the technology is still too immature to provide baseload capacity on a utility scale.

9.2.2.6.4 Potential Environmental Impacts

Fuel cells work without combustion and, therefore, do not produce the environmental side effects associated with combustion. The only by-products of the fuel cell generation process are heat, water, and carbon dioxide (MTC 2008b). The impacts of the end-of-life phase of fuel cells are small, in part, because of the large motivation to recover precious metals components. However, one must also consider the life cycle impacts of fuel cells. A life cycle assessment which considered the manufacturing of fuel cells was conducted by EPA’s National Risk Management Research Laboratory and NASA’s Jet Propulsion Laboratory. As detailed in this report, the fabrication of fuel cells is an energy-intensive, high-temperature process and the fuel cell also uses heavy metals such as nickel, chromium, and manganese in the catalysts, electrodes, and interconnects (U.S. EPA 2009). Further, the fuel, hydrogen, in hydrogen fuel cells requires the manufacturing of hydrogen. Significant challenge must be overcome. Hydrogen production is capital intensive and developers have not established standard designs (U.S. DOE Dec 2005).

9.2.2.6.5 Conclusions

This technology has not matured sufficiently for a baseload facility on a utility scale. Therefore, fuel cell technology is not a potentially competitive alternative for the proposed project.

9.2.2.7 Biomass

9.2.2.7.1 Overview

Biopower refers to electric power generated from converted vegetation (i.e., biomass). The most common biomass resources today are waste wood and agricultural crop residues from growing such crops as corn and sugar cane. Research is underway to explore the production of switch grass and other crops for the specific purpose of biomass conversion for electricity production (NRRI Feb 2007).

Biopower generation is a two-step process. The first step is to convert biomass feedstock into biofuel. The second step is to convert biofuel into electricity via combustion. Most biopower today is produced in direct combustion gas turbines, but it can also be used in combined-cycle turbines, diesel engines, or serve as a substitute in existing coal-fired burners (NRRI Feb 2007). Power from biomass is a proven commercial electricity generation option in the United States (EERE Jun 2000).

9.2.2.7.2 Current Technology Status

Biomass-fired facilities generate electricity using commercially available equipment and well-established technology (EERE Jun 2000). Biomass is the largest source of renewable electricity generation among the non-hydropower renewable fuels (EIA Mar 2009). There are four primary classes of utility-scale biomass power systems: direct-fired, co-fired, gasification, and modular systems. A brief description of each class is provided as follows:

- Nearly all of the biomass-energy-using electricity generation facilities in the United States use direct-fired steam turbine conversion technology. This technology is relatively simple to operate and it can accept a wide variety of biomass fuels. Biomass power boilers are typically in the 20 MW to 50 MW range and the technology is inefficient (U.S. DOE Sep 2006).

- Co-firing involves substituting biomass for a portion of coal in an existing power plant furnace. It is the most economic near-term option for introducing new biomass power generation. Because much of the existing power plant equipment can be used without major modifications, co-firing is far less expensive than building a new biopower plant. Compared to the coal it replaces, biomass reduces sulfur dioxide, nitrogen oxides, and other air emissions. After tuning the boiler for peak performance, there is little or no loss in efficiency from adding biomass (U.S. DOE Sep 2006). While biomass can be successfully co-fired with coal, it is not without technical challenges. Biomass is much less dense than coal, requiring a large volume of fuel to be handled. Larger areas of biomass storage and additional handling are required to accommodate the lower-density materials. Moreover, the ash residue left from combusting biomass contains alkali and alkaline earth elements, such as sodium, potassium, and calcium. These compounds bind irreversibly with the catalysts used in selective catalytic reduction reactors that have been installed on coal-fired generating plants. These compounds can lead to increased catalyst plugging and cause deactivation of selective catalytic reduction catalysts, thus reducing or eliminating the ability of this technology to reduce nitrogen oxide emissions (Bowers Mar 2005).

- Biomass can be used in integrated gasification combined-cycle (IGCC) systems in which gasifiers heat the biomass in an environment where the solid biomass breaks down to form a flammable gas. The biogas is then cleaned and filtered to remove problem chemical compounds before being burned in a combined-cycle unit (U.S. DOE Sep 2006). IGCC systems are described in Subsection 9.2.2.12.
- Modular systems employ some of the same technologies mentioned above, but on a smaller scale that is more applicable to villages, farms, and small industries (U.S. DOE Sep 2006).

9.2.2.7.3 Ability to Serve Regional Needs

Florida ranks 16th in the nation in agriculture. According to the U.S. Department of Agriculture 2002 Census, there are 10.41 million acres of farmland equaling 30.2 percent of the state’s total land area (USDA Jul 2008). The Department of Agriculture and Consumer Services believes that Florida can be a leader in the effort of producing energy from crops and timber because of the vast amount of farm acreage in the state and its mild climate, which permits crops to be grown virtually year round (FDACS 2008).

In 2006, the Farm-to-Fuel Initiative was statutorily created to enhance the market for and promote the production and distribution of renewable energy from Florida-grown crops, agricultural waste and residues, and other biomass (FDACS 2008). In 2006, wood/wood waste and other biomass accounted for 1.1 percent of Florida’s 2 percent total renewable net generation or 202 MW of summer electricity capacity (EIA May 2008).

A study on biomass feedstock availability (Walsh et al. 2000) reports that there are 9,757,000 tons of forest residues available annually in Florida. Because mill residues are clean, concentrated at one source, and relatively homogeneous, nearly 98 percent of all residues generated in the United States are currently used as fuel or to produce other fiber products. There are 2,678,000 tons of mill residues available annually in the state (Walsh et al. Jan 2000).

9.2.2.7.4 Potential Environmental Impacts

As addressed in NUREG-1437, the overall level of construction of a biomass-fired power facility would be approximately the same as that for a similar sized coal-fired plant. Like coal-fired facilities, biomass plants require large areas for fuel storage and processing and involve the same type of combustion equipment. Fuel processing, in most cases involving some type of grinding operation, produces emissions of dust and particulates (NREL Nov 1999).

Conversion of large tracts of land for production of energy crops would pose potentially adverse environmental impacts on wildlife habitat and biodiversity, reduce soil fertility, increase erosion, and reduce water quality. The net environmental impacts would depend on previous land use, the particular energy crop, and how the crop is managed. If the land has not previously been developed for farming or other purposes, displacement of natural land cover such as forests and wetlands with energy crops would likely have negative environmental impacts. In addition, conversion of food crops into energy crops results in a reduction in food production that may need to be replaced elsewhere.

Air emissions and water consumption are usually the principal sources of environmental concern related to biomass facilities. Combustion of biomass fuels in modern power plants leads to many of the same kinds of emissions as the combustion of fossil fuels, including criteria air pollutants, greenhouse gases, and production of ash. While the air emissions would likely be less than a coal-fired facility, they would be substantially greater than the proposed nuclear project. The controls for limiting these emissions are similar to those used in coal-fired plants (NREL Nov 1999). Water consumption impacts would be similar to other boiler power technology.

9.2.2.7.5 Conclusions

Based on this analysis, biomass-fired technology is developed, proven, and available in Florida at the start of commercial operation of the proposed nuclear project. However, as a result of adverse environmental impacts, the small scale of existing plants, and the large amount of fuel preparation, burning biomass to generate electricity is not considered to be a potentially competitive alternative.

9.2.2.8 Municipal Solid Waste/Landfill Gas

9.2.2.8.1 Overview

Municipal solid waste refers to the stream of garbage collected through community sanitation services. Municipal solid waste includes everyday items such as grass clippings, household garbage, newspapers, food scraps, clothing, bottles, paint, batteries, etc. Municipal solid waste can be directly combusted in waste-to-energy facilities to generate electricity (U.S. EPA Dec 2007c).

Landfill gas is created when organic waste in a landfill naturally decomposes. This gas consists of approximately 50 percent methane, approximately 50 percent carbon dioxide, and a small amount of non-methane organic compounds. Instead of allowing landfill gas to escape into the air, it can be captured, converted, and used as an energy source (U.S. EPA Jun 2008).

9.2.2.8.2 Current Technology Status

Municipal solid waste-fired and landfill gas facilities generate electricity using commercially available equipment and well-established technology. Conventional direct combustion is presently the most common technology used in the United States for municipal solid waste-to-energy power generation. At the power plant, municipal solid waste is unloaded from collection trucks and shredded or processed to ease handling. Very large items such as refrigerators or stoves, recyclable materials, and hazardous waste materials such as batteries are removed before combustion. Noncombustible materials such as metals can be removed before or after combustion, but are usually separated from the ash with magnetic separators. After separation, the remaining waste is fed into a combustion chamber to be burned. The heat released from burning the municipal solid waste is used to produce steam, which turns a steam turbine to generate electricity (U.S. EPA Dec 2007c).

At the end of 2007, the DOE reported 107 municipal solid waste generation facilities in operation in the United States. Nameplate capacities of these plants range from 0.1 MW to 90 MW, and more than half are less than 20 MW. The combined power capacity of the nation’s municipal solid waste facilities is approximately 2829 MW (EIA 2007). These power facilities are much smaller than the proposed nuclear project.

Another option of converting landfill waste into electricity is using landfill gas in internal-combustion turbines that are connected to generators. The amount of gas that a particular landfill will produce depends on its age and size. Although gas is produced as soon as anaerobic conditions are established in the landfill, it may be several years before there is enough gas to fuel an electric generator. Later, as the site ages, gas production (as well as the quality of the gas) declines to the point at which power generation is no longer economical. In the case of a typical well-engineered and well-operated landfill, gas may be produced for as long as 50 to 100 years, but using this to fuel generators may be economically feasible for only 10 to 15 years (Santee Cooper 2008).

The EPA reports that the United States has at least 450 operational projects in 43 states supplying 11 billion kilowatt hours of electricity and 77 billion cubic feet of landfill gas to direct-use applications annually. The power capacity of these power plants ranges between 30 kW and 10.5 MW. There are an additional 540 candidate landfills with a total gas generation potential of 240 billion cubic feet per year or electric potential of 1280 MW—much less than the proposed project (U.S. EPA Jun 2008).

9.2.2.8.3 Ability to Serve Regional Needs

In Florida, there are 12 municipal solid waste-to-energy facilities (FLDEP 2007). Currently, there are 82 landfills in Florida, and the EPA regards only 21 of them as candidates for landfill gas-to-energy development and an additional 30 others as potential candidate sites (U.S. EPA Aug 2008). Assuming the landfills identified by the EPA as candidates or potential candidates produce enough gas to generate 20 MW each annually, the energy production is still less than half of the proposed nuclear project's power capacity. In 2006, municipal solid waste-landfill gas accounted for 0.8 percent of Florida's 2 percent total renewable net generation or 447 MW of summer electricity capacity (EIA May 2008). Additionally, as landfill gas generators can only be economically used for 10 to 15 years, even if future landfills are constructed that provide additional candidate sites, the fuel source will likely be depleted before the end of the proposed nuclear project's operating life.

9.2.2.8.4 Environmental Impacts

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations (NUREG-1437). Combusting waste usually reduces its volume by approximately 90 percent and the remaining ash is buried in landfills (FPSC & FDEP Jan 2003). However, it is unlikely that many landfills will begin converting waste to energy due to the factors that may limit the growth in municipal solid waste power generation. Chief among these reasons are environmental regulations and public opposition to siting municipal solid waste facilities near feedstock supplies.

The overall level of land use impacts from construction of a municipal solid waste-fired plant would be approximately the same as that for a conventional coal-fired plant (NUREG-1437). The air emission profile and other operational impacts (including impacts on the aquatic environment, air, and waste disposal) for a municipal solid waste plant would also be similar to a conventional fossil fuel unit.

Burning landfill gas is beneficial to the environment by preventing methane, a greenhouse gas, from entering the atmosphere directly (Santee Cooper 2008). The air emission profile and other operational impacts (including impacts on the aquatic environment, air, and waste disposal) for a landfill gas plant would also be similar to a conventional fossil fuel unit. The overall level of land use impacts from construction of a landfill gas-fired plant should be approximately the same as for similar sized conventional gas-fired plant.

9.2.2.8.5 Conclusions

Based on this analysis, municipal solid waste- and landfill gas-fired technology is developed, proven, and would be available in Florida at the start of commercial operation of the proposed nuclear project. However, the small scale of existing plants, the large amount of fuel preparation required in the case of municipal solid waste-fired plants, the relatively short operating life in the case of landfill gas-fired plants, and because the full potential of municipal solid waste and landfill gas in Florida is less than the proposed project, burning municipal solid waste and landfill gas to generate electricity is not a potentially competitive alternative.

9.2.2.9 Coal

9.2.2.9.1 Overview

Coal-fired electric plants provide the greatest percentage of the electricity generated in the United States, accounting for approximately 48.5 percent of the electricity generated and approximately 31.4 percent of the available net summer electric power capacity in 2007 (EIA Apr 2009). To generate electricity from coal, coal is initially extracted from surface or underground mines. The coal is often cleaned or washed at the coal mine to remove impurities before it is transported to the power plant—usually by train, barge, or truck. At the power plant, coal is burned in a boiler to produce steam. The steam is run through a turbine to generate electricity (U.S. EPA Dec 2007).

The United States has abundant coal reserves, and the price of coal per million Btu is projected to be roughly the same price in 2030 as in 2007 (EIA Mar 2009). Coal-fired plants are likely to continue to be a reliable energy source well into the future, assuming environmental constraints do not cause the gradual substitution of other fuels.

9.2.2.9.2 Current Technology Status

There are two primary technologies identified for generating electrical energy from coal: pulverized coal boiler and circulating fluidized bed boiler.

9.2.2.9.3 Pulverized Coal Boiler

In pulverized coal boilers, coal is ground up finely and blown into the combustion chamber of a boiler where it is combusted. The hot gases and heat energy from the incineration process convert water into high-pressure steam. The steam is then passed through a turbine to produce electricity. Flue gases are usually routed through a selective catalytic reduction scrubber for nitrogen oxide reduction, and into a heat exchanger to salvage any residual heat. After this, the flue gas flows to a particulate removal system and a sulfur dioxide scrubber system.

The steam systems used in the current generation of pulverized coal boilers are generally designated as subcritical (or conventional), supercritical, or ultra-supercritical. This designation is based on the pressure and temperature of the steam. Subcritical units operate at a nominal pressure of 2400 psi and a peak temperature of 1050°F. Supercritical units would operate at a similar peak temperature but at a nominal pressure of 3500 psi. Ultra-supercritical units operate at a nominal pressure of 4500 psi and a minimum temperature of 1100°F. As the temperature and pressure of the steam at the turbine inlet increases, so does the efficiency of the power steam cycle. As the efficiency of the steam cycle is increased, the amount of fuel necessary to produce the same amount of energy is reduced, in turn reducing plant emissions (NRRI Feb 2007). Therefore, ultra-supercritical units are the most effective steam systems available and have efficiencies as high as 46 to 48 percent. This is compared to subcritical and supercritical net efficiencies of 36 to 37.5 percent and 40 to 42 percent, respectively (EPRI May 2007).

The subcritical pulverized coal technologies are commercially mature and widely used throughout the world. In 2005, 346 of the operating coal plants in the United States had been in operation for more than 50 years. Supercritical pulverized coal plants are a highly proven and reliable technology with installations dating back to 1957. Ultra-supercritical units are still undergoing development in the United States (NRRI Feb 2007).

9.2.2.9.4 Fluidized Bed Boiler Technologies

The fluidized bed boiler is an advanced electric power generation process that minimizes the formation of gaseous pollutants by controlling coal combustion parameters and by injecting a sorbent (such as crushed limestone) into the combustion chamber along with the fuel. Crushed fuel mixed with the sorbent is fluidized on jets of air in the combustion chamber to enhance combustion and heat transfer. Sulfur released from the fuel as sulfur dioxides is captured by the sorbent in the bed to form a solid compound that is removed with the ash. The resultant by-product is a dry, benign solid that is potentially a marketable by-product for agricultural and construction applications. More than 90 percent of the sulfur in the fuel is captured in this process. Nitrogen oxide formation in fluidized bed power plants is approximately 70 to 80 percent lower than that for conventional pulverized coal boilers because the operating temperature range of 1500ºF to 1700ºF is below the temperature at which thermal nitrogen oxide is formed. However, due to this lower operating temperature, fluidized bed systems do not achieve the higher efficiency levels achieved by conventional pulverized coal boilers (U.S. DOE Mar 2003).

Circulating fluidized bed combustion boilers use a relatively high fluidization velocity that entrains the bed material, in conjunction with hot cyclones, to separate and recirculate the bed material from the flue gas before it passes to a heat exchanger (U.S. DOE Mar 2003). This improves operating characteristics and performance and simplifies design, making it easier to scale up (Ghosh Sep 2005). In terms of environmental performance, circulating beds have better sulfur capture, carbon burnout, and nitrogen oxide control characteristics than noncirculating beds (Ghosh Sep 2005).

To improve the thermal efficiency of the fluidized bed technology, a new type of fluidized bed boiler has been proposed that encases the entire boiler inside a large pressure vessel pressurized 6 to 16 times greater than atmospheric pressure. Combustion of coal in a pressurized fluidized bed boiler results in a high-pressure stream of combustion gases that can spin a gas turbine to make electricity and boil water for a steam turbine. It is estimated that pressurized fluidized bed plants could generate 50 percent more electricity from coal than a regular power plant from the same amount of coal. The pressurized fluidized bed technology is currently in the demonstration phase and is not a feasible alternative for the proposed nuclear project (U.S. DOE Mar 2003).

The atmospheric fluidized bed combustion technology is a commercially mature technology that has been used for more than 50 years and has more than 600 units operating worldwide in the size range of 20 MW to 300 MW (Ghosh Sep 2005). Designs are being developed for units as large as 600 MW. The technology's total capacity represents approximately 2 percent of the overall coal-fired generation capacity in the world. In the United States, there are 185 atmospheric fluidized bed combustion boilers with a total capacity of 6000 MW (Ghosh Sep 2005).

9.2.2.9.5 Ability to Serve Regional Needs

The United States has abundant low-cost coal reserves, and the price of coal for electric generation is projected to remain steady for the next 20 years (EIA Mar 2009). Coal is one of the leading fuels for electricity production in Florida, accounting for over one-third of the net generation. There are no coal mines in Florida and coal-fired plants rely on supplies delivered by railroad and barge, mainly from Kentucky, Illinois, and West Virginia (EIA Aug 2008). However, Executive Orders issued by Florida's Governor in July 2007 requiring a significant reduction in greenhouse gas emissions in Florida, may hinder the approval to build a new advanced coal technology plant in Florida (FPL Apr 2010).

9.2.2.9.6 Potential Environmental Impacts

The environmental impacts of construction of a typical pulverized coal-fired steam plant are well known because coal-fired steam plants represent approximately half of the electrical generation in the United States (EIA Apr 2009). The combustion of coal creates several by-products that are damaging to the air quality of the environment, including sulfur dioxides, nitrogen oxides, carbon dioxide, mercury and other trace metals, ash, and volatile organic compounds (NRRI Feb 2007).

Coal-fired power plants use large quantities of water for producing steam and for cooling (U.S. EPA Dec 2007). A coal-fired plant uses approximately 600 gallons of water per megawatt-hour of generation (EPRI Mar 2002). When the water used in the power plant is discharged to a lake or river, the pollutants in the water can harm fish and plants (U.S. EPA Dec 2007). This water may contain trace levels of metals or chemicals and may be at a higher temperature than the source water into which it is discharged (NRRI Feb 2007). Life cycle impacts are also associated with the mining and transportation of coal. Coal mining impacts include air quality impacts from fugitive dust, water quality impacts from acidic runoff, and aesthetic and cultural resource impacts (NUREG-1437). While impacts from the transportation of coal include air quality impacts from the emissions produced during transport, environmental impacts from the transportation of coal by barge would also include aquatic ecology and water impacts.

9.2.2.9.7 Conclusions

Based on the analysis, pulverized coal boiler technology is a potentially competitive alternative to the proposed nuclear project. Based on ample fuel availability, generally understood environmental impacts associated with constructing and operating a coal-fired power generation plant, and good plant efficiencies, a pulverized coal-fired power plant is considered a potentially competitive alternative and is, therefore, examined further in Subsection 9.2.3.

However, because of the lower operating temperature of the fluidized bed system—thus its lower efficiency levels in relation to the conventional pulverized coal boilers—and the limited size of available units, fluidized bed is not a potentially competitive alternative for the proposed nuclear project.

9.2.2.10 Natural Gas

9.2.2.10.1 Overview

There are several commercially mature generation technologies that use natural gas as fuel, as described below:

- Gas-fired steam generator technology uses combustion to heat water to produce pressurized steam, which rotates a generator to produce electricity. Because of the much lower energy efficiencies of steam gas facilities, this technology is being replaced, in particular with combined cycle technology.
- In simple-cycle combustion turbine technology, fuel is burned in a combustion turbine and the resulting hot gases rotate the turbine to generate electricity before being emitted to the air. Simple combustion gas turbine systems are not efficient enough to be economically viable for baseload applications.
- Combined-cycle technology uses a combination of combustion turbine technology and steam generator technology. In the combined-cycle unit, hot combustion gases in the turbine rotate the turbine to generate electricity, and waste combustion heat from the turbine is routed through a heat recovery steam generator. There, water is turned to steam that rotates a steam turbine to generate additional electricity. Combining two cycles in the generation of electricity improves the overall thermal efficiency by as much as 50 percent over simpler, straight combustion gas turbines (NRRI Feb 2007).

9.2.2.10.2 Current Technology Status

Since the early 1990s, gas-fired power plants have comprised more than 90 percent of new generation capacity in the United States (NRRI Feb 2007). Natural gas-fired electric plants now account for the largest percentage of the U.S. electric power net summer capacity at 39.5 percent, but generated only 21.6 percent of the nation's electricity in 2006 (EIA Apr 2009). This low use is caused by the high prices for natural gas in recent years, making it more economical to produce electricity using other fuels and using gas-fired plants during periods of high demand. Recent studies indicate that when natural gas prices exceed $6 per thousand cubic feet, gas-fired combined cycle units lose their competitiveness with other technologies, particularly pulverized coal units (NRRI Feb 2007). In 2007, the average annual price of natural gas used for electric power generation was $7.30 per thousand cubic feet (EIA Jul 2008a).

9.2.2.10.3 Ability to Serve Regional Needs

Natural gas accounts for approximately 27 percent of Florida's net power generation (EIA Aug 2008). Florida receives most of its natural gas supply from other Gulf Coast States via two major interstate pipelines: the Florida Gas Transmission line, which runs from Texas through the Florida panhandle to Miami, and the Gulfstream pipeline, an underwater link from Mississippi and Alabama to central Florida. With the completion of the Cypress pipeline in May 2007, the Jacksonville area has also begun receiving supplies from the liquefied natural gas import terminal at Elba Island, Georgia. Because Florida's natural gas supply is vulnerable to disruption from hurricanes and tropical storms, to safeguard against these threats and meet energy demand, FPL is considering the option of constructing a third natural gas pipeline along the eastern portion of the state.

Florida's natural gas consumption is high and has grown rapidly in recent years, due primarily to increasing demand from the electric power sector. To help meet Florida's growing demand for natural gas, companies have proposed building new liquefied natural gas import terminals in the federal waters off of Florida's Atlantic and Gulf Coasts, and on the nearby islands of the Bahamas (EIA Aug 2008). There is an extensive infrastructure for distribution and abundant resources available for a large baseload combined cycle gas-fired power plant. However, Executive Orders issued by Florida's Governor in July 2007 requiring a significant reduction in greenhouse gas emissions in Florida, may hinder the approval to build a gas-fired power plant in Florida (FPL Apr 2010).

9.2.2.10.4 Potential Environmental Impacts

Combustion of natural gas produces nitrogen oxides and carbon dioxide, but in lower quantities than burning coal or oil (U.S. EPA Dec 2007b). The burning of natural gas in combustion turbines requires very little water and does not produce any water discharges. However, pollutants and heat build up in natural gas boilers and combined cycle systems. When these pollutants and heat reach certain levels, the water is often discharged into lakes or rivers (U.S. EPA Dec 2007b).

Gas-fired plants occupy approximately one-tenth the space of nuclear and pulverized coal plants. This partially explains the relatively low level of public opposition to combined cycle gas turbine plants relative to other baseload technologies (NRRI Feb 2007).

9.2.2.10.5 Conclusions

Because gas-fired generation, using combined-cycle turbines, is based on the use of well-known technology and generally has well-understood environmental impacts associated with construction and operation, it is a potentially competitive alternative to the proposed nuclear project. Gas-fired generation is examined further in Subsection 9.2.3.

9.2.2.11 Petroleum

9.2.2.11.1 Overview

Petroleum (oil) consumption in the electric power sector uses three main types of oil derivatives: distillate fuel oil, residual fuel oil, and petroleum coke. To produce electricity from oil, crude oil is initially removed from the ground by drilling deep wells and pumping it to the surface. The crude oil is then transported to a refinery where it is refined into a number of fuel products and where a number of the impurities such as sulfur, nitrogen, and metals are removed. From the refinery, oil is transported to power plants by barge, pipelines, trucks, or trains. At the power plants, several methods can be used to generate electricity from oil. One method is to burn the oil in boilers to produce steam that is used by a steam turbine to generate electricity. Alternatively, a more common method is to burn the petroleum in combustion turbines, similar to simple combustion gas turbine systems. Another technology is to burn the oil in a combustion turbine and use the hot exhaust to make steam to drive a steam turbine—called combined-cycle technology (U.S. EPA Sep 2008).

9.2.2.11.2 Current Technology Status

Petroleum-fired power plants are a commercially mature generation technology. Petroleum-fired power plants provided 1.6 percent of electricity generated in the United States in 2006 and accounted for approximately 5.6 percent of the electric power capacity (EIA Apr 2009). The high cost of petroleum has prompted a steady decline in its use for electricity generation in recent decades. Reliance on foreign sources of petroleum, future increases in petroleum prices, and competition for petroleum resources by the transportation and petrochemical industry are expected to make petroleum-fired generation less attractive than other power alternatives.

9.2.2.11.3 Ability to Serve Regional Needs

Most of Florida's crude oil production comes from fields in the northwestern panhandle, but the state also produces some crude oil from smaller fields in the south. Although companies have explored for oil and gas in the federal outer continental shelf south of Panama City, exploration activity has been dormant since 1995, when a litigation settlement returned 73 oil and gas leases in this area to the federal government. Florida has no oil refineries and relies on petroleum products delivered by tanker and barge to marine terminals near the state's major coastal cities. Due in part to Florida's tourist industry, demand for petroleum-based transportation fuels (i.e., motor gasoline and jet fuel) is among the highest in the United States (EIA Aug 2008). Though Florida petroleum reserves are approximately 0.3 percent of U.S. reserves, Florida ranks third among states in petroleum use, and approximately 73 percent of Florida petroleum consumption is for transportation. Florida production of electrical power from oil fluctuates between 12 and 17 percent (Mulkey Sep 2007).

9.2.2.11.4 Environmental Impacts

Construction and operation of a petroleum-fired plant would have environmental impacts. For example, NUREG-1437 estimates that construction of a 1000 MWe petroleum-fired plant would require approximately 120 acres. Construction and operation of a petroleum-fired plant would have comparable impacts on regional air quality and the aquatic environment as would a similar sized coal-fired plant.

9.2.2.11.5 Conclusions

Based on this analysis, petroleum energy technology is developed, proven, and would be available in Florida at the start of commercial operation of the proposed nuclear project. Although the land use requirements are relatively small, concerns related to fuel availability, along with the national policy to reduce foreign oil dependence, and the adverse environmental impacts to air and water quality led to the conclusion that petroleum energy technology is not a potentially competitive alternative.

9.2.2.12 Integrated Gasification Combined Cycle

9.2.2.12.1 Overview

Integrated Gasification Combined Cycle (IGCC) is an electric power generation process that combines modern gasification technology with both gas turbine and steam turbine power generation (combined-cycle). IGCC plants can be powered by many carbon-based fuels such as coal, petroleum coke, and biomass. Gasification uses steam and oxygen to convert the fuel into synthesis gas (syngas) in a high-temperature, high-pressure chamber. Syngas is a mixture of carbon dioxide, carbon monoxide, and hydrogen, of which the last two are the primary combustible components. The syngas is burned in a combustion turbine and the hot exhaust gas from the turbine is routed to a heat recovery steam generator, where it produces steam to power a steam turbine. Electricity is produced in both cycles via generators, powered by the gas turbine and the steam turbine, thus the term combined cycle. IGCC plants are suitable for baseload operation because they combine low cost fuels and high output (NRRI Feb 2007).

9.2.2.12.2 Current Technology Status

IGCC power plants are in the early stages of commercialization. There are currently two commercial-size, coal-based IGCC plants in the United States. Both were supported initially under the DOE Clean Coal Technology demonstration program, but now operate commercially without DOE support (CEUS Jul 2006). The nameplate capacity of existing and planned units typically ranges from 250 MW to 630 MW (NRRI Feb 2007).

Experience has been gained with the chemical processes of gasification, fuel properties, and their impact on the IGCC design, efficiency, and economics. However, system reliability is still relatively lower than conventional coal-fired power plants, and the major reliability problem is related to the gasification section. There are also problems with the combination of gasification and power production systems. For example, if the gases are not adequately cleaned, they can cause damage to the gas turbine (PERMG Jun 2005).

9.2.2.12.3 Ability to Serve Regional Needs

As mentioned in Subsection 9.2.2.9, the United States has abundant low-cost coal reserves, and the price of coal for electric generation is projected to remain steady for the next 20 years (EIA Mar 2009). As described in Subsection 9.2.2.7, there is insufficient biomass feedstock available in the Florida to power a large baseload facility. Subsection 9.2.2.11 describes that petroleum coke sources are likely to be available economically in Florida. Further, IGCC technology has the ability to economically capture the sulfur in the carbon-based fuels; therefore, the process can be used to burn cheaper high-sulfur coal and petroleum-coke with less environmental impacts.

9.2.2.12.4 Environmental Impacts

IGCC technology is cleaner than any other coal-based fuel combustion technology because major pollutants can be removed from the gas stream before combustion (NRRI Feb 2007 and Ghosh Sep 2005). For example, the sulfur in the fuel is captured and removed as hydrogen sulfide in the gasifier via a conventional acid-gas removal system. The concentrated hydrogen sulfide can be recovered as elemental sulfur or sulfuric acid and sold as commercial by-product. The largest solid waste stream produced by IGCC installations is slag, a black, glassy, sand-like material that is potentially a marketable byproduct. Slag production is a function of the fuel’s ash content. In this way, IGCC units do not produce ash or scrubber wastes. As much as 50 percent of the mercury in a feedstock is removed in IGCC systems, much of it bound in the slag and sulfur byproducts (NCC May 2001 and Ghosh Sep 2005). Land use concerns would be similar to conventional pulverized coal-fired power plants of the same capacity.

9.2.2.12.5 Conclusions

Based upon the analysis, IGCC technology has not matured sufficiently to support production for a large baseload facility. Both of the IGCC facilities that presently operate in the United States were supported with federal funds that would be unavailable for this IGCC alternative. Additionally, the system reliability associated with IGCC technology is considerably less than other carbon-based fuel-fired technologies. Thus, IGCC is not considered to be a potentially competitive alternative.

9.2.2.13 Conclusion

Based on the analysis of alternatives that require new generation, there are two potentially competitive alternatives identified—the pulverized coal-fired alternative and the combined cycle natural gas fired alternative—each is, therefore, retained for further analysis in Subsection 9.2.3. The remaining alternatives were eliminated either because they could not reasonably meet the demand as a baseload source, the technology was immature, or the technology was not viable in the region of interest.

9.2.3 ASSESSMENT OF COMPETITIVE ALTERNATIVE ENERGY SOURCES AND SYSTEMS

This subsection provides an analysis of the potentially competitive alternatives identified in Subsections 9.2.1 and 9.2.2 for comparison with the associated proposed nuclear project. The analysis of the potentially competitive alternatives is a two-step process:

1. The first step provides a comparison of the environmental and health impacts of the potentially competitive alternatives to the proposed action to determine if one or more of the identified potentially competitive alternatives can be expected to provide an appreciable reduction in overall environmental and health impacts, and/or offer solutions to potential adverse impacts predicted for the proposed project for which no mitigation procedure could be identified.

2. The second step includes a comparison of the economic costs of any potentially competitive alternatives found to be environmentally preferable to the proposed action to determine if an alternative is preferred/superior to the proposed project.

The alternatives assessed in Subsections 9.2.1 and 9.2.2 that were considered to be competitive and were identified for further analysis are: (1) pulverized coal-fired generation, (2) combined cycle gas-fired generation, and (3) a combination of alternatives. Completion of the first step of the analysis involves a determining or categorizing the environmental impacts associated with the potentially competitive alternative. This categorization of the environmental impacts associated with the identified alternatives and the proposed action was completed in accordance with the NRC established regulations for quantifying environmental impacts based on the Council on Environmental Quality Guidance, 40 CFR 1508.27, and those identified in 10 CFR Part 51, and in NUREG-1555. These regulations and guidance establish three significance levels for characterizing environmental impacts: SMALL, MODERATE, or LARGE. The definitions of the significance levels are as follows:

- SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Consideration is given to ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are SMALL receive less mitigative consideration than impacts that are LARGE).

9.2.3.1 Pulverized Coal-Fired Generation

Subsection 9.2.2.9 identified pulverized coal boiler technology as a potentially competitive alternative to the proposed nuclear project. The comparative pulverized coal-fired alternative consists of three boiler units, each with a net capacity of 728.4 MW. This configuration was chosen to equate to the proposed nuclear project net capacity and the natural gas-fired alternative described in Subsection 9.2.3.2, allowing for a valid comparison amongst the alternatives chosen and the proposed project. Table 9.2-1 details basic attributes chosen to complete a reasonable analysis of the pulverized coal-fired units. The boiler and emission control technology were chosen to yield the lowest emission factor for the pollutants of concern provided by the EPA AP-42 document, yielding a more favorable comparison for the alternative (U.S. EPA Jan 1995). For the purposes of this analysis, coal and limestone were assumed to be delivered by barge to the Turkey Point plant property.

9.2.3.1.1 Environmental Impacts

In accordance with NUREG-1555, the first step in the analysis is to make a determination as to whether the potentially competitive alternative is environmentally preferable. The results of this analysis are presented in this subsection. In conformance with NUREG-1555, an analysis of the following environmental impact categories is included for comparison with the proposed project:

air quality, waste management, land use, ecology, water use and quality, aesthetics, socioeconomics, historic and cultural resources, and environmental justice.

The NRC provides an overview of these environmental impact categories associated with the construction and operation of a coal-fired alternative in NUREG-1437. In summary, the NRC concludes that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed; however, the installation of a new coal-fired plant where an existing nuclear plant is located would reduce many of these construction impacts. The analysis presented in NUREG-1437 also concludes that there are major adverse impacts from operations of a coal-fired plant such as human health concerns associated with air emissions, waste generation, and losses of aquatic biota as a result of cooling water withdrawals and discharges. NUREG-1437 also identifies socioeconomic benefits for the surrounding communities in the form of several hundred jobs, substantial tax revenues, and plant spending. In order to characterize the environmental impacts of the comparison pulverized coal-fired plant, a more detailed evaluation of the particular comparison plant, taking into account the conclusions presented in NUREG-1437, is provided below.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power and can potentially be significant, as depicted in NUREG-1437. A coal-fired plant would emit:

- Acid rain precursors—(sulfur dioxides, as sulfur oxide surrogate) and nitrogen oxides
- Criteria (health based) air pollutants—particulate matter, carbon monoxide, sulfur dioxides, and an ozone precursor, nitrogen oxide
- Hazardous air pollutants—mercury (Hg), and the naturally occurring radionuclides—uranium-238 and thorium-232
- Greenhouse gases —mainly CO_2 which has been linked to global climate change

As Table 9.2-1 indicates, and for the purpose of this analysis, it is assumed a plant design would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. The analysis indicates that the comparison pulverized coal-fired alternative would burn an estimated 5.72 million tons of coal per year and produce the following emissions:

Pollutant	Emissions
Nitrogen Oxide	1387 tons per year
Sulfur Dioxides	7499 tons per year
Carbon Monoxide	1430 tons per year
PM_{10}[(a)]	58 tons per year
$PM_{2.5}$[(b)]	15 tons per year
Carbon Dioxide	14 million tons per year
Mercury	0.24 tons per year

(a) Particulates with an aerodynamic diameter of less than 10 microns
(b) Particulates with an aerodynamic diameter of less than 2.5 microns

These emission totals for the potentially competitive alternative are calculated based on the parameters and assumptions identified in Table 9.2-1 and emission factors published in AP-42 (U.S. EPA Jan 1995).

Thus, the pulverized coal-fired comparison plant would emit several of the regulated criteria air pollutants. Criteria air pollutants are regulated in the Clean Air Act. The Clean Air Act required the EPA to set national ambient air quality standards (NAAQS) for six common air pollutants known as criteria pollutants: particle pollution, or particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. For each of these six criteria air pollutants, the EPA has set primary (health-based) standards and/or secondary (environmental and property damage) standards. Areas of the country in violation of NAAQS primary standards are designated as non-attainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements. Florida does not have regions that are designated as non-attainment with respect to the NAAQS for one or more criteria pollutants. New sources of criteria air pollutants would need to be considered to prevent significant deterioration or increases above the air quality baseline before permitting a pulverized coal-fired plant (U.S. EPA Apr 2008).

The pulverized coal-fired comparison plant would also emit significant sulfur dioxides and nitrogen oxide emissions, both acid rain precursors, and would be subject to the requirements in Title IV of the Clean Air Act. Title IV of the Clean Air Act was enacted to reduce emissions of sulfur dioxides and nitrogen oxide, the two principal precursors of acid rain. The acid rain requirements of the Clean Air Act amendments established a cap on the allowable sulfur dioxides emissions from power plants. Each company with fossil fuel-fired units was allocated sulfur dioxide allowances. To be in compliance with the Act, companies must hold enough allowances to cover their annual sulfur dioxides emissions. The Clean Air Act amendments also implemented a technology-based emission reduction program for nitrogen oxide aimed at achieving emission reductions through compliance with emission limitations (U.S. EPA Apr 2008). In 2007, emissions from generators in Florida ranked third nationally (in thousand metric tons) and 28th nationally (in lbs/MWh—for nitrogen oxide emissions). While for sulfur dioxide emissions, Florida ranked 11th highest nationally (in thousand metric tons) and 31st nationally (in lbs/MWh) for sulfur dioxide emissions (EIA Apr 2009). Both sulfur dioxides and nitrogen oxide emissions would increase if a new coal-fired plant were operated at Turkey Point. To operate a fossil-fuel generation plant, FPL would have to purchase sulfur dioxide allowances from the open market or shut down existing fossil-fired capacity from one of its other plants and apply the credits from that plant to the new one. Additionally, technology based nitrogen oxide limitations would have to be met.

The emission of nitrogen oxide, sulfur dioxides, and mercury from the pulverized coal-fired comparison plant may potentially be impacted by additional pieces of legislation. In March 2005, the EPA promulgated two rules as part of the Clear Skies initiative—the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR). Although both CAIR and CAMR have been vacated, consideration of the possible impacts of potentially similar regulations is warranted. The CAIR rule addressed power plant nitrogen oxide and sulfur dioxide emissions that contribute to non-attainment of the 8-hour ozone and fine particulate matter standards in downwind states. Twenty-eight states, including Florida, would have been subject to the requirements of the rule. On July 11, 2008, the D.C. Court issued an opinion vacating and remanding these rules; however, parties to the litigation requested rehearing of aspects of the Court's decision, including the vacatur of the rules. On December 23, 2008, the Court granted rehearing only to the extent that it remanded the rules to EPA without vacating them. It is anticipated that promulgation of a rule similar to the CAIR would yield the following analogous emission reduction requirements—emission reductions of nitrogen oxide by over 60 percent and sulfur dioxide emissions by over 70 percent would be required. These reductions would be accomplished by the installation of additional emission controls at existing coal-fired facilities or by the purchase of emission allowances from a cap-and-trade program (U.S. EPA Mar 2009).

The second rule of legislation the U.S. EPA issued, the CAMR, addressed mercury emissions, a regulated hazardous air pollutant—also potentially emitted by the pulverized coal-fired comparison plant. CAMR would have set emissions limits on mercury to be met in two phases beginning in 2010 and 2018, and encouraged a cap and trade approach to achieve the target emission limits. On February 8, 2008, the D.C. circuit court vacated the EPA’s CAMR. On February 6, 2009, the Department of Justice, on behalf of EPA, asked the Supreme Court to dismiss EPA's request that the Court review the D.C. Circuit Court's vacatur of the CAMR. Promulgation of a rule similar to CAMR would yield the following analogous emission reduction requirements to the March 2005 rule—during the first phase cap in 2010, mercury will be reduced by taking advantage of “co-benefit” reductions required in CAIR— nitrogen oxide and sulfur dioxide controls indirectly help to reduce mercury emissions. The second phase cap in 2018 would reflect a level of mercury emission reductions that exceed the level that would be achieved solely as a co-benefit of controlling nitrogen oxides and sulfur dioxides under CAIR. Each new coal-fired electrical generation unit in Florida would be required to acquire enough mercury allowances to cover its annual mercury emissions (U.S. EPA Mar 2009b).

The pulverized coal-fired comparison plant would also emit large quantities of greenhouse gases, particularly carbon dioxide. Recent concern over the emissions of greenhouse gases and their effect on climate change is leading to legislation requiring the reduction of greenhouse gas emissions. In fact, Executive Orders issued by Florida's Governor in July 2007 require a significant reduction in greenhouse gas emissions in Florida. These orders include a goal of providing 20 percent of the energy produced by electric utilities from renewable, non-emitting sources and requiring a significant reduction in greenhouse gas emissions by 2017. Therefore, new advanced coal technology power plants may no longer be seen as viable options in Florida (FPL Apr 2010).

NUREG-1437 identified that air quality from a coal-fired alternative would be impacted by releases of radionuclides. Radionuclides are among the hazardous air pollutants included in section 112 (b) of the Clean Air Act amendments. The three major fossil fuels—coal, oil, and natural gas—contain varying quantities of the naturally occurring radionuclides of the uranium-238 and thorium-232 series and potassium-40. When these fuels are burned to produce steam in the production of electricity, radionuclides are entrained in the combustion gases and may be emitted into the environment. The decay series of uranium and thorium constitute the major radionuclides contained in coal. A national database of nearly 7000 coal samples was analyzed with regard to the uranium and thorium content of the major ranks of coal used by utilities. Bituminous coal, the coal assumed to be used in the comparison plant, had an average content of 1.24 ppm uranium and 2.18 ppm thorium, with a corresponding activity of 0.41 picoCuries per gram (pCi/g) for each member of the U-238 series and 0.24 pCi/g for each member of the Th-232 series. The EPA assessed the exposure and risks as a result of radionuclide emissions from utilities and decided not to regulate radionuclide emissions from coal-fired boilers. The radionuclide content of coal is not unique when compared to other natural materials. In fact, it is generally assumed that the average radioactivity of the earth's crust (i.e., soil and rocks) is approximately twice that of coal (U.S. EPA Feb 1998).

NUREG-1437 also identified that temporary fugitive dust would be generated during construction of a coal-fired plant. Exhaust emissions would come from vehicles and equipment used during the construction process. In addition, during operations, coal-handling equipment would introduce fugitive particulate emissions.

Thus, air impacts from a coal-fired generation facility would be substantial. Adverse human health effects from coal combustion have led to important federal legislation in recent years because public health risks, such as cancer and emphysema, have been associated with coal combustion. Global warming and acid rain are also potential impacts. Recent changes in air quality regulations indicate that the EPA and the federal government recognize the importance of stability for air resources. However, a new pulverized coal-fired generating plant would need to obtain a New Source Review and Prevention of Significant Deterioration construction permit and the plant would need an operating permit issued under Title V of the Clean Air Act. These permits would establish limits to prevent substantial air quality impacts from the pulverized coal-fired alternative.

Thus, the coal-fired alternative would have MODERATE impacts on air quality. The impacts may be noticeable, but would not destabilize air quality in the area as a result of the use of mitigation technologies and compliance with issued permits.

Waste Management

The pulverized coal-fired alternative would generate substantial solid waste in the form of ash from coal combustion and scrubber sludge from air pollution controls. Based on the assumed plant parameters, the potentially competitive coal comparison plant would annually consume approximately 5.72 million tons of coal with an ash content of 8.94 percent. Particulate control equipment would collect most (99.9 percent) of this ash (approximately 510,906 tons per year). According to the EPA, approximately 30 percent of the ash produced by coal-fired power plants is recycled (U.S. EPA Jul 2008). Assuming this amount of waste mitigation, a new pulverized coal-fired plant at Turkey Point would recycle approximately 153,272 tons of coal ash per year and an annual total of approximately 357,634 tons of ash would require disposal.

For comparison purposes, it was assumed that the potentially competitive pulverized coal plant would be equipped with a wet flue gas desulfurization system with forced air oxidation using limestone as a reagent. (The wet flue gas desulfurization system would be located after the particulate matter control equipment [filter baghouse].) The wet flue gas desulfurization control removal technology with a forced-air oxidation system generates a large amount of gypsum waste that would need to be recycled or disposed of in a landfill (Buecker Aug 2006). Forced-oxidized systems produce gypsum (calcium sulfate dihydrate, whereas unoxidized systems will produce a wet material that is comprised of calcium sulfite with varying levels of calcium sulfate (EERC Dec 2007). The American Coal Ash Association reported that over 79 percent of the flue gas desulfurization gypsum was beneficially used in 2006. The major beneficial use of gypsum is wallboard. In addition to building materials, gypsum can be used for a variety of civil engineering applications from road construction to agricultural applications such as soil conditioners, nutritional sulfur, and fertilizer absorption enhancers (ACAA Aug 2006 and U.S. EPA Mar 2008). The comparison plant flue gas desulfurization control equipment would require approximately 234,107 tons of limestone a year to mitigate sulfur oxide emissions and would generate 402,708 tons per year of waste in the form of gypsum. Assuming 79 percent of the waste is recycled as a mitigation measure, Turkey Point would recycle approximately 318,140 tons of gypsum under the pulverized coal-fired alternative and an annual total of 84,569 tons of gypsum would require disposal. Ash and gypsum waste disposal over a 60-year plant life would require approximately 380 acres, primarily for ash disposal—assuming a landfill height of 30 feet (U.S. EPA Jul 2008).

With proper facility placement, along with current waste management and monitoring practices, waste disposal would not destabilize any resources. After closure of the waste site and revegetation, the land would be available for other uses. Waste disposal for the coal-fired alternative would have MODERATE impacts. The impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation of the impact would be unwarranted.

Land Use

NUREG-1437 estimates that approximately 1700 acres and the associated terrestrial habitat would be impacted during the construction of a 1000 MW coal-fired power plant and an additional 22,000 acres for mining the coal and disposing of the waste could be committed to supporting a coal plant during its operational life. Because most of this construction would be in previously disturbed areas, impacts would be minimal. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized through application of best management practices that minimize soil loss and restore vegetation after construction (NUREG-1437).

Thus, land use impacts from construction and operation of the pulverized coal-fired alternative would be MODERATE.

Ecology

During construction of the pulverized coal-fired alternative, construction impacts would alter the ecology. Ecological impacts to a plant site could include impacts on threatened or endangered species, wildlife habitat loss, reduced wildlife reproduction, habitat fragmentation, and a local reduction in biodiversity. There could be impacts to terrestrial ecology from cooling tower drift. There would also be aquatic ecology impacts from the transport of coal by barge to the site. It is estimated that approximately 272 barge deliveries to the site per year would be required, assuming the capacity of each coal barge is 21,000 tons (NREL Jun 1999). Most of the construction impacts would be avoided if a previously disturbed site such as Turkey Point is used (NUREG-1437).

Thus, the ecological impacts and impacts to threatened and endangered species would be SMALL to MODERATE, similar to the proposed project.

Water Use and Quality

Construction activities would disturb the land surface, which may temporarily affect surface water quality. Potential water quality impacts would consist of suspended solids from disturbed soils, biochemical oxygen demand, nutrient loading from disturbed vegetation, and oil and grease from construction equipment. Construction activities that disturb one acre or more would require a

National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from the site. Provisions of the NPDES permit would ensure that best management practices are implemented to minimize impacts to surface waters during construction. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills of fuel, hydraulic fluid, lubricants, paint, and other liquids. Construction would cause no appreciable consumption of surface water resources.

During operation of the pulverized coal-fired alternative, based on EPRI estimates, cooling tower water makeup water withdrawal would be approximately 18,450 gpm to 22,140 gpm and consumptive use through evaporation would be approximately 17,712 gpm (EPRI Mar 2002). This amount of water consumption would be taken from a combination of sources, reclaimed water and radial collector wells. Reclaimed water would come from a Miami-Dade County wastewater treatment plant that could potentially supply the required makeup water for the comparison pulverized coal-fired plant along with radial collector wells. Radial collector wells would be designed and sited to induce recharge from Biscayne Bay. The quality of the supply water from these sources would meet the regulatory requirement for use in industry.

The Boulder Zone within the lower Floridian aquifer could be used for discharge of blowdown effluents originally sourced from either saline or fresh water. The Boulder Zone has been used since 1977 to store vast quantities of treated sewage injected into it by Miami, Fort Lauderdale, and West Palm Beach. Currently, over 90 Class I injection wells are used to dispose over 400 million gallons/day of secondary wastewater in southeast Florida. The extremely high permeability associated with its cavernous nature prevents pressure buildup in injection wells, and its high salinity, make it an ideal zone for receiving injected wastes.

An underground injection control permit would be required for disposal of effluent through an underground injection well. This permit would establish conditions for discharging to wastewater to the Boulder Zone. Stormwater runoff streams from the coal storage area, fly ash and bottom ash piles, and the gypsum storage area would be collected in a lined recycle basin for reuse with no direct discharge to the surface water. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills.

Thus, water use and quality impacts would be SMALL.

Aesthetics

The pulverized coal-fired power block would be as high as 200 feet tall and the exhaust stack could be as high as 650 feet. The stack and associated plume would likely be visible in daylight hours for distances greater than 10 miles. The Federal Aviation Administration generally requires that structures exceeding an overall height of 200 feet above ground level have markings and/or lighting so as not to impair aviation safety. Visual effects of a new coal-fired plant at Turkey Point would be consistent with the industrial nature of the current site—located onsite are two nuclear units along with three oil and gas units.

Coal-fired generation introduces mechanical sources of noise that could be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise associated with barge transportation of coal and limestone would be minimal for the pulverized coal-fired alternative comparison plant. Noise and light from the pulverized coal-fired comparison plant may be detectable offsite, but these effects would be mitigated by the location of the comparison pulverized coal-fired plant in a relatively unpopulated area.

Thus, the aesthetic impacts associated with the pulverized coal-fired alternative would be SMALL.

Socioeconomics

Short-term socioeconomic impacts would result from the estimated 2500 peak construction workers to build the facilities, and long-term impacts would result from the estimated 250 full-time workers to operate the coal-fired facility (NUREG-1437).

During construction, the communities immediately surrounding the plant site would experience demands on housing and public services that could have noticeable impacts. NUREG-1437 states that socioeconomic impacts at a rural site would be greater than at an urban site, because more of the peak construction workforce would need to move to the area to work. New construction could have a negative impact on availability and cost of housing and after construction, the communities would be affected by the loss of jobs (NUREG-1437). Transportation impacts would be temporary, noticeable, but not destabilizing during plant construction and small during plant operation.

Miami-Dade County would benefit from tax payments for the new pulverized coal-fired comparison plant and, depending on how these are distributed, this could help address socioeconomic impacts.

Thus, socioeconomic impacts associated with constructing and operating the pulverized coal-fired alternative would be MODERATE (adverse) to LARGE (beneficial).

Historic and Cultural Resources

The potential impacts of new plant construction on historic and archaeological resources have been described and evaluated for the proposed project, Units 6 & 7 in Subsections 2.5.3 and 4.4.3. Cultural resource impacts would be unlikely because of the previously disturbed nature of the site and could be, if needed, minimized by survey and recovery techniques.

Thus, cultural resource impacts associated with constructing and operating the pulverized coal-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

Environmental Justice

Environmental justice impacts would depend on the nearby population distribution. Environmental justice impacts have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3.

Thus, environmental justice impacts associated with constructing and operating the pulverized coal-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

9.2.3.1.2 Human Health Effects

As NUREG-1437 states, human health effects associated with coal combustion include public health risks such as cancer and emphysema. Concerns over adverse human health effects from coal combustion have led to federal legislation in recent years. The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur oxide, and nitrogen oxide, mercury, trace elements (including arsenic, fluorine, selenium, and the radionuclides uranium and thorium), and organic compounds generated by incomplete coal combustion.

Nitrogen oxide emissions contribute to ozone formation, which in turn contributes to health risks. Ozone can irritate respiratory systems, reduce lung function, aggravate asthma, inflame and damage cells that line the lungs, and may cause permanent lung damage (U.S. EPA Sep 2008b). Additionally, exposure to fine particulates, $PM_{2.5}$ —sulfur dioxides are a precursor to fine particulates—has been associated with reduced lung function and chronic bronchitis; and, in people with heart disease, short-term exposure has been linked to heart attacks and arrhythmias (U.S. EPA Sep 2008c).

Recently, the EPA conducted a detailed study of possible health impacts from exposure to emissions of approximately 20 potentially toxic substances from coal-burning electric utilities. The EPA used U.S. Geological Survey (USGS) information on U.S. coal quality to assess the potential health impacts of approximately 14 potentially toxic trace elements that may be mobilized by coal combustion. The EPA concluded that, with the possible exception of mercury, there is no compelling evidence to indicate that emissions from U.S. coal-burning electric utilities cause human health problems in relation to toxic pollutants of concern (USGS Jul 2000).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health and environmental impacts for the criteria air pollutants. These agencies also impose site-specific emission limits as needed to meet the health standards.

Thus, with the limits imposed for the regulated constituents of air emissions, human health impacts from burning coal at a newly constructed coal-fired plant would be SMALL.

9.2.3.1.3 Design Alternatives

The location of Turkey Point lends itself to coal delivery by barge. Subsection 9.4.1 analyzes alternative designs for the Units 6 & 7 heat dissipation systems. Based on this analysis, a cooling tower was assumed to be used for the pulverized coal-fired alternative.

9.2.3.1.4 Conclusion

The impacts of the pulverized coal-fired alternative are compared to the proposed nuclear project in Table 9.2-3. As the comparison in these tables demonstrates, the pulverized coal-fired alternative is not environmentally preferable to the proposed nuclear project. Therefore, an economic cost comparison is not warranted.

9.2.3.2 Natural Gas Generation

As identified in Subsection 9.2.2.10, gas-fired generation using combined-cycle turbines has been identified as a potentially competitive alternative to the proposed project. The gas-fired alternative would be located at the site for the proposed nuclear project. It would be comprised of three 728.4 MW net capacity natural gas combined cycle units for comparison with the proposed project. Table 9.2-2 details basic attributes chosen to complete a reasonable analysis of the natural gas-fired units. The emission control technology selected was chosen to yield the lowest emission factor for the pollutants of concern provided by the EPA AP-42 document, yielding a more favorable comparison for the alternative. The gas-fired alternative defined in Subsection 9.2.2.10 would be located on land adjacent to an 1100 MW unit, Unit 5, natural gas combined-cycle unit exists along with the associated pipeline (U.S. EPA Jan 1995).

9.2.3.2.1 Environmental Impacts

The NRC provides an overview of the environmental impacts associated with natural gas-fired plants. Land use impacts from gas-fired units would be less than those of the coal-fired alternative. Reduced land requirements as a result of construction on the existing site and a smaller facility footprint would reduce impacts to ecological, aesthetic, and cultural resources. As described, an incremental increase in the workforce could have socioeconomic impacts. Human health effects associated with air emissions would be of concern, but the effect would be less than those of coal-fired generation (NUREG-1437). An evaluation of the environmental impacts related to the potentially competitive combined-cycle gas-fired plant is presented below.

Air Quality

As indicated in NUREG-1437, natural gas combustion is relatively clean compared to other fossil fuel combustion. Also, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient versus the coal-fired alternative. Therefore, the gas-fired alternative would release similar types of emissions, but generally in quantities less than the coal-fired alternative (NUREG-1437). Control technology for gas-fired turbines focuses on the reduction of nitrogen oxide emissions. The comparative gas-fired alternative would use approximately 104 billion standard cubic feet of natural gas per year and would generate these emissions:

Pollutant	Emissions
Nitrogen Oxide	584 tons per year
Sulfur Dioxides	35 tons per year
Carbon Monoxide	121 tons per year
$PM_{2.5}$[a]	101 tons per year
Carbon Dioxide	5.9 million tons per year

(a) Particulates with an aerodynamic diameter of less than 2.5 microns—all particulates are $PM_{2.5}$

These emission totals for the competitive alternative are calculated based on the parameters and assumptions identified in Table 9.2-2 and emission factors published in AP-42 (U.S. EPA Jan 1995).

As described in Subsection 9.2.3.2, the potentially competitive natural gas combined-cycle plant would also have to meet requirements of the Clean Air Act regarding both the criteria air pollutants and acid rain requirements. The emission reductions required in potentially new legislation would also apply to the competitive combined-cycle gas-fired generation plant—analogous to the CAIR. Additionally, similar to the pulverized coal-fired alternative, the combined-cycle gas-fired alternative would also need to obtain and meet New Source Review and Prevention of Significant Deterioration requirements and operational requirements in a Title V operating permit.

Similar to the pulverized coal-fired comparison plant, the combined cycle gas-fired alternative would also emit large quantities of greenhouse gases, although in much less quantities than the coal-fired alternative. As described in Subsection 9.2.3.1, Executive Orders issued by Florida's

Governor in July 2007 require a significant reduction in greenhouse gas emissions in Florida. These orders include a goal of providing 20 percent of the energy produced by electric utilities from renewable, non-emitting sources and requiring a significant reduction in greenhouse gas emissions by 2017. Therefore, approval for a new combined cycle gas-fired power plants may prove challenging in Florida (FPL Apr 2010).

Thus, the combined cycle gas-fired alternative would have MODERATE impacts on air quality. The impacts may be noticeable, but would not destabilize air quality in the area due the use of mitigation technologies and compliance with permits.

Waste Management

In NUREG-1437, an analysis of environmental impacts from waste generation from gas-fired plants concludes that the impact would be minimal. The only significant solid waste generated at a new gas-fired plant would be spent selective catalytic reduction catalyst used to control nitrogen oxide emissions, portions of which could be regenerated or recycled. Other then spent selective catalytic reduction catalyst, waste generation at an operating natural gas-fired plant would largely be limited to construction debris during construction and typical office wastes. These impacts would be so minor that they would not noticeably alter any important resource attribute.

Thus, the solid waste impacts associated with a combined cycle natural gas-fired alternative would be SMALL.

Land Use

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on land adjacent to Turkey Point would reduce construction-related impacts relative to construction on a greenfield site. NUREG-1437 estimates that the gas-fired alternative would impact approximately 110 acres of land and associated terrestrial habitat for plant requirements and approximately 3600 acres of additional land would be required for gas wells, collection stations, and pipelines. A new pipeline corridor would not need to be constructed. An existing 24-inch transmission pipeline located at Turkey Point, which serves Unit 5, is present and utilization of the existing corridor would minimize additional land use impacts. Construction impacts would be minimized through the application of best management practices that minimize soil loss and restores vegetation immediately after the excavation is backfilled.

Thus, land use impacts for construction and operation of the combined cycle gas-fired alternative would be SMALL.

Ecology

The gas-fired alternative would introduce construction impacts and new incremental operational impacts, which may alter the ecology of the surrounding environment. Ecological impacts to a plant site could include impacts on threatened or endangered species, wildlife habitat loss, reduced wildlife reproduction, habitat fragmentation, and a local reduction in biological diversity. Most of these impacts would be avoided, however, due to the disturbed nature of Turkey Point (NUREG-1437).

Thus, the ecological impacts and impacts to threatened and endangered species would be SMALL.

Water Use and Quality

Construction activities would disturb land surface, which may temporarily affect surface water quality. Potential water quality impacts would consist of suspended solids from disturbed soils, biochemical oxygen demand, nutrient loading from disturbed vegetation, and oil and grease from construction equipment. Construction would require an NPDES permit for stormwater discharges from the site. Provisions of the NPDES permit would ensure implementation of best management practices to minimize impacts to surface waters during construction. Runoff detention ponds would be designed to detain runoff within the containment areas to allow for settling and to reduce peak discharges. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills of fuel, hydraulic fluid, lubricants, paint, and other liquids. Although the spill prevention control and countermeasures plan would be primarily intended to prevent spills from reaching navigable waters, it would also mitigate impacts on local groundwater because any spills would be quickly responded to and not permitted to penetrate to groundwater. Construction would cause no appreciable consumption of surface water resources.

During operation of the gas-fired alternative, based on the EPRI estimates, cooling tower makeup water withdrawal would be approximately 8487 gpm and consumptive use through evaporation would be approximately 6642 gpm (EPRI Mar 2002). This amount of water consumption would be taken from a combination of sources, reclaimed water and radial collector wells. Reclaimed water would come from a Miami-Dade County wastewater treatment plant that could potentially supply the required makeup water for the comparison gas-fired plant along with radial collector wells that would be designed and sited to induce recharge from Biscayne Bay. The quality of the supply water from these sources would meet the regulatory requirement for use in the industry.

The Boulder Zone within the lower Floridian aquifer could be used for discharge of blowdown effluents originally sourced from either saline or fresh water. The Boulder Zone has been used since 1977 to store vast quantities of treated sewage injected into it by Miami, Fort Lauderdale, and West Palm Beach. Currently, over 90 Class I injection wells are used to dispose over 400 million gallons/day of secondary wastewater in southeast Florida. The extremely high permeability associated with its cavernous nature prevents pressure buildup in injection wells, and its high salinity makes it an ideal zone for receiving injected wastes.

An underground injection control permit would be required for disposal of effluent through an underground injection well. This permit would establish conditions for discharging to wastewater to the Boulder Zone. A spill prevention control and countermeasures plan would be implemented to minimize water quality impacts from minor spills.

Thus, water use and quality impacts would be SMALL.

Aesthetics

Aesthetic impacts would be similar to the pulverized coal-fired alternative, but smaller because of the reduced site size. The gas-fired units' steam turbine building would be approximately 100 feet high. The tallest structure would be the 150-foot-high auxiliary boilers and heat recovery steam generator stacks. These structures would not alter the visual effects of existing two nuclear units along with three oil and gas units located at Turkey Point.

Thus, the aesthetic impacts associated with the gas-fired alternative would be SMALL.

Socioeconomics

Short-term socioeconomic impacts would result from the estimated 1200 peak construction workers to build the facilities, and long-term impacts would result from the estimated 150 full-time workers to operate the gas-fired facility (NUREG-1437).

Similar to the pulverized coal-fired alternative, during construction, the communities immediately surrounding the plant site would experience demands on housing and public services that could have noticeable impacts. New construction could have a negative impact on availability and cost of housing and after construction, and the communities would be affected by the loss of jobs (NUREG-1437).

Miami-Dade County would benefit from tax payments for the new gas-fired comparison plant and, depending on how these tax payments are distributed, this could help address socioeconomic impacts.

Transportation impacts would be temporary, noticeable, and destabilizing for brief periods during plant construction and small during plant operation.

Thus, socioeconomic impacts associated with constructing and operating the gas-fired alternative would be MODERATE (adverse) to MODERATE (beneficial).

Historic and Cultural Resources

The potential impacts of new plant construction on historic and archaeological resources have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3. Cultural resource impacts would be unlikely due to the previously disturbed nature of the site and could be, if needed, minimized by survey and recovery techniques.

Thus, cultural resource impacts associated with constructing and operating the gas-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

Environmental Justice

Environmental justice impacts would depend on the nearby population distribution. Environmental justice impacts have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3.

Thus, environmental justice impacts associated with constructing and operating the gas-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

9.2.3.2.2 Human Health Effects

In NUREG-1437, the NRC identified cancer and emphysema as potential health risks from gas-fired plants. Nitrogen oxide emissions contribute to ozone formation, which in turn contributes to health risks. Ozone can irritate respiratory systems, reduce lung function, aggravate asthma, inflame and damage cells that line the lungs, and may cause permanent lung damage (U.S. EPA Sep 2008b). Nitrogen oxide emissions from any plant would be regulated by the state or EPA. Exposure to fine particulates, $PM_{2.5}$, has been associated with reduced lung function and chronic bronchitis; and, in people with heart disease, short-term exposure has been linked to heart attacks and arrhythmias (U.S. EPA Sep 2008c).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health and environmental impacts for the criteria air pollutants. These agencies also impose site-specific emission limits as needed to meet the health standards.

Thus, with the limits imposed for the regulated constituents of air emissions, human health impacts from a newly constructed gas-fired plant would be SMALL.

9.2.3.2.3 Design Alternatives

Combined-cycle plants use a combination of combustion turbine and heat recovery steam generators to generate power. Therefore, their heat rejection rates are substantially lower than comparably sized nuclear- and coal-fired steam generators. Consequently, combined-cycle plants with recirculated cooling systems generally use cooling towers rather than ponds.

9.2.3.2.4 Conclusion

The impacts of the potentially competitive combined-cycle gas-fired generation are compared to the proposed nuclear project in Table 9.2-3. As the comparison in this table demonstrates, the gas-fired alternative is not environmentally preferable to proposed nuclear project. As such, an economic cost comparison is not warranted.

9.2.3.3 Combination of Alternatives

As identified in NUREG-1555, consideration of combinations of individual alternatives available to the applicant should be analyzed with respect to environmental and health impacts for comparison with the proposed project to determine if any of the available combinations are environmentally preferable. This subsection reviews possible combinations of alternatives that could generate replacement baseload power instead of the proposed nuclear project. As previously stated, the nuclear project has a net capacity of approximately 2200 MW of electrical generation and is expected to supply baseload power to the Florida Public Service Commission region.

9.2.3.3.1 Determination of Alternatives

The selected combinations of alternatives were developed as potentially competitive alternatives to the proposed project, based on technological maturity, ability to serve regional needs, and suitability of the technology in the region of interest. As detailed in Subsection 9.2.2, individually, many of the alternatives would not be able to provide the baseload capacity required; however, a combination of these alternatives may be sufficient to provide the required baseload capacity equivalent to the proposed project.

When determining a plausible combination of alternatives, consideration was given to either a technology’s capability of supplying baseload power, or its ability to provide smaller environmental impacts. Because the proposed nuclear project would provide baseload capacity in a predictable, consistent manner, the alternative combination would need to provide the consistent baseload supply, and if coupled with a renewable energy source, environmental impacts may be reduced. Therefore, when determining a combination of alternative sources that includes a variable renewable source of energy, the alternative must be combined with an alternative capable of supplying baseload capacity, a fossil fuel-fired source. This allows the fossil fuel-fired portion to provide the entire load during times when the output of the renewable source of energy is reduced or unavailable. When available, the output of the renewable source may displace a portion of the baseload supply, and the output of the fossil fuel-fired portion can be reduced to accommodate the increase in renewable generation.

Of the renewable energy alternatives evaluated, only wind and solar are viable technologies in the region of interest. The remaining technologies were eliminated from further consideration because they were either not viable in the region of interest, the technology was not mature, and/or the environmental impacts would not be preferable to the proposed project. The two remaining renewable energy technologies, evaluated in Subsection 9.2.2, wind energy (Subsection 9.2.2.2) and solar energy (Subsection 9.2.2.3), individually were not considered potentially competitive alternatives as stand-alone technologies primarily because of each alternative's lack of ability to provide the required baseload capacity because of their intermittent capacity. However, as noted in the evaluation provided in Subsection 9.2.2, each technology is viable in the region of interest. In fact, FPL plans to pursue both wind and solar projects in the FPL service area. Therefore, for this portion of this analysis, wind and solar are considered as renewable power sources that can supplement a baseload capable source.

Of the fossil fuel alternatives evaluated, only coal (Subsection 9.2.2.9) and natural gas (Subsection 9.2.2.10) were technologically viable and could provide the required baseload capacity and, thus, were deemed potentially competitive alternatives. However, as the evaluations presented in Subsections 9.2.3.1 and 9.2.3.2 indicate, the coal and natural gas alternatives did not produce smaller environmental impact levels in comparison with the proposed project. Of the two technologies, natural gas has a smaller environmental impact. For this reason, in the environmental comparison portion of this combination alternative study, natural gas is used as the fossil fuel for baseload capacity.

Thus, this analysis examines the reduction in environmental impacts from a combined-cycle natural gas-fired facility when generation from the facility is displaced by a renewable resource—either wind or solar. The impacts of natural gas considered are those shown in Subsection 9.2.3.2. Also, the renewable part of the alternative combination is any combination of renewable technologies that could produce power equal to or less than the proposed nuclear project, when that resource is available.

9.2.3.3.2 Environmental Impacts

The overall environmental impacts associated with the construction and operation of the combined-cycle gas-fired alternative is addressed in Subsection 9.2.3.2 and summarized in Table 9.2-3. Depending on the amount of renewable output included in the combination alternative, the level of environmental impacts of the combined-cycle gas-fired alternative portion would be comparatively lower. If 100 percent of the power level of the proposed project was not available from the renewable alternative, some level of environmental impact associated with the combined-cycle gas-fired alternative remains. Alternatively, when 100 percent of the load is carried by the renewable portion, the environmental impact of the operation of the combined-cycle gas-fired alternative is eliminated.

A determination of the environmental impacts that a combination of these alternatives would have can be made from the previous evaluations provided in Subsections 9.2.2 and 9.2.3.2. The environmental impacts associated with a combined-cycle gas-fired facility and equivalent renewable wind and solar facilities are summarized in Table 9.2-3. Individually, the combined-cycle gas-fired facility has impacts that are greater than the proposed project. Some of the environmental impacts of the renewable energy sources are equal to or greater than those of the proposed nuclear project. Therefore, the combination of a gas-fired plant and wind or solar facilities would have environmental impacts that are equal to or greater than those of a nuclear facility.

Impacts from wind and solar facilities are described in Subsections 9.2.2.2 and 9.2.2.3, respectively. Land use impacts from wind and/or solar facilities could be SMALL to LARGE, and the aesthetic impacts of wind could be SMALL to LARGE, depending on the size of the facilities. Similarly, impacts of wind/solar facilities on ecological resources and threatened and endangered species could be SMALL to MODERATE, depending on facility sizes and locations. The environmental impacts from the operation of wind and/or solar facilities in combination with a combined-cycle gas-fired facility would be SMALL, except for land use and aesthetic impacts from wind and solar facilities which would range from SMALL to LARGE, the ecological resource and threatened and endangered species impacts from wind and solar facilities which would range from SMALL to MODERATE, and the air quality impacts from the combined cycle gas-fired facility which would be MODERATE. In comparison, the environmental impacts of a new nuclear plant for the proposed nuclear project would be SMALL except for ecological resources (SMALL to MODERATE). Therefore, a combination of alternatives would not be environmentally preferable to the proposed nuclear project and are not evaluated further.

9.2.3.3.3 Summary

Although other combinations of the various alternatives are not presented, the lower capacity factors, greater potential environmental impacts, and immature technologies would not provide a viable, potentially competitive alternative that is either environmentally equivalent or preferable. Wind and solar generation in combination with a combined-cycle natural gas-fired facility could be used to generate baseload power and would serve the equivalent purpose of the proposed project. However, wind and solar generation in combination with a combined-cycle natural gas-fired alternative would have equivalent or greater environmental impacts when compared to a new nuclear units at Turkey Point. Therefore, wind and solar generation in combination with a natural gas-fired alternative is not competitive with the proposed project.

9.2.4 CONCLUSION

Based on the environmental impacts evaluated, neither a pulverized coal-fired nor a combined-cycle natural gas-fired alternative would result in fewer environmental impacts than the proposed nuclear project. In fact, both types of plants would result in substantially greater environmental impacts on air quality relative to the proposed nuclear project. This conclusion is shown in detail in Table 9.2-3. In addition, a combination of the combined-cycle natural gas-fired alternative with a renewable source of energy—wind or solar—could achieve a smaller impact on the air quality but only with an accompanying moderate to large impact on land use. Therefore, the pulverized coal-fired alternative, combined-cycle natural gas-fired alternative, and combination of alternatives would not be environmentally preferable to the proposed nuclear project.

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Table 9.2-1
Coal-Fired Alternative

Attribute	Basis
Unit size = 728.4 MWe net	Will provide equivalent comparison to the AP1000 units at Turkey Point
Number of units = 3	Provides equivalent comparison to two AP1000 units at Turkey Point
Boiler type = PC, dry bottom, tangentially fired, bituminous	Minimizes nitrogen oxide emissions (U.S. EPA Jan 1995)
Capacity factor = 0.85	Typical for large coal-fired units (U.S. DOE Dec 1998)
Heat rate = 8,568 Btu/kWh	Assumed based on DOE data (U.S. DOE Dec 1998)
Fuel type = Bituminous coal	Typical coal used by Florida electric utilities in 2005 and 2006 (EIA Oct 2007) and (USGS 1996)
Fuel heat value = 12,185 Btu/lb	Average heat value of coal used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Fuel ash content by weight = 8.94%	Average percent ash content of coal by weight used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Fuel sulfur content by weight = 1.38%	Average sulfur content of coal used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Uncontrolled nitrogen oxide emission factor = 9.7 lb/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, with low nitrogen oxide burner (U.S. EPA Jan 1995)
Nitrogen oxide control = low nitrogen oxide burners, overfire air and selective catalytic reduction (95% reduction)	Best available and widely demonstrated to minimize nitrogen oxide emissions (U.S. EPA Jan 1995)
Uncontrolled sulfur oxide emission factor = 38S, where S= the weight percent sulfur content of coal; therefore, the emission factor for the comparison plant = 52.44 lbs/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, with low nitrogen oxide burner (U.S. EPA Jan 1995)
Sulfur oxide control = post combustion flue gas desulfurization wet scrubber system - limestone (95% removal efficiency)	Best available for minimizing sulfur oxide emissions (U.S. EPA Jan 1995)
Uncontrolled PM filterable (PM_{10}) emission factor = 2.3A, where A is the percent ash content of the coal; therefore, the emission factor for the comparison plant = 20.56 lbs/ton	AP-42 uncontrolled emission factor for PM_{10} (U.S. EPA Jan 1995)
Uncontrolled $PM_{2.5}$ emission factor = 0.6A, where A is the percent ash content of the coal; therefore, the emission factor for the comparison plant = 5.36 lbs/ton	AP-42 uncontrolled emission factor for $PM_{2.5}$ (U.S. EPA Jan 1995)
PM control = fabric filters (baghouse-99.9% removal efficiency)	Best available for minimizing particulate emissions (U.S. EPA Jan 1995)
Uncontrolled carbon monoxide emission factor = 0.5 lb/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, (U.S. EPA Jan 1995)
Mercury (Hg) emission factor = 8.3E-05 lbs/ton	AP-42 emission factor for controlled coal combustion—wet limestone scrubber with a fabric filter (U.S. EPA Jan 1995)
Uncontrolled carbon dioxide emission factor = 204.33 lbs/MMBtu	DOE emission factor based upon typical coal used by Florida electric utilities in 2005 and 2006 (EIA Aug 1994) and (EIA Oct 2007)

Btu = British thermal unit
kWh = kilowatt hour
MWe = megawatt electrical output
MM= million
PM= Particulate Matter
$PM_{2.5}$ = particulates with a diameter of 2.5 microns or less

Table 9.2-2
Gas-Fired Alternative

Attribute	Basis
Unit size = 728.4 MWe net	Will provide equivalent comparison to the AP1000 units at Turkey Point
Number of units = 3	Provides equivalent comparison to two AP1000 units at Turkey Point
Comparison Plant Type = combined cycle natural gas	Assumed
Capacity factor = 0.8	Assumed based on performance of modern plants (Baxter Sep 2004)
Heat rate = 7,000 Btu/kWh	Assumed based on comparison data for new gas-fired combined cycle developed for Interstate Natural Gas Association of America (INGAA 2000)
Fuel heat value = 1,028 Btu/cubic feet	Approximate heat value of natural gas for the years 2005–2008 as listed by the Energy Information Administration (EIA Jul 2008c)
Fuel Sulfur content = 0.0007%	Sulfur content of natural gas in pipelines (INGAA 2000)
Nitrogen oxide control = selective catalytic reduction with steam/ water injection	Best available to minimize nitrogen oxide emissions (U.S. EPA Jan 1995)
Nitrogen oxide emission factor = 0.0109 lb/MMBtu	AP-42 emission factor for selective catalytic reduction -controlled gas fired units with water injection (U.S. EPA Jan 1995)
Uncontrolled sulfur dioxide emission factor = 0.94S, where S= the weight percent sulfur content of coal; therefore, the emission factor for the comparison plant = 0.000658 lbs/MMBtu	AP-42 emission factor for natural gas fired turbines (U.S. EPA Jan 1995)
Carbon monoxide emission factor = 0.00226 lb/MMBtu	AP-42 emission factor for selective catalytic reduction -controlled gas fired units (U.S. EPA Jan 1995)
Uncontrolled $PM_{2.5}$ emission factor[a] = 0.0019 lb/MMBtu	AP-42 emission factor for stationary gas turbines using water-steam injection

(a) All particulate matter is $PM_{2.5}$

Btu = British thermal unit
kWh = kilowatt hour
MWe = megawatt electrical output
MM= million
PM= Particulate Matter
$PM_{2.5}$ = particulates with a diameter of 2.5 microns or less

Table 9.2-3
Impacts Comparison Summary

Impact Category	Proposed Project (Turkey Point COL)	Coal-Fired Generation	Gas-Fired Generation	Combinations of Alternatives
Land Use	SMALL	MODERATE	SMALL	SMALL to LARGE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL[(a)]	SMALL[(a)]	SMALL[(b)]	SMALL
Waste Management	SMALL	MODERATE	SMALL	SMALL
Aesthetics	SMALL	SMALL	SMALL	SMALL to LARGE
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL	SMALL

(a) SMALL (adverse) to LARGE (beneficial).
(b) SMALL (adverse) to MODERATE (beneficial).
Note: To allow for a valid comparison, only adverse impacts are listed in the table.

9.3 SITE SELECTION PROCESS

As required by 10 CFR 51.45(b)(3), this section provides an analysis of alternative sites for the proposed Turkey Point site for the construction and operation of two nuclear power reactors (the proposed project). The National Environmental Policy Act (NEPA) mandates that reasonable alternatives to a proposed action be evaluated. Consistent with this requirement, the site selection process is focused on other sites that could be considered to be a reasonable alternative to the proposed project. The objective of this evaluation is to verify there is no “obviously superior site” for the eventual construction and operation of the proposed project.

The traditional way to review alternative sites has changed because existing nuclear sites with the ability to support additional units can be included in the mix of alternatives. Existing sites offer decades of environmental and operational information about the impacts of operating a nuclear plant at the proposed site on the environment. Because these sites already support licensed nuclear facilities, the NRC has found them to be acceptable. In the excerpt below from NUREG-1555, the NRC recognizes that the proposed site could be selected as a special case given its location at an existing plant site and not necessarily as a result of a systematic review:

> Recognize that there will be special cases in which the proposed site was not selected on the basis of a systematic site-selection process. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a state government from a list of state-approved power-plant sites.
>
> As a corollary, all nuclear power plants sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant’s proposed site.

The review process outlined in this section is consistent with the special case postulation recognized in NUREG-1555 and considers the advantages already present at existing nuclear facilities within the relevant service area that have been previously reviewed by the NRC and found to be suitable for construction and operation of a nuclear power plant. Potential sites that already have a commercial nuclear power plant offer obvious benefits that other power plant sites or greenfield sites may not offer:

<u>Environmental Advantages of Existing Nuclear Power Plant Sites</u>

- The environmental conditions and the environmental impacts of a commercial nuclear station are known from monitored data (air, water, ecology, etc.) collected over years of nuclear plant operation. Based on the knowledge of the reactors and ancillary facilities considered, it is reasonable to assume that the impacts of additional units would be similar to those of the nuclear units already present at the site.

- Construction of new transmission corridors may potentially be avoided if the existing transmission system (lines and corridors) can accommodate the increased power generation. This benefit could substantially reduce environmental impacts associated with construction of the new plant.
- No additional land acquisitions would be necessary if a new transmission corridor can be avoided, and the land use impacts of the new plant would be small.
- Existing nuclear power plant sites have already been subject to the alternative review process mandated by the NEPA.
- Existing nuclear power plant sites have had extensive environmental studies performed for the original site selection process. These studies can be updated and used for new units.

Constructability and Cost Benefits

- Site physical criteria (e.g., geologic/seismic suitability) have been previously characterized at existing nuclear plant sites.
- The cost of additional land acquisitions may be avoided if existing transmission corridors to the power plant are adequate and if the site can accommodate the land requirements of the new units.
- Plant construction, operation, and maintenance costs could be reduced because existing site infrastructure (e.g., roads, transmission lines, water source, intake and discharge systems) can potentially serve the new nuclear power units.

Other Benefits

- Existing commercial nuclear power plant sites have nearby power markets.
- In many cases, existing commercial nuclear power plants have previously gained local community acceptance and support.
- Existing commercial nuclear power plant sites have personnel with relevant nuclear operating experience.

9.3.1 REGION OF INTEREST

For the purpose of alternative site analysis, NUREG-1555 defines the region of interest as the geographic area considered in the search for potential and candidate sites, and the relevant service area is defined as the region to be served by the proposed project (NUREG-1555). For this COL Application, the region of interest is the area within (or very close to) the FPL service territory. The FPL service territory is shown in Figure 9.3-1.

The FPL service territory spans from the southern tip of Florida to the northern boundary and is concentrated mainly along the eastern coast. The general topography of the territory is relatively flat, and land classifications include residential, industrial, and agricultural. Florida has abundant surface water resources that include the ocean, lakes, rivers, and canals, as well as abundant groundwater resources. Florida does not have significant seismic activity; however, karst formations and sinkholes are common in parts of Florida.

The FPL service territory covers an area of 27,650 square miles over 35 counties with power delivered over 6727 circuit-miles of bulk transmission lines. Integration of the generation, transmission, and distribution system is achieved through 580 FPL-owned substations in Florida (FPL, Oct 2007a, FPL Apr 2009). Within the FPL service territory, the 21,943 MWe of peak summer demand incurred in year 2007 represented about 98.5 percent of the all-time peak demand of 22,276 MWe from year 2005 (FPL Oct 2007b). Power generated by the proposed project would be used within the FPL service territory, with particular emphasis on the load centers for the greater Miami area (Palm Beach, Broward, and Miami-Dade Counties. Figures 9.3-2 through 9.3-4 show the load centers, population centers, and transmission system within the FPL service territory. The need for power is described in Chapter 8 of this environmental report (ER).

9.3.2 OVERVIEW OF SITE SELECTION PROCESS

FPL commissioned a team of industry and environmental experts to initiate a site selection study to identify and evaluate possible sites for construction and operation of two new nuclear power units. The overall objective of the site selection study was to identify a nuclear power plant site that:

- Satisfies FPL business objectives for the proposed project
- Satisfies applicable NRC site suitability requirements
- Is compliant with NEPA requirements

Site selection was conducted consistent with the process outlined in the EPRI Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application, dated March 2002

(EPRI 2002), and in accordance with site suitability guidance outlined in NUREG-1555. The site selection process included three steps:

- Identify potential sites within the region of interest via two parallel processes
- Screen the potential sites to identify alternative sites
- Select the proposed site from the alternative sites

Evaluations performed to select and screen potential sites were based on publicly available data sources.

9.3.2.1 Alternative Site Selection Process

Step 1: Identify and Screen Potential Sites

FPL has provided power and electrical transmission in the State of Florida for 79 years. Over that time, FPL has grown to become the largest electric utility in the State of Florida and serves a population of nearly 9 million (more than 40% of the Florida population). The FPL service territory now spans from the southern tip of Florida in Monroe County to the northeastern tip in Nassau County and includes 12 power generation plants in 10 counties. Given the size and breadth of its power supply responsibility and the continuous increase in power demand throughout Florida, FPL has conducted multiple studies through the years to identify potential sites for new power generation plants. Through these efforts, FPL professionals have become intimately familiar with their service territory and have developed extensive expertise with regard to potentially viable power plant sites, transmission routes, water resources, and other relevant factors.

In the early stages of the proposed project, FPL assembled a team of professionals and subject matter experts to identify potential sites for the proposed nuclear power units. The team included experts in a wide range of relevant disciplines (e.g., environmental specialists; environmental scientists; civil, electrical, mechanical, and nuclear engineers; corporate real estate; public relations; regulatory affairs; and external affairs). Each team member represented their organization in the subsequent site selection process, which collectively provided access to the full knowledge and capability of the Company with respect to the FPL service territory and nearby regions. This team was further supported by external consultants and resources as needed to answer specific questions. The site selection process was facilitated by a team of consultants who specialize in site selection of nuclear facilities, and these consultants provided significant experience and guidance with respect to the execution of the analyses.

The goal established by the FPL site selection team was to identify a comprehensive set of known potential sites believed to represent all reasonable site alternatives available within the region of interest (ROI). This set would serve as the basis to evaluate potential locations for the proposed project.

The proposed project is based on a specific need for power for FPL customers within the FPL service territory, and this need for power was confirmed by Florida Public Service Commission in the Need Order provided in April 2008. The Need Order confirms that FPL has a need for all of the output for the project. FPL does not require a partner to utilize, finance, design, construct, or operate the facility. Therefore, FPL did not include non-FPL-owned power plant sites outside its own service territory.

To be conservatively inclusive, the FPL site selection team included the 12 existing FPL power generation plants as potential sites to be considered in the site selection process. In addition, the FPL team canvassed the FPL service territory (and nearby areas), and based on their collective professional knowledge and experience, identified 11 other potential sites for the proposed project. These eleven sites, plus the 12 FPL power plant sites, yielded an initial list of 23 potential sites.

In parallel with these efforts, FPL hired a consultant to conduct an independent evaluation to canvass the region to ensure that no reasonable candidate regions were overlooked. The independent consultant applied a GIS-based map system and search mechanism based on a series of criteria-based searches of a GIS database. The searches were based on various exclusion criteria such as distance to water sources, airports, highways, railroads; presence of regional population and population centers (i.e. census blocks with a population density greater than 300 people per square mile), proximity of water use caution areas; and proximity of dedicated land uses (State or Federal Parks, Bureau of Land Management, Bureau of Indian Affairs, Department of Defense, Fish and Wildlife Service, Military Facilities, and National Forests).

The results of the searches yielded a graphical representation that distinguished potentially suitable regional areas from areas that are less suitable or unsuitable. The potentially more suitable areas on the composite map (i.e., those not eliminated by the exclusionary criteria) were then further reviewed to: verify that adequate land area is present; provide a reasonable diversity in potential sites; and verify that potential sites would likely satisfy FPL business objectives.

These independently identified site areas were compared to the list of 23 sites identified by the FPL site selection team to determine if any additional sites should be included in the site selection evaluations. Based on this comparison, the 23 sites chosen by the FPL site selection team were judged to provide a comprehensive set of sites to represent all potential site regions. FPL thus confirmed that its initial selection process was complete and no further sites warranted review.

The initial list of 23 sites included both FPL-owned and non-FPL-owned sites, some with operational power plants and some that were greenfields, and some located just outside the FPL service territory. None of the 23 identified sites were federally owned sites. The list of 23 potential sites, as identified by the site selection process, is shown in Table 9.3-1. The general location of the 23 potential sites is illustrated in Figure 9.3-1.

Step 2: Identification of Alternative Sites

In a graded approach, a series of site evaluation criteria were applied to narrow the search from 23 potential sites to 15 potential sites, then to 8 potential sites, and finally to 5 candidate sites (four alternative sites and a proposed site).

In the initial round of evaluation, the four feasibility factors (evaluation criteria) listed below were qualitatively applied to the 23 potential sites based on the collective experience and judgment of the FPL site selection team as supported by their respective business units.

- Criterion A: The site has sufficient land to construct a new nuclear plant

  This criterion was whether there is sufficient land available at the site to accommodate the footprint of two nuclear power units and the requisite security perimeters (i.e. 2500–3000 acres).

- Criterion B: Sufficient land can be obtained to construct a new nuclear plant

  This criterion was applied so that a site without adequate land could be retained in the analysis if conterminous land could reasonably be made available through acquisition. The ability to obtain land was based on the type of land (i.e. residential, commercial, industrial, and government), regional land use, and the number of owners for the land parcels under consideration. If some or all of the target properties were under institutional or government ownership in a specific use (i.e., environmental protection), it was assumed that the property would be more difficult to acquire. Likewise, if the properties were owned by a large number of individuals, or if the properties were occupied by successful commercial or industrial developments, then property acquisition was judged to be more difficult.

- Criterion C: Transmission feasibility

  FPL transmission experts assessed the length and complexity of transmission interconnection and additional integration improvements presented by the injection of new capacity at various grid locations. In general, sites closer to the target load center (the region including Broward and Miami-Dade Counties) were recognized to present fewer challenges and were judged likely to be more feasible. Sites that were connected to or near high voltage transmission corridors that could accommodate or be expanded to accommodate new lines were judged to be more feasible. Sites located in heavily developed areas were assumed to present additional challenges and were judged to be less feasible.

- Criterion D: Number and regulatory acceptability of available water sources

  The collective knowledge of the FPL site selection team was applied to identify the various sources of water (groundwater, surface water, reclaimed, ocean) available at each site. A site with more options was preferred over a site with fewer options. In certain cases, the potential to deliver water from regional sources to the site was considered. Water sources within a 50-mile radius of the site were considered.

Based on a qualitative assessment of these four feasibility factors, seven FPL-owned power plant sites (Canaveral, Cutler, Lauderdale, Port Everglades, Putnam, Riviera, and Sanford) and one FPL-owned greenfield site (Andytown) were eliminated. The basis for elimination of each of these sites is described below. Criterion D, inadequate water resources, was not an elimination factor for any of the eight eliminated sites.

Canaveral

The Canaveral site scored poorly with respect to qualitative Criteria A, B, and C. This site is located about 165 miles from the target load center, and current transmission infrastructure to the Canaveral site is inadequate to support connection for the proposed units. Because of the large distance to the target load center, substantial transmission improvements would be necessary to facilitate connection to the grid. Acquisition of transmission right-of-way would pose a significant project risk, and development of new transmission infrastructure to the Canaveral site would be costly. Transmission would potentially have to be coordinated with another utility, which also poses additional project risk.

The Canaveral site is located within a narrow strip of land between Highway A1A and the Atlantic Ocean. This land strip offers insufficient area to support the proposed nuclear units and requisite security perimeter. In addition, acquisition of conterminous lands would be prohibitively costly and would not be feasible within the time frame necessary to support the proposed project.

Cutler

The Cutler site scored poorly with respect to qualitative Criteria A, B, and C. Although the Cutler site is within the target load center, transmission infrastructure to the Cutler site is inadequate to support connection for the proposed power units, and thus substantial upgrades and new transmission infrastructure would be required to support connection to the grid. Because the land area of the Cutler site is less than 70 acres; and the Cutler Power Plant occupies a large portion of the site, there is little land available onsite to support new construction. In addition, the Cutler site is surrounded by residential real estate, thus acquisition of coterminous land for power plant infrastructure or transmission right-of-way would require condemnation and the purchase of residential real estate—actions that would be potentially difficult to implement.

Lauderdale

The Lauderdale site scored poorly with respect to qualitative Criteria A and B. Because the FPL-owned land area of the Lauderdale site is 210 acres, and the Lauderdale Power Plant occupies 130 acres, there is little land available onsite to support new construction. In addition, the Lauderdale site is nestled within a heavily developed industrial and commercial area of urban Fort Lauderdale. Acquisition of additional land for the proposed project would require condemnation and the purchase of developed commercial and industrial real estate—actions that would be potentially difficult to implement.

Port Everglades

The Port Everglades site scored poorly with respect to qualitative Criteria A and B. Because the land area of the Port Everglades site is small, and the Port Everglades Power Plant occupies most of the site, there is little land available onsite to support new construction. In addition, the Port Everglades site is nestled within a heavily developed industrial and commercial area of urban Fort Lauderdale. Acquisition of additional land for the proposed project would require condemnation and the purchase of developed industrial and commercial real estate—actions that would be potentially difficult to implement.

Putnam

The Putnam site scored poorly with respect to qualitative Criterion C. This site is located in the northeastern region of the FPL Service Territory, more than 250 miles from the target load center. Current transmission infrastructure to the Putnam site is inadequate to support connection for the proposed units. Because of the large distance to the target load center, substantial transmission improvements would be necessary to facilitate connection to the grid. Acquisition of transmission right-of-way would pose a significant level of project risk, and development of new transmission infrastructure to the Putnam site would be costly. Transmission would potentially have to be coordinated with another utility, which also poses additional project risk.

Riviera

The Riviera site scored poorly with respect to qualitative Criteria A and B. This site is located on the western bank of the Lake Worth inlet and within a heavily developed residential and industrial area of downtown Riviera Beach. Because the land area of the Riviera site is small, and the Riviera Power Plant occupies most of the site, there is little land available onsite to support new construction. In addition, acquisition of additional land for the proposed project would require condemnation and the purchase of developed residential and industrial real estate—actions that would be potentially difficult to implement.

Sanford

The Sanford site scored poorly with respect to qualitative Criteria A, B, and C. This site is located nearly 200 miles from the target load center. Current transmission infrastructure to the Sanford site is inadequate to support connection for the proposed units. Because of the large distance to the target load center, substantial transmission improvements would be necessary to facilitate connection to the grid. Acquisition of transmission right-of-way would pose a significant level of project risk, and development of new transmission infrastructure to the Sanford site would be costly. Transmission would potentially have to be coordinated with another utility, which also poses additional project risk.

The Sanford site is located just north of the greater metropolitan Orlando area near the town of DeBary. The site is bounded on the east by Highway 17, to the south and west by the St. Johns River, and to the north by Konomac Lake. A 250-home residential development (Leisure World Subdivision) is located about 3500 feet northwest of the power plant.

The available land area at the Sanford Plant is insufficient to support construction and operation of the proposed nuclear units. The combined area of conterminous properties lands—bounded by the St. Johns River to the south and west, Konomac Lake to the north, the town of DeBary to the northwest, and Lake Monroe to the east—are also insufficient for the proposed project.

Andytown

The Andytown site scored poorly with respect to qualitative Criteria A and B. This site is located in west Broward County and is the location of the Andytown Substation. The Andytown site is small and offers very little land to support new construction. The Andytown site is located along Highway 27 on the western outskirts of metropolitan Fort Lauderdale. Acquisition of the additional land needed to support the proposed project was judged to be difficult.

The 15 potential sites not eliminated in the qualitative assessment were screened to a set of eight potential sites based on a set of nine, quantitative, screen-level criteria. These nine criteria, described in Table 9.3-2, were developed based on the EPRI Siting Guide and in accordance with NUREG-1555. Each criterion was assigned an integer score from 1 to 5; each score was numerically weighted based on relative importance; and overall composite scores were developed for each potential site. Table 9.3-3 illustrates the overall comparative scores assigned for each criterion. The composite scores for the top 15 potential sites are graphically illustrated in Figure 9.3-5. Based on their composite scores, and on the collective expertise of the FPL site selection team, four sites (Charlotte, Fort Myers, Highlands, and West County) were determined to be less suitable than the other 11 sites and were eliminated from further consideration as described below:

- The Charlotte site is a 5000-acre, FPL-owned greenfield site located in Charlotte County. As shown in Table 9.3-3, the Charlotte site rated poorly for the top two criteria: water supply and transmission access. Potential water sources include 209 cfs from the Peace River and 11 cfs from reclaimed water. Groundwater availability is minimal. Only one regional water source is sufficient to provide the required flow, and the combined water sources offer less than 3 times the required flow. In addition, the Charlotte site is located in the Southern Water Use Caution Area (SWUCA), as identified by the South West Florida Water Management District. The SWUCA has significant restrictions on ground and surface water resources in the subject area. Construction of a seawater pipeline was considered; however, a pipeline would have to span at least 45 miles and would cross several jurisdictions.

  In addition, the Charlotte site is located about 100 miles from the target load center. To facilitate connection to the grid, an estimated 140 miles of right-of-way acquisition would be required, which would be difficult to obtain. Acquisition of such a large quantity of transmission access would pose a significant level of project risk, and development of new transmission infrastructure to the Charlotte site would be very costly. For these reasons, the Charlotte site would pose considerable risk, resource challenges, and regulatory challenges for the proposed project.

  The Charlotte site also ranked poorly in terms of wetlands and ecology. Within the 5000 acre area that encloses the Charlotte site, more than 2000 acres are wetlands. In addition, 20 threatened, endangered, or rare species are identified at this site. Other disadvantages of the Charlotte site include the distance to the nearest railroads (18 and 23 miles, respectively) and unfavorable flood potential.

- The Fort Myers site is a 460-acre, FPL-owned and operated, gas-fired power plant site located along the Caloosahatchee River in Lee County about 18 miles inland from the Atlantic Ocean. As shown in Table 9.3-3, for the most important criterion, water supply, the Fort Myers site received a neutral score. Two independent water sources, the Atlantic Ocean and Caloosahatchee River, are adequate to satisfy the water requirement for the proposed project; however, the distance to the ocean, the current demand for non-ocean water resources in the area, and challenges associated with acquisition of water rights from the Caloosahatchee River contributed to the neutral score with respect to water supply. The Fort Myers site ranked poorly with respect to the second-most important criteria, transmission access. The site is located about 100 miles from the target load center and would require an estimated 95 miles of right-of-way acquisition which would likely be costly and difficult to obtain, particularly in the well-developed region near the site. Therefore, water resources and transmission access would pose considerable risk, resource challenges, and regulatory challenges for the proposed project.

The Fort Myers site ranked very poorly with respect to the population criteria. This site is located in a largely populated county, and also in a densely populated area. Lee County had a 2000 population of 440,888 with a density of 548.6 people per square mile. Within Lee County there are three cities within 12 miles of the site with populations over 30,000, and one city (Cape Coral) with a population of more than 100,000 located just 11 miles from the site.

The Fort Myers site also ranked poorly with respect to the hazardous land use criteria. The Fort Myers power plant is operated by natural gas that is fed to the site through a major pipeline. In addition, there are six airports in the region, one regional and five smaller airfields.

Other criteria for which the Fort Myers site ranked poorly include transmission access, ecology, wetlands, and flood potential. Within the 5000 acre area that encloses the Fort Myers site, more than 800 acres are wetlands. In addition, 20 threatened, endangered, or rare species are identified at this site.

- The Highlands site is a non-FPL owned greenfield site located just outside the FPL service territory in Highlands County. As shown in Table 9.3-3, the Highlands site rated poorly for the top two criteria: water supply and transmission access. Potential water sources include the Kissimmee River, located 10 miles away, and reclaimed water from Highlands County. The combined water supply from these sources would not be sufficient to satisfy the water requirement for the proposed nuclear units. Groundwater sources are minimal, and ocean water is too far away to be considered a viable water source for the Highlands site.

  The Highlands site is located 125 miles from the target load center and would require an estimated 165 miles of new right-of-way acquisition for power transmission which would likely be costly and difficult to obtain. Therefore, water resources and transmission access would pose considerable risk, resource challenges, and regulatory challenges for the proposed project.

  The Highlands site also rated poorly with respect to hazardous land use, ecological risk, and wetlands. The site includes 37 species of threatened or endangered wildlife and three unique habitat areas that contain numerous protected species found at the site. In addition, there are an estimated 547 acres of wetlands on the site.

- The West County site is owned by FPL and is located in Palm Beach County. This site was a greenfield site as of the Autumn of 2006; however, since that time, FPL has begun construction of a new power plant (two 1250 MWe gas-fired combined cycle units) at this site, with a third 1250 MWe gas-fired combined cycle unit scheduled to begin construction in 2009.

The West County site is now known as the West County Energy Center. Although adequate water sources were identified for this site, these sources were determined to pose substantial risk and regulatory challenge, so the site received an overall neutral score for water supply.

Because the West County site is located in a densely populated area, it rated poorly with respect to transmission access and population. An estimated 50 miles of new transmission right-of-way would be necessary to facilitate connection to the grid. Acquisition of transmission access would likely be difficult to acquire due to substantial development in the region. In addition, Palm Beach County fared poorly with respect to population criteria. Palm Beach County had a population of 1,131,184 in year 2000 and a density of 511 people per square mile. West Palm Beach, which had a population of 82,103, is 18 miles away.

The West County site also rated poorly with respect to wetlands, ecological risk, rail access, and flood potential. There are 30 threatened, endangered, or rare species identified at this site, and more than 1900 acres of wetlands within the 5000 acre circular area that encloses the site.

As described below, three other sites were also eliminated at this stage of the evaluation. Although the decision to retain or eliminate a site was mainly based on the overall quantitative scores, the FPL site selection committee also considered other factors at this stage, based on their collective expertise and experience with regard to regulatory challenges and familiarity with public sentiment for prior FPL plans and initiatives in the region. These other factors were considered for all sites evaluated, but are only discussed where they have a material influence on the decision to retain or eliminate a site. The rationale to eliminate three additional sites is described below.

- Two potential greenfield sites were identified in Okeechobee County. These sites are less than 15 miles apart, both are located on farm and agricultural land in rural areas, and both would require purchase by FPL. Both sites offer groundwater (155 cubic feet per second) and surface water from Lake Okeechobee (at least 360 cubic feet per second); however, Lake Okeechobee is two miles closer to the Okeechobee 2 site. The reduced pipeline length (two miles), although fairly small with respect to construction, would pose a considerable operational improvement over the 40 year life of the plant.

  In addition, the Okeechobee 2 site offers 475 cubic feet per second from the Kissimmee River, located only two miles away. Because the Okeechobee 2 site includes two water sources sufficient to satisfy the project demand, and because these water sources are closer to the site, the Okeechobee 2 site was judged to offer superior flexibility (with respect to water resources) and lower risk. Given the overall equality of these sites, the most important evaluation criterion—water resources—was applied as the determinant factor to choose between these sites. Therefore, although the overall evaluation score for the Okeechobee 1 site was slightly higher, the choice went in favor of the Okeechobee 2 site.

- Two potential greenfield sites were identified in Hendry County. These sites are less than 20 miles apart, both are located on farm and agricultural land in rural areas, and both would require purchase by FPL. The site evaluation scores for water resources, transmission access, and land acquisition were identical between the two, and the overall evaluation scores for these sites were effectively identical. Because these sites are very similar overall, both are representative of the geographical region, and both were comparably rated, to further narrow the list of potential sites, the Hendry 2 site was deferred in favor of the Hendry 1 site, on the basis of water resources. Although both sites offer the same water sources, the Hendry 1 site is located 13 miles closer to the principal water source (Lake Okeechobee) and would therefore encounter lower risk, lower cost, improved operational performance, and fewer regulatory difficulties than the Hendry 2 site.

- The Manatee site hosts a three-unit, FPL-owned power generation plant in Manatee County. Although this site ranked well for many of the evaluation criteria, it received a neutral score with regard to water supply, because there is only one water source within 15 miles with sufficient capacity to satisfy the water demand, and development of this source would pose a considerable regulatory challenge.

  The Manatee site also ranked poorly with regard to both transmission access and population. This site would require an estimated 250 miles of new right-of-way, and acquisition would be difficult and would impose substantial project risk. Based on the 2000 census, the population density of Manatee County was 363 persons per square mile, and there are several population centers within 20 miles of the site. In addition, based on previous FPL development activities in the vicinity of the site, the proposed project would likely receive considerable opposition. Therefore, even though the Manatee site received a competitive overall score, based on FPL experience in this area, known regulatory challenges, and likely opposition, the Manatee site was eliminated from further consideration.

Although the previous discussion has focused on reasons why sites were eliminated, the St. Lucie and Turkey Point sites were both retained because each of these sites currently hosts a two-unit operational nuclear power plant. Inclusion of these sites allows a detailed evaluation of the advantages of an existing nuclear power plant site such as public acceptance, previously developed plant infrastructure, and well-known site characteristics. These sites are retained for further analysis as falling within the special case (described above) for licensed nuclear power plant sites.

To narrow the eight potential sites even further, a more extensive set of 34 evaluation criteria were applied, weighted based on relative importance. The list of criteria is shown in Table 9.3-4, and the relative importance of these criteria is illustrated in Table 9.3-5.

Each of the nine evaluation criteria considered earlier in the site selection process are also addressed by the 34 evaluation criteria, but in greater detail. However, the set of 34 criteria also include: metrics not considered in the previous evaluation round, such as radionuclide pathway and accident-related factors; dewatering, thermal discharge, and entrainment/impingement effects; civil works; and others. Because this evaluation round is more detailed and includes criteria not previously considered in the initial evaluations, the relative rank of the sites did change. For example, after the initial round of quantitative evaluation, the Martin plant site was ranked at the top, and the Turkey Point site was ranked seventh (see Figure 9.3-5). After the more extensive set of evaluation criteria was applied, the Turkey Point site ascended to the top position, and the Martin site fell to the second position.

Table 9.3-6 is provided to illustrate how the relative strength of the Turkey Point site emerged to the top position based on the more extensive evaluation. This table shows the relative rank of each site (on a scale of 1 to 5) for the nine most heavily-weighted criteria. For eight of the top nine evaluation criteria, the Turkey Point site scores were equal to or superior to the other potential sites. The Martin site, however, placed second with respect to five of these criteria, and third with respect to another. Therefore, although the Martin site appeared superior in the more limited (9-metric) evaluation, based on the additional level of detail in the more extensive evaluation, the Turkey Point site proved to be superior.

The composite weighted scores for the eight potential sites are illustrated in Figure 9.3-6. Based on the results of the final round of quantitative evaluation, the three sites with the lowest composite scores (DeSoto, Hardee, and Hendry 1) were eliminated (as described in the bullets list below), and the other five sites were retained as alternative sites for detailed comparative analysis.

- The DeSoto site is an FPL-owned greenfield site located in DeSoto County. This site had several drawbacks that contributed to its elimination. These drawbacks include, for example, lack of barge access and water flow along with water supply flexibility problems (i.e., limited water supply options to support plant operations). The only source of water identified for the site was nearby Peace River which offers only 62 cubic foot per second.

- The Hardee site is a non-FPL-owned site outside of FPL service territory in Hardee County. The greenfield site currently consists of farm and agricultural land in an area that leads the state in citrus and cattle production. In addition to the partial loss of valuable economic resources, the difficulties with water supply became primary issues that led to the elimination of this site from consideration.

- The Hendry 1 site, located in Hendry County, is a greenfield site that would require purchase by FPL. In the final evaluation round of eight sites, the Hendry 1 site ranked sixth overall. Water resources for this site were rated neutral in terms of flow and flexibility, but the site rated poorly in terms of risk and regulatory challenge. Portions of northern, eastern, and southern Hendry County include sensitive waters listed in F.A.C. 62-303(d). The Hendry 1 site also ranked poorly in terms of the heavily weighted air-food ingestion pathway and surface water—food radionuclide pathway criteria. Other areas where the Hendry 1 site ranked poorly include dewatering effects on adjacent wetlands, civil infrastructure issues, and flood potential.

Step 3: Selection of Proposed Site

Selection of the proposed site (Turkey Point) was determined based on composite evaluation scores and other applicable considerations related to FPL business plans and objectives. To select a proposed site out of the final five alternative sites, the selection team applied additional considerations to provide further insight into site conditions and other specific issues that are important to the site selection decision. The specific factors evaluated are listed below:

1. Environmental Impact: Existence of ecological or environmental permit issues.

2. Transmission: Availability of existing right-of-way and the cost of upgrades.

3. Land Acquisition: Current land ownership and the expected difficulty associated with site acquisition (if applicable).

4. Transmission Reliability: Analysis of reliability from a power transmission perspective.

5. Power Generation Reliability: Qualitative assessment of risk factors for reliable power production and supply.

6. Public acceptance: Ability to obtain public acceptance to support COL activities.

7. Local Political Acceptance: Governmental/organizational support at the local level.

8. State Political Acceptance: Political and regulatory support at the state level.

9. Transmission Takeaway Feasibility: Feasibility of construction for the necessary upgrades to deliver power to the system.

10. Schedule compatibility: Level of confidence that site would support commencement of COL Application activities in January 2007.

11. Site layout feasibility: Ability of each site to accommodate a suitable plant layout.

The multidisciplinary team of FPL professionals with expertise, experience, and current involvement in the areas evaluated, then conducted an evaluation of the five alternative sites based on the topics listed above. The multidisciplinary team confirmed that the site selection evaluations properly serve to distinguish among the five candidate sites and identify the most favorable site. The Turkey Point site rates more favorably in eight of the 11 factors listed above, and does not rate less favorable with respect to any of them. Each of the other candidate sites rates more favorably in fewer factors and rates less favorably in at least one factor. Therefore, the Turkey Point site proved overall to be the superior and feasible choice.

The following subsection presents the information assembled for the detailed evaluation of the Turkey Point site. To facilitate comparison with the other candidate sites (Glades, Martin, Okeechobee 2, and St. Lucie), a reconnaissance level analysis is presented in Subsections 9.3.3.1 through 9.3.3.4. Summary tables are then presented to compare the impacts of construction and operation for each of the five candidate sites to demonstrate that none of the candidate sites are obviously superior to the proposed site. The locations of the Turkey Point site and the other four alternative sites are illustrated in Figure 9.3-7.

9.3.3 ALTERNATIVE SITE REVIEW

This subsection reviews the four alternative sites based on the selection criteria suggested in NUREG-1555 to determine whether any of the alternative sites are obviously superior to the proposed Turkey Point site.

RG 4.2, *Preparation of Environmental Reports for Nuclear Power Stations* notes: “The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type investigations need be conducted” (U.S. NRC Jul 1976). The site alternatives described here are compared based on recent information about existing facilities in the surrounding area and existing environmental studies.

Potential impacts from construction and operation of the proposed project at candidate sites other than the proposed site are analyzed, and a single significance level of potential impact (i.e., SMALL, MODERATE, or LARGE) is assigned to each analysis consistent with the criteria that NRC established in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

- SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

- LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

For some analyses, FPL determined the criteria used by the NRC in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, to be appropriate for the analyses presented here, and those criteria were reviewed to assign a significance level in impacts. Impact categories (e.g. land use, socioeconomics) for the alternative sites are the same as those described in Chapter 4 for construction and Chapter 5 for operation of Units 6 & 7 at the Turkey Point site.

For the purpose of alternative site analysis, FPL assumed the same type of power units would be placed at each of the four sites (two Westinghouse AP1000 nuclear power units). However, other design parameters would not necessarily be the same at each of the sites. Because the Glades and St. Lucie sites are within the 100-year floodplain, it may be necessary to transport fill material to these sites to increase the site elevation before construction. The Okeechobee 2 site and the Martin site are outside of the 100-year floodplain and would, therefore, not require modification to site elevation.

FPL estimated that 3000 acres of land acquisition would be required at either of the greenfield sites (Glades and Okeechobee 2). Land acquisition would not be required to site the AP1000 units at either the Martin site or St. Lucie site because these sites are already owned by FPL and are designated for power plant activities.

FPL assumed that freshwater sources (surface or groundwater) would supply the water needs for the Glades, Martin, and Okeechobee 2 sites. Surface water sources include Lake Okeechobee, a river, or a water canal, and the water would be transferred to the site via underground pipelines. FPL assumed the St. Lucie site would employ the same type of water intake and canal transfer system used for St. Lucie Units 1 & 2 (ocean water). For heat rejection, FPL assumed a closed-loop system with mechanical draft cooling towers for each alternative site.

9.3.3.1 Evaluation of the Glades Site

The Glades site is a nominal 3000-acre undeveloped area in the southeastern region of Glades County approximately 1 mile south of U.S. Highway 27. Nearby towns include Moore Haven, 2 miles east, Clewiston 15 miles southeast, La Belle 18 miles west, and Okeechobee 35 miles northeast. The Miami load center is approximately 75 miles southeast of the Glades site. Lake Okeechobee is approximately 5 miles to the northeast. The site is not owned by FPL but is considered potentially available and feasible for a power generation project. The site is within a 100-year floodplain. The location of the Glades site is shown in Figure 9.3-8.

9.3.3.1.1 Land Use Including Site and Transmission Line Rights-of-Way

The Glades site is a 3000-acre area developed for agricultural and farm use. A topographic survey of the nearby, formerly proposed FPL Glades Power Park site, was performed at this site. In general, the topographic survey indicates that there is very little natural slope to the ground surface. The site is surrounded primarily by sugarcane fields.

Based on land use data for year 2002, approximately 82.4 percent of the land in Glades County is farmland (USDA Jun 2004). Glades County is currently the second largest producer of sugar in the state. Like most of the land area in the county, the Glades site is used for agriculture and farm activities. The topography of the site is generally flat with a mean elevation of 15 feet. Results of a recent survey show that 489 acres of wetlands are within the 5000-acre area that encompasses the site.

Construction of the power plant and transmission lines would alter land use at the site from agricultural to industrial. Because the site is within the 100-year floodplain, it may be necessary to import fill material to elevate the site. It is assumed the fill material would be delivered from offsite sources; therefore, the acquisition of fill material would not disturb land at the Glades site. FPL assumed that the total land disturbance at the Glades site as a result of construction activities (laydown areas, batch plant, spoils areas, etc.) would be approximately 491 acres. FPL assumed the footprint of the new facilities would cover approximately 308 acres (FPL Jan 2008). New facilities would include the nuclear power units, support buildings, a switchyard, storage areas, and injection wells for subsurface water disposal. Because the Glades site is undeveloped, additional acreage would be required for roads and railroad spurs. The entire plant footprint would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007).

FPL assumed that construction of a one-half mile paved access road may be necessary to provide access from the main roadway in the area, U.S. Highway 27, to the site. Based on an assumed 100-foot right-of-way, this new road would disturb approximately 6.1 acres of land that is currently used for agriculture. A railway is approximately 3.1 miles northeast of the site. Based on an assumed 100-foot-wide corridor, construction of railway access to the site would disturb approximately 37.6 acres.

Potential surface water sources include the C-43 Channel (approximately 2.5 miles southwest) and Lake Okeechobee (approximately five miles northeast). Based on an assumed 50-foot-wide pipeline construction corridor, the acreages disturbed for these options would be 15.2 acres and 30.3 acres, respectively.

For the purpose of alternative site analysis, it was assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system. FPL assumed that the lines would be routed approximately 73 miles along two parallel transmission corridors (one for the 230 kV lines, one for the 500 kV lines) from the Glades site to the Andytown Substation in Broward County. Each corridor would be nominally 330 feet wide. Overall, the new transmission corridors would require approximately 5840 acres . Although the most direct route would generally be used between terminations, consideration would be given to prevent possible conflicts with any natural or man-made areas where important environmental resources are located. Route selection would also avoid populated areas and residences to the extent possible. When possible, the new lines would be routed along existing transmission rights-of-way. The use of lands that are currently used for forests would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect a small number of residents along the right-of-way. The land use in the region (and, therefore, along the new transmission corridors) is generally rural, sparsely populated, and primarily used for agricultural activities. Glades County is not within the Florida Coastal Zone, and the route for the new transmission lines would not pass through any portion of the Florida Coastal Zone.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Impacts are considered moderate if land disturbance is greater than 3000 acres or there are major changes to land use. Based on the land disturbance totals and the change of land use from agricultural to industrial, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Glades site and the transmission corridor would be MODERATE.

9.3.3.1.2 Air Quality

Glades County (the Glades site is within Glades County) is part of the Southwest Florida Intrastate Air Quality Control Region. Glades County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the National Ambient Air Quality Standards (NAAQS) (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Glades site. (40 CFR 81.311)

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Glades site would be comparable to the emissions generated at the Turkey Point site, as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total vehicular emissions in the region. It is unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the Florida Department of Environmental Protection (FDEP) in accordance with the air rules published under Florida Administrative Code (F.A.C.) Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. (The Federal Class I area nearest to the Glades site is the Everglades National Park approximately 63 miles to the south.) Because of the significant distance, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.1.3 Hydrology, Water Use, and Water Quality

Florida is divided into five watershed management areas. The Glades site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the South Florida Water Management District (SFWMD). This watershed region spans over 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007). Lake Okeechobee is at the center of the south Florida regional water management system. This relatively shallow lake has an average depth of 9 feet and covers approximately 730 square miles. The Lake Okeechobee drainage basin covers more than 4600 square miles (SFWMD 2008).

Water quality and ecological health of Lake Okeechobee are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD, in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services, has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the *Northern Everglades and Estuaries Protection Program* that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, constructing treatment wetlands to clean water flows into the lake, and creating 900,000 to 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

In 2000, the average daily surface freshwater withdrawals in Glades County totaled 53.6 million gallons, which represents 72 percent of the total daily withdrawal rate for the county (USGS Dec 2004). Major surface freshwater sources near the Glades site include Lake Okeechobee (5 miles away) and the C-43 Channel (2.5 miles away).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. Locally, the Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980).

Principal groundwater sources in Glades County include the surficial aquifer and the middle Floridan aquifer. Within Glades County, in year 2000, average daily (fresh) groundwater withdrawals from these aquifers totaled approximately 21 million gallons per day (mgd), and surface freshwater withdrawals totaled approximately 53.6 million gallons per day. Approximately 92 percent of freshwater withdrawals (ground and surface) in Glades County (69 mgd) are used for agriculture. Fresh groundwater was the only source of public water supply in Glades County (USGS Dec 2004).

The depth to the water table near the site is less than 30 feet below ground level. Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to National Pollutant Discharge Elimination System (NPDES) permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II, where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et. al, 1985). Furthermore, there were no indications of karst geology, such as voids or loss of circulation, encountered in borings drilled nearby as part of the site investigation for the proposed Glades Power Park, approximately 2 miles away.

Site groundwater wells are expected to be installed in the middle Floridan aquifer. Since the site is inland from the coast, lateral saltwater intrusion is not likely. However, there is a potential for saltwater to migrate vertically into the middle Floridan aquifer from the saline deeper Floridan aquifer. Since the middle Floridan aquifer already produces brackish water, resultant saltwater intrusion could require additional osmosis or dilution with clean water to satisfy potable water quality standards.

As shown in Table 3.3-1, the peak construction water demand is estimated at 407 gallons per minute (gpm), which is slightly less than 1 cfs, and the peak estimated potable water demand for operations is 70 gpm. As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of more than 360 cfs, and an estimated 482 cfs is available from the C-43 Channel. The estimated groundwater potential at the Glades site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Glades site. Water use impacts are considered small when water sources are readily available to meet demand. Therefore, because adequate water sources are available nearby, the impact on regional water use for both construction and operation would be SMALL.

Lake Okeechobee is identified as a potential potable and process water source for the Glades Site. The anticipated total water demand associated with plant operations (approximately 100 cfs) would represent a negligible fraction of the average lake recharge rate of 48,300 cfs. Therefore, it is not expected that water demand for plant operations would adversely impact water quality for Lake Okeechobee.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). It is assumed that a closed loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown waters are either routed to a suitable surface water body or injected into the

Boulder Zone (the Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders). Plant construction and operation activities at the Glades site would be performed under the authorization of an NPDES permit (construction) Industrial Wastewater (IWW) permit (surface water), or Underground Injection Control (UIC) (groundwater) permit issued by the FDEP (FDEP 2008b). Any releases from the power plant site into Lake Okeechobee, regional streams, or groundwater as result of construction or operation would be regulated by the FDEP through the NPDES, IWW, or UIC permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.1.4 Terrestrial Resources and Protected Species

The Glades site is a 3000-acre area developed for agricultural and farm use. A topographic survey of the nearby formerly proposed FPL Glades Power Park site was performed. In general, the topographic survey indicates that there is very little natural slope to the ground surface. The average ground surface elevation is approximately 15 feet above MSL, and the site is surrounded primarily by sugarcane fields. The site has been modified to allow for irrigation using an irrigation/drainage ditch network throughout the site. Water levels in the ditches are controlled manually with pumps to support the irrigation process. Most of the site is an active sugarcane field, that is unsuitable habitat for most wildlife species because of the lack of native vegetation and the amount and frequency of human disturbance. The fields are regularly treated with herbicides and pesticides, and the agricultural ditches are routinely maintained. However, wading birds and alligators do use the irrigation canals and opportunistically forage in areas of heavy machinery usage such as ditch maintenance sites and field clearing/preparation areas for replanting. The wetlands within the surrounding sugarcane fields also provide habitat for avian species and common herpetofauna (FPL Dec 2006). In the 5000 acres surrounding the Glades site, there are 489 acres of wetlands, none of which are considered high-quality wetlands such as forested wetlands. Any wetland functions that are impacted during construction would be replaced or restored. The footprint of the new facilities would cover approximately 308 acres (FPL Jan 2008).

Non-listed wildlife observed at the nearby formerly proposed FPL Glades Power Park site include a variety of common avian species, such as cattle egret (*Bubulcus ibis*), barn swallow (*Hirundo rustica*), loggerhead shrike (*Lanius ludovicianus*), black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), mourning dove (*Zenaida macroura*), redwinged blackbird (*Agelaius phoeniceus*), ground dove (*Columbina passerina*), swallow-tail kite (*Elanoides forficatus*), cardinal (*Cardinalis cardinalis*), moorhen (*Gallinula chloropus*), green heron (*Butorides virescens*), great egret (*Ardea albus*), glossy ibis (*Plegadis falcinellus*), red-shouldered hawk (*Buteo lineatus*), anhinga (*Anhinga anhinga*), least bittern (*Ixobrychus exilis*), great blue heron (*Ardea herodias*), osprey (*Pandion halieatus*), common nighthawk (*Chordeiles minor*), red-tailed hawk (*Buteo jamaicense*), marsh hawk (*Circus cyaneus*), coot (*Fulica americana*), white-eyed vireo (*Vireo griseus*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nycticorax violaceus*), bobwhite quail (*Colinus virginianus*), purple gallinule (*Porphyrio martinica*), red-bellied woodpecker (*Melanerpes carolinus*), and Eastern meadowlark (*Sturnella magna*) (FPL Dec 2006).

Mammalian species directly observed or identified through tracks or scat include Eastern cottontail (*Sylvilagus floridanus*), feral hog (*Sus scrofa*), raccoon (*Procyon lotor*), armadillo (*Dasypus novemcinctus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), otter (*Lutra canadensis*), and white-tailed deer (*Odocoileus virginianus*). Herpetofauna observed include Florida cooter (*Pseudemys floridana*), green tree frog (*Hyla cinerea*), soft-shelled turtle (*Trionyx ferox*), pig frog (*Rana grylio*), leopard frog (*Rana pipiens*), and broadhead skink (*Eumeces laticeps*) (FPL Dec 2006).

Threatened, endangered, and/or species of special concern that exist in Glades County are listed in Table 9.3-7. The site has been largely cleared of native vegetation, graded, and planted with sugarcane. The Florida Natural Areas Inventory (FNAI) element occurrence report for the formerly proposed FPL Glades Power Park did not include any documented occurrences of listed plants within that site and vicinity. For fauna, the formerly proposed FPL Glades Power Park site was surveyed in August and December 2006 through pedestrian and vehicular surveys, and observations of protected species were recorded. Three federally listed species—the wood stork, the crested caracara, and the Everglades snail kite—were observed at that site, while seven species listed by the state were identified. These species include the little blue heron, snowy egret, white ibis, tricolor heron, sandhill cranes and American alligator. No nesting areas were observed, nor do any critical wildlife habitats exists on that site (FPL Dec 2006).

The irrigation ditches within the site provide foraging habitat for a variety of wading birds, which although not classified as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or the Florida Fish and Wildlife Conservation Commission (FFWCC), are considered species of special concern by the FFWCC. These include the little blue heron, snowy egret, white ibis, and tricolor heron. A few individual wood storks were also observed associated with irrigation ditches. The wood stork is classified as endangered by both the USFWS and the

FFWCC. American alligators also use the irrigation ditches at the site. The alligator is not classified as threatened or endangered, but is listed as a species of special concern by the FFWCC and listed by the USFWS because of its similarity in appearance to the endangered American crocodile (*Crocodylus acutus*) (FPL Dec 2006).

According to the FFWCC Bald Eagle Nest Location Database, no active bald eagle (*Haliaeetus leucocephalus*) nests are at the Glades site. The closest nest is approximately 6 miles from the project area: Nest GL018 is west of the site at 26°47.98′ N 81°16.04′ W (Section 19, Township 42 South, Range 31 East) (FFWCC 2008a).

Further field surveys would be conducted for federally listed and state-protected species as part of the permitting process before any land preparation or construction activities began at the site or along associated transmission or pipeline corridors. Land preparation activities associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.1.1, FPL assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system via the Andytown Substation in Broward County. The transmission lines would be routed in two parallel corridors. Each corridor would be approximately 73 miles long and nominally 330 feet wide. Construction of the new transmission lines would impact approximately 5840 acres of transmission corridor. Although the most direct route would generally be used between terminations, consideration would also be given to avoiding possible conflicts with natural areas where important environmental resources are located.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plumes have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry. However, the freshwater sources identified for the Glades site have modest levels of salts and dissolved minerals. Therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. Glades County has a low number of sensitive species, there are no known sensitive species onsite, and the transmission corridor is short. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and transmission corridor at the Glades site would be SMALL.

9.3.3.1.5 Aquatic Resources and Protected Species

The Glades site is just north of the C-43 Channel and Lake Hicpochee, and approximately 5 miles from Lake Okeechobee. Lake Hicpochee sometimes does not resemble a lake and often looks like a sandy desert plain (U.S. Power Squadrons 2008). The lake changes in size as Lake Okeechobee is drained to meet proper levels and acts as a stormwater discharge area. Lake Okeechobee is at the center of the south Florida regional water management system. The massive lake is a 730-square-mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. The Lake Okeechobee drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the C-43 Channel or Lake Okeechobee via pipeline would be the source to cool the new nuclear units constructed at the Glades site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No listed fish species are known to exist in Glades County (FNAI 2008a), that includes the C-43 Channel and the portion of Lake Okeechobee near the Glades site. One state-listed amphibian, the gopher frog (*Rana capito*), has been documented or observed in Glades County. Field surveys would be conducted for federally listed and state-protected aquatic species as part of the permit process before any land preparation or construction activities began at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Glades site would be SMALL.

The most likely aquatic impact from nuclear operations at the Glades site would be entrainment and impingement of aquatic organisms in the C-43 Channel or Lake Okeechobee. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Glades site would be SMALL.

9.3.3.1.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Glades site. Much of the socioeconomic analysis relies on census data gathered by the United States Census Bureau (USCB). The USCB performs an extensive census every 10 years. The most recent decennial U.S. census was performed in 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information. However, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models. However, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Ideally, a socioeconomic analysis would be based on the most recent census information. However, because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census is chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.1.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most of the construction activities would occur within the boundaries of the Glades site; however, an access road and a railway connection spur would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts from those due to their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Glades site is in a rural area surrounded by agricultural land, with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits would govern operation of this equipment to ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected, or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur primarily within the boundaries of the Glades site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Glades site would be SMALL.

9.3.3.1.6.2 Demography

The population distribution within and around the Glades site is low with typical rural characteristics, and satisfies the 10 CFR Part 100 definition of a low population zone. The nearest population center is Moore Haven, approximately 2 miles east, with a population of 1635 residents. The nearest population center larger than 25,000 residents is Fort Myers, approximately 45 miles west. Conterminous counties include Highlands to the north, Okeechobee to the northeast, Martin to the east, Palm Beach to the southeast, Hendry to the south, Lee to the southwest, Charlotte to the west, and DeSoto to the northwest. Other counties within 50 miles include Hardee to the northwest, St. Lucie to the northeast, Broward to the southeast, and Collier to the south.

To determine which counties best represent the region of influence (ROI) for socioeconomic analysis of the Glades site, counties that fall within 50 miles around the Glades site were initially identified. Several factors were then considered to determine which of these counties would best represent the ROI. These factors, listed below, are evaluated based on historical data from the

USCB. Key assumptions of the ROI determination are that (1) workers will seek to live within 50 air miles of the site and within a 60-minute commute time and (2) most workers will seek to live in population centers that generally offer more amenities (stores, medical facilities, schools, churches, a larger selection of houses, etc.) than rural locations.

<u>Factors Considered to Determine Which Counties Would Best Represent the ROI</u>

- County population and population density
- Populations of the largest population centers
- Geographic locations of the population centers in relation to the Glades site
- The land fraction of nearby counties that falls within 50 miles of the site
- Relative distance from nearby counties to the site
- Estimated travel distance and estimated travel time from the population centers to the site
- Mean travel time to work
- County employment
- Worker commuter patterns to and from counties conterminous the site

Based on the results of this evaluation, the counties that best represent the ROI for socioeconomic analysis of the Glades site include Glades, Hendry, Lee, and Okeechobee. Because there is no reliable method to predict the distribution of the workforce among these four counties, the ROI is generally treated as a whole for much of the socioeconomic analysis.

Based on the 2000 census, the total population of the ROI was 523,584, that included 10,576 in Glades County, 36,210 in Hendry County; 440,888 in Lee County, and 35,910 in Okeechobee County (USCB 2000). Census estimates for 2007 showed an ROI population of 681,595, that included 11,109 in Glades County, 39,611 in Hendry County, 590,564 in Lee County, and 40,311 in Okeechobee County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Glades site is 979.5 square miles, and based on 2000 census data, the population of this area was 39,196. This yields a population density of 40 people per square mile. There are no cities within 20 miles of the Glades site that have a population greater than 25,000. Therefore, the sparseness level is 2 based on a population density of 40 to 60 people per square mile and no community greater than 25,000 people within 20 miles (NUREG-1437).

The land area within 50 miles of the Glades site is 6540.3 square miles, and the population of this area was 512,911. This yields a population density of 78.4 people per square mile. There are no cities within 50 miles of the Glades site that have a population greater than 100,000. Therefore, based on NRC guidelines, the proximity level is 2 based on a population density of 50 to 190 people per square mile and no city greater than 100,000 people within 50 miles. Therefore, the Glades site has a sparseness-proximity measure of 2.2, which is categorized as medium (NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time. Therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and some of these workers would also relocate to the area. Because of the location of the Glades site relative to population centers, FPL assumed that 70 percent of the construction workers and 85 percent of the operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction workforce and 100 percent of the operation workforce that moved to the area would bring their families. Based on these assumptions, 2484 construction and 84 operation workers would relocate to the area during the project construction phase, and 1823 of these workers would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to the peak total workforce at the Glades site would be 6669 people. An influx of 6669 people represents a 1.3 percent increase in the ROI population of 523,584. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437). Therefore, this would pose a SMALL impact on population for the ROI.

FPL estimated the total onsite operations workforce to be 1050 workers, and that 85 percent of these workers (893) would relocate from outside the ROI. For this analysis, FPL assumed that 100 percent of operations workers who relocate will bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project operations is 2901 people. This represents a 0.6 percent increase in the four-county ROI population. This would pose a SMALL impact on population for the ROI.

9.3.3.1.6.3 Economy

Based on 2000 census data, Glades County had a civilian labor force of 4034 people and an unemployment rate of 8.8 percent; Hendry County had a civilian labor force of 15,814 people and an unemployment rate of 7.8 percent; Lee County had a civilian labor force of 193,651 people and an unemployment rate of 3.7 percent; and Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent. For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.8 percent are employed and 4.2 percent are unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the state, which is 5.6 percent (USCB 2000).

The economies of the four counties in the ROI are very similar, dominated primarily by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force resides in Lee County (USCB 2000).

Based on the assumptions stated above, the number of workers who relocate from outside the area would include 70 percent of the 3548 peak construction workers and 85 percent of the 99 operations workers for a total of 2568 workers. An influx of 2568 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7604 jobs (direct and indirect) for every construction job and 2.3016 for every operation job (BEA Aug 2009), an influx of 2568 construction and operation workers would create 2006 indirect jobs, for a total of 4574 new jobs in the ROI. This represents a 2 percent increase in the total labor force in the ROI. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project construction would be beneficial and SMALL within the ROI.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Glades site (U.S. DOE May 2004), and FPL assumes that 85 percent of these employees (893) would migrate into the region. Based on a multiplier of 2.3016 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 893 workers would create 1162 indirect jobs for a total of 2054 new jobs in the region. This represents a 0.9 percent increase in the total labor force in the ROI. The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project operation would be beneficial and SMALL within the ROI.

9.3.3.1.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Glades site would benefit the state and local tax authorities. FPL would pay property taxes to each taxing authorities whose boundaries would contain the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the Glades site, because the units would not generate revenues until they became operational. However, once the units were placed in service, Glades County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Glades site would be similar to those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2007 fiscal year, Glades County had property tax revenues of $4,735,034 (State of Florida, Mar 2008a).

With respect to the school district, in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida’s 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that reallocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by most of the workers’ children. Therefore, it is not possible to assess the direct impact of the plant on the school district. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 59 percent of the 2007 property tax revenues for Glades County would be provided by FPL and would constitute a LARGE positive impact.

9.3.3.1.6.5 Transportation

Principal road access to the Glades site would be from U.S. Highway 27/State Road 78, which spans concurrently in an east-west orientation along the northern boundary of the site. This road is a four-lane divided highway. Approximately 2 miles west of the site, U.S. Highway 27/ State Road 78 diverge, such that U.S. Highway 27 spans northward toward Palmdale and Venus communities, and State Road 78 generally spans westward toward La Belle. U.S. Highway 27 and State Road 78 also diverge approximately 2 miles east of the site, so that U.S. Highway 27 continues eastward through Moore Haven, and State Road 78 continues northward toward Lakeport, Buckhead Ridge, and Okeechobee. Therefore, commuters from the west (La Belle) would travel eastward along U.S. Highway 27 and State Road 78; those from the northwest (Venus, Palmdale) would travel eastward along U.S. Highway 27; those from the northeast (Lakeport, Buckhead Ridge, Okeechobee) would travel south along State Road 78; and those from the east and southeast (Moore Haven, Clewiston, Harlem, Lake Harbor, Belle Glade) would travel westward along U.S. Highway 27.

The Florida Department of Transportation (FDOT) reports the average annual daily traffic (AADT), the K_{100} demand factor, and direction factors (D-factors) at several points along the travel routes to the site. The product of these parameters yields the directional peak hour volume that is the volume of traffic in the most congested direction for the most congested hour of the day. Monitored locations include U.S. Highway 27 just west of the site at the confluence of U.S. Highway 27 and State Road 78, U.S. Highway 27 just east of the site within Moore Haven, and the stretch of State Road 78 that spans just north of the site. The AADT count and directional peak hour volume of the western location along U.S. Highway 27 is 7800 vehicles per day and 424 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this western portion of the roadway as a level of service (LOS) of A (FDOT 2007), and the remaining peak hour capacity is 1776 vehicles. In general terms, LOS is an indicator of how effectively the road accommodates the volume of traffic. LOS is represented by one of the letters A through F, A for the freest flow and F for the least free flow. The remaining directional peak hour capacity is the total number of vehicles that can be added to the most congested direction traffic at the peak hour and still remain within the capacity of the road. The directional peak hour volume of the eastern location along U.S. Highway 27 is 10,200 vehicles per day and 554 vehicles per hour (FDOT 2008). This peak hour volume classifies this eastern portion of the roadway as a LOS of A (FDOT 2007), and the remaining directional peak hour capacity is 1676 vehicles. The AADT count and directional peak hour volume of the northern location along State Road 78 is 3282 vehicles per day and 173 vehicles per hour (FDOT 2008). This peak hour volume classifies this northern location as a LOS of B, and the remaining directional peak hour capacity is 247 vehicles (FDOT 2007).

Based on the existing population distribution around the site, FPL assumed that most of the workforce would likely travel along the westward portion U.S. Highway 27 and that smaller portions of the workforce would travel along the eastern portion of U.S. Highway 27 and the northern portion of State Road 78. Also, the traffic attributable to delivery of construction materials could cause additional congestion on U.S. Highway 27 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Glades site would add 1485 vehicles per day and 488 vehicles during the peak hour to the western and eastern portion of U.S. Highway 27. The additional construction traffic would not cause U.S. Highway 27 to exceed capacity but would drop the roadway to a LOS classification of C in the western direction, and to a LOS classification of B in the eastern direction. FPL determined that construction at Glades site would add 382 vehicles during the peak hour to the northern portion of State Road 78. The additional construction traffic would cause the road to exceed capacity, further add to current traffic congestion, and drop the roadway to a LOS classification of D.

Based on the above analysis, it is likely that the additional traffic would pose delays along U.S. Highway 27 and State Road 78. It is anticipated that the drops in LOS classification along U.S. Highway 27 would only pose negligible additional delays or other operational problems. To facilitate the additional traffic, State Road 78 could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. The NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant because both plant construction and refurbishment would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. Therefore, it is anticipated that the impact of the construction workforce on transportation would be MODERATE and may warrant mitigation.

Operations at the Glades site would add approximately 427 and 140 more vehicles to the western and eastern respective portions of U.S. Highway 27 during the hour of peak traffic. An estimated 110 vehicles would be added the northern portion of State Road 78 during the hour of peak traffic as well. The current peak hour capacities of these roadways are sufficient to accommodate the additional traffic expected from operations. Additional traffic as a result of operations would not result in any changes to LOS classifications along U.S. Highway 27, but would drop the LOS classification on State Road 78 from B to C. Shift changes could be staggered so that the traffic increase would be less likely to cause congestion. Therefore, it is anticipated that the impact of the operations workforce on transportation would be MODERATE and would not warrant mitigation.

9.3.3.1.6.6 Aesthetics and Recreation

The Glades site is a 3000-acre undeveloped site in an unincorporated area of Glades County, approximately 5 miles southwest of Lake Okeechobee. The site is on flat, swampy land at an approximate elevation of 15 feet above MSL (USGS 1971) and lies within the Everglades physiographic province (USGS 2008).

Because the entire area is relatively flat, the power plant and water intake facilities may be visible from some angles. There would be occasional visible plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered to be moderate if there are complaints about diminution in the enjoyment of the physical environment and measurable impacts that do not alter the continued function of socioeconomic institutions and processes. Construction and operation of an industrial facility on a previously undeveloped site would likely result in some complaints from the affected public with respect to diminution in the enjoyment of the physical environment. Therefore, impacts of construction and operation of the new units on aesthetics would be MODERATE and could warrant mitigation.

The western shoreline of Lake Okeechobee lies within 6 miles of the site, as well as portions of the Lake Okeechobee Scenic Trail and Big Water Heritage Trail, which parallel the shoreline of the lake. Lake Hicpochee is approximately 2 miles southeast of the site. There are no state parks or federal parks within 6 miles of the Glades site.

Lake Okeechobee occupies 730 square miles and is the second largest freshwater lake wholly within the United States. The lake is the epicenter of Florida and is renowned for its unique natural habitat, rich heritage, recreational fishing, and birding (SFRPC 2008).

The Lake Okeechobee Scenic Trail spans 110 miles along the perimeter of Lake Okeechobee. The trail is designated as a segment of the Florida National Scenic Trail. The trail is atop the Herbert Hoover Dike, which surrounds the lake for flood protection, and provides views ranging from scenic lakeside to working agricultural landscapes. The trail affords opportunities to view wildlife and to fish, bike, and hike. The nearest access point to the trail from the Glades site is the Moore Haven Recreation Area, which is east of the site at the confluence of Lake Okeechobee and the Caloosahatchee River (USACE 2008a).

The Big Water Heritage Trail is a designated vehicle roadway that provides vehicular access to the landscapes created by south central Florida's watersheds. The trail begins at the Kissimmee River and continues through the communities around Lake Okeechobee and south through the Everglades. It includes portions of State Road 78, U.S. Highway 27, State Road 76, U.S. Highway 98, and U.S. Highway 441, and spans within a few miles of the Glades site. The

Big Water Heritage Trail is a partnership project that promotes public awareness of natural and cultural features (SFRPC 2008).

Within 50 miles of the Glades site there are several lakes, rivers, swamps, wetlands, and other areas of interest. The Nicodemus Slough is approximately 5.8 miles northeast of the Glades site. The slough contains wet prairies, freshwater marsh wetlands, and pasturelands bordered on the north by a portion of the Herbert Hoover Dike. The property was historically used to graze cattle. In the 1990s, the SFWMD purchased 2219 acres of Nicodemus Slough for hydrologic restoration and public recreational use and designated the area as the Nicodemus Slough Management Area. The area was sparsely used by recreational enthusiasts; therefore, as part of a large land acquisition, the land, encumbered with the continued right to flow water over it, reverted to private ownership in the summer of 2006 and public access was closed (FPL Dec 2006).

Fisheating Creek Wildlife Management Area (FECWMA) is approximately 9.7 miles north-northeast of the Glades site. The FECWMA is bounded on the north and south by the Herbert Hoover Dike, and north and west of the Nicodemus Slough. Fisheating Creek travels approximately 50 miles from its origin in Highlands County through Glades County into Lake Okeechobee. The FECWMA spans 40 miles along this course and includes cypress swamps, hardwood hammocks, freshwater marsh, and mesic hammock habitats. Fisheating Creek has become incorporated into the Fisheating Creek ecosystem project in Glades and Highlands Counties, which is a part of the Florida Forever land acquisition and restoration program. The ecosystem project entails purchase of lands for conservation along the shores of Fisheating Creek for hikers, hunters, and wildlife observers, and to help maintain populations of rare plant and animal communities. The Fisheating Creek ecosystem project is designed to conserve lands that link Fisheating Creek to the Okaloacoochee Slough, Big Cypress swamp, and Babcock-Webb Wildlife Management Area, and Lake Okeechobee. The Fisheating Creek ecosystem project plans include 176,876 acres, 59,910 of which have been acquired by the state of Florida (FPL Dec 2006).

The Lake Wales Ridge National Wildlife Refuge is approximately 23 miles northwest of the site. The refuge occupies approximately 1858 acres and was established in 1993 as the first refuge designated for the recovery of endangered and threatened plants (USFWS 2008a). The northern portion of the Big Cypress National Preserve is approximately 39 miles south of the Glades site, and the Florida Panther National Wildlife Refuge is due west and adjacent to the Big Cypress National Preserve. The Big Cypress Preserve protects more than 720,000 acres of vast swamp containing a dynamic mixture of tropical and temperate plant communities that are home to diverse wildlife. The preserve provides a variety of recreational opportunities including hiking, backpacking, paddling, biking, camping, fishing, hunting, and off-road vehicle access (NPS 2008a). The Florida Panther National Wildlife Refuge consists of 26,400 acres and was established in 1989 under the authority of the Endangered Species Act to protect the Florida panther and its habitat (USFWS 2008b).

Construction activities at the Glades site would pose temporary aesthetic impacts in the region. Construction activities would generate noise and fugitive dust, and the use of cranes (which could exceed 400 feet in height) would alter a portion of the regional viewscape. Construction of the transmission lines would pose similar impacts. Because the parks, trails, and other scenic areas in the region are several miles away, the aesthetic impacts from construction would be SMALL.

When completed, the presence of the power plant and transmission lines would pose a visual disturbance in the viewscape for the life of the structures. Vapor plumes generated by operations could also be visible. Plume visibility would depend on weather conditions and the location of the viewer, however, the visible portion of a vapor plume generally dissipates within 200 meters of the source. Because the region is sparsely populated and is used mainly as farmland, and because the parks, trails, and other scenic areas in the region are several miles away, the aesthetic impacts from operations would be SMALL.

Two of the 154 state parks in Florida are within 50 miles of the Glades site and include the Highlands Hammock State Park and the Lake June in Winter Scrub State Park, both of which are more than 35 miles northwest of the Glades site.

Construction and operation of the new units at the Glades site could impact the attractiveness of recreational areas in the region. Recreational facilities could also be affected by increased traffic on area roads at peak travel periods; however, impacts would be minimal. During plant operations, some employees and their families would use the regional recreational facilities. However, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.1.6.7 Housing

FPL estimates that 2568 construction and operation workers would move from outside the 50-mile radius of the Glades site to one of the counties within 50 miles, and each of these workers would need a place to live. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in a private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there are 278,993 housing units of which 63,099 are vacant (22.6 percent). The number of vacant housing units within each of these counties was 1938 (33.5 percent) in Glades County, 1444 (11.7 percent) in Hendry County, 56,806 (23.1 percent) in Lee County, and 2911 (18.8 percent) in Okeechobee County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

FPL estimates that, in absolute numbers, the available housing would be sufficient to house the construction workforce. Workers who relocate could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region.

Because Glades, Hendry, and Okeechobee Counties have relatively small populations, their housing markets would likely be the most impacted. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). The entire construction and operation workforce would occupy no more than 4.1 percent of vacant housing units in the ROI. Therefore, the impacts during plant construction would be SMALL, and mitigation would not be warranted.

FPL estimated that approximately 1050 workers would be needed for operation of two nuclear power facilities at the Glades site (U.S. DOE May 2004). FPL assumed that 85 percent of these workers (893) would relocate from outside the region and would settle in the four-county ROI. Based on these assumptions, the entire operations workforce would occupy no more than 1.4 percent of vacant housing units in the ROI. Therefore, the impacts from plant operations would be SMALL, and mitigation would not be warranted.

9.3.3.1.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities; law enforcement, fire, and medical facilities; libraries, parks and recreation, roadway maintenance, and other social services. Construction or operations employees who relocate from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and, therefore, the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of the public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely economically benefit the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and, therefore, remove them from the care of social services.

The ratio of residents to law enforcement officers in Glades, Hendry, Lee, and Okeechobee Counties was 353:1, 624:1, 796:1, and 399:1, respectively (FBI 2008). Within the ROI, the resident-to-law-enforcement-officer ratio was 715:1, and for the state of Florida, the resident-to-law-enforcement-officer ratio was 851:1. Ratios partly depend on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Glades site would increase the resident-to-law-enforcement-officer ratio by 1.3 percent to 724:1. This is a small increase and would still yield a lower resident-to-law-enforcement-officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law-enforcement-officer ratio attributable to operations would yield less than a 0.6 percent increase.

The ratio of residents to firefighters in Glades, Hendry, Lee, and Okeechobee Counties was 82:1, 394:1, 431:1 and 492:1, respectively. Within the ROI, the resident-to-firefighter ratio was 397:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009). As described above concerning law enforcement officers, ratios partly depend on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Glades site would increase the resident-to-firefighter ratio by 1.3 percent to 402:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.6 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel. However, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Therefore, impacts are considered SMALL, and mitigation would not be warranted.

9.3.3.1.6.9 Education

Based on data for the 2006–2007 school year, Glades County had 8 schools that covered prekindergarten through 12th grade (PK-12) schools with a total enrollment of 1256 students; Hendry County had 17 PK-12 schools with a total enrollment of 7463 students; Lee County has 112 PK-12 schools with a total enrollment of 78,981 students; and Okeechobee County had 17 PK-12 schools with a total enrollment of 7289 students (NCES 2009). In the four-county ROI, there are 154 schools with a total enrollment of 94,989 students.

FPL estimated that 2568 construction and operation workers would migrate to the area, and that 1823 workers would bring a family. This would yield a total population increase of 6669 people. Based on an estimate of 0.8 school-aged children per family (BMI Apr 1981), an estimated 1458 of the 6669 people who relocate to the four-county area would be school-aged children. This would yield a 1.5 percent increase in the student population within the four-county ROI. Small impacts are generally associated with project-related enrollment increases of up to 3 percent, and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, this would pose a SMALL impact on the ROI, and mitigation would not be warranted.

FPL assumed that 893 operations workers and their families would relocate from outside the region and that the total population increase attributable to operations would be 2901 people. This would include an estimated 714 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 0.8 percent within the four-county ROI. The impacts on public education are considered SMALL, and mitigation would not be warranted.

9.3.3.1.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service National Register Information System (NRIS) and reviewed information on historic and archeological sites provided in documents associated with the FPL Glades Power Park project. Where applicable, historic and archeological sites are identified by their historic site structure identifier.

In 2006, FPL conducted an archeological reconnaissance survey for a 4900-acre undeveloped area for the formerly-proposed FPL Glades Power Park project (FPL Dec 2006). The FPL Glades Power Park site is approximately 3 miles north of the Glades site.

No archaeological sites were identified during the FPL archeological reconnaissance survey. Background research conducted as part of the 2006 FPL Glades Power Park archeological survey indicates that one archaeological site (8GL60) is within the FPL Glades Power Park project boundary. The site was recorded as a Belle Glade mound based on its designation as an “Indian Mound” on a topographic map. Because of lack of previous field investigation of the site, it has not been evaluated for its National Register of Historic Places (NRHP) eligibility. Other notable archaeological sites are described below.

Gator Mound (8GL53) is just outside the northeastern corner of FPL Glades Power Park project boundary and just south of the Nicodemus Slough. This site is recorded as a prehistoric mound and earthworks of unknown cultural affiliation, and has not been evaluated for NRHP eligibility.

The Nicodemus Earthworks site (8GL9) is approximately 2500 feet north of the FPL Glades Power Park site and Nicodemus Slough. It is recorded as a destroyed white sand burial mound and linear crescent earthworks with linear ridge and mound components that are associated with the Belle Glade culture. The burial mound has been recorded as containing human remains. This site has not been evaluated for its NRHP eligibility.

An unnamed site (8GL61) is approximately 6500 feet north of the FPL Glades Power Park site. It is recorded as a prehistoric mound associated with Belle Glade culture. This site has not been evaluated for its NRHP eligibility.

The Glades Circle Ditch (8GL38) is 7000 feet north of the FPL Glades Power Park site and Nicodemus Slough. The site is recorded as a prehistoric earthwork associated with the Glades culture. It has not been evaluated for its NRHP eligibility.

The Fort Center Archeological District (8GL13) is composed of numerous middens and earthworks associated with the Belle Glade I and II culture. The earthworks include mounds, linear embankments, a burial mound, borrow areas, and circular ditches. This complex includes archeological sites 8GL11–8GL13, 8GL15–8GL25, 8GL375 and 8GL376. The site is named for a 19th century Seminole war fort (8GL23) built on the site. The complex is situated in both hammock and savannah adjacent to the south bank of Fisheating Creek. The Fort Center Archaeological District is an important prehistoric site group with the potential to be a state park, but it has not been evaluated for NRHP eligibility.

The Herbert Hoover Dike (8GL421) that surrounds Lake Okeechobee is listed in the Florida Master Site File as a district or resource group. The site consists of five historic structures in five different counties; 8GL421A is the historic site structure number for the segment in Glades County. Construction of the dike began in the early 1930s by the U.S. Army Corps of Engineers (USACE) and was completed in 1938. The 34-foot high dike is composed of shell, rock, and gravel covered with grass, trees, and a service drive on top of the levee. It is considered to be the largest civil engineering work in south Florida and continues to control the waters around Lake Okeechobee. This historic resource has been previously determined by the State Historic Preservation Officer (SHPO) to be NRHP-eligible.

The archeological background research did not reveal any military forts, encampments or roads, battle sites, homesteads, farmsteads, trails, or Native American villages within 3 miles of the FPL Glades Power Park site.

There are two Seminole Indian Reservations within the four-county ROI (Seminole Tribe of Florida 2008). The Brighton Seminole Reservation is in Glades County approximately 12 miles northeast of the Glades site. The northern portion of the Big Cypress Seminole Reservation is in the southwest corner of Hendry County approximately 33 miles southeast of the Glades site.

The NRHP identifies 61 properties in the four-county ROI, including two properties in Glades County, 46 properties in Lee County, two properties in Okeechobee County, and 11 properties in

Hendry County. Two of these properties, the Glades Moore Haven Downtown Historic District and the Glades Moore Haven Residential Historic District, are within 10 miles of the Glades site (NPS 2008b).

Siting the proposed nuclear plant at the Glades site would require a formal cultural resources survey, and consultation with the SHPO would be conducted so that any adverse effects to onsite archeological or historic resources would be avoided, minimized, or mitigated. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Mitigation measures would be applied to resolve any adverse effects and reduce impacts to onsite cultural resources from construction or operation of the new units at the Glades site to SMALL.

Sites are considered to have large impacts to historic resources if they would be disturbed or otherwise have their historic character altered by construction. Two historic properties and several archeological areas were identified within 10 miles of the Glades site. Construction of the new units at the Glades site would result in adverse effects to the historic and cultural landscape through introduction of visual elements that would be out of character with the property and its setting. The visual impacts would be LARGE and would warrant mitigation.

Siting the proposed nuclear plant at the Glades site would require a formal determination of areas of potential effect from physical disturbance or visual impacts, identification of historic properties within the areas of potential effect, and a determination of adverse effects. FPL would consult with the SHPO to identify measures for avoidance, minimization, or mitigation of any adverse effects.

9.3.3.1.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 499 block groups within 50 miles of the Glades site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 54 block groups; significant American Indian or Alaskan Native populations exist in 3 block groups; significant other minority populations exist in 21 block groups; significant multiracial minority populations exist in 3 block groups; significant “aggregate of minority races” populations exist in 80 block groups; and significant Hispanic ethnicity populations exist in 53 block groups. There are no block groups containing significant Asian or Native Hawaiian or other Pacific Islander minority populations within 50 miles of the Glades site.

Three Indian Reservations lie within 50 miles of the Glades site: the Brighton Indian Reservation, the Big Cypress Indian Reservation, and a portion of the Miccosukee Indian Reservation. The Brighton and Big Cypress Indian Reservations are both part of the Seminole Tribe of Florida. The Brighton Indian Reservation, 10 miles north of the Glades site, offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. The Big Cypress Reservation, an 85-acre complex 40 miles south of the Glades site, offers the Ah-Tah-Thi-Ki Museum, the Billie Swamp Safari, the Big Cypress RV Resort, the Big Cypress Citrus Grove, the Swamp Water Café, and Big Cypress Hunting Adventures. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

A portion of the Alligator Alley Miccosukee Indian Reservation also lies within the 50-mile radius. The Miccosukee Tribe of Indians was originally part of the Creek Nation, an association of clan villages that inhabited the areas now known as Alabama and Georgia. There are approximately 650 people enrolled in the Miccosukee Tribe. However, The Tamiami Trail Reservation, 40 miles west of Miami in Miami-Dade County, is the site of most Tribal operations and the center of the Miccosukee Indian population. Alligator Alley is the largest of the Miccosukee Tribe reservations and covers approximately 75,000 acres. This land consists of 20,000 acres with potential for development and 55,000 acres of wetlands. The reservation contains a modern service station plaza, a police substation, and 13,000 acres of land that is leased for cattle grazing. Plans are currently underway for additional commercial and agricultural development as well as community facilities and homes sites (Miccosukee Resort and Gaming 2007).

The locations of the minority populations and Indian Reservations within 50 miles of the Glades site are shown in Figure 9.3-9.

The census data characterizes 11.7 percent of Florida households as low income. Based on the “more than 20 percent” criterion, 45 block groups out of a possible 499 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Glades site are shown in Figure 9.3-10.

Although the Glades site is within a minority block group, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not disproportionately impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operating the new units at the Glades site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the Glades site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted.

9.3.3.2 Evaluation of the Martin Site

The Martin site is an 11,300-acre area that includes five fossil-fired power units. A solar unit is now under construction on the land considered as a potential alternative site. The site is owned by FPL (FPL Apr 2009) and is in western Martin County, approximately 40 miles northwest of West Palm Beach, 5 miles east of Lake Okeechobee, and 7 miles northwest of Indiantown. The Miami load center is approximately 65 miles south southeast. The site is bounded on the west by the Florida East Coast Railway (FEC) and the adjacent SFWMD L-65 Canal; on the south by the St. Lucie Canal (C-44 or Okeechobee Waterway); and on the northeast by State Route 710 and the adjacent CSX Railroad (FPL Apr 2009). Site elevation is 28 feet above sea level and outside the 100-year floodplain. The location of the Martin site is shown in Figure 9.3-11.

9.3.3.2.1 Land Use Including Site and Transmission Line Rights-of-Way

Power plant units and related facilities occupy approximately 300 acres of the Martin site. The site also includes a 6800-acre water reservoir (6500 acres of water surface and 300 acres of dike area) used to cool the fossil-fired power units. To the east of the power plant there is an area of mixed pine flat wood and scattered small wetlands. To the north of the onsite water reservoir is a 1200-acre area that has been set aside as a mitigation area. There is a peninsula of wetland forest on the west side of the reservoir that is named the Barley Barber Swamp. The Barley Barber Swap encompasses 400 acres and is preserved as a natural area (FPL Apr 2009). Results of a recent survey show that 210 acres of wetlands are within a 5000-acre area around the proposed location for new units at the Martin site. Agricultural uses such as croplands, pastures, and groves account for much of the land use and cover within 5 miles of the Martin site. Three types of wetlands (forested freshwater, non-forested freshwater, and mixed forested and forested freshwater) also account for a large portion of nearby land use. Forested cover found nearby includes coniferous and other mixed species (FPL May 2008).

Because the site already hosts multiple power generation units, construction of additional power units would not alter site land use. FPL assumed that the total land disturbance at the Martin site as a result of construction activities (laydown areas, batch plant, spoils areas, etc.) would be approximately 491 acres. FPL assumed the footprint of the new facilities would cover approximately 308 acres to include the nuclear power units, support buildings, a switchyard, storage areas, and injection wells for subsurface water disposal (FPL Jan 2008). Because the Martin site is already developed, the need for additional acreage for roads and railroad spurs would be relatively small. The plant footprint would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007).

FPL assumed that a construction of a 1-mile paved access road may be necessary to provide access to the site from State Route 710. Based on a 100-foot right-of-way, this new road would disturb approximately 12.1 acres of land that is currently used for agriculture or natural vegetative growth. In addition, FPL assumed it would be necessary to widen a 2-mile span of State Route 710 to accommodate additional traffic. Based on an additional 50-foot right-of-way for road expansion, this would disturb approximately 12.1 acres of land along Route 710. A railway is approximately 1.5 miles northeast of the site. Based on a 100-foot wide corridor, construction of railway access to the site would disturb approximately 18.2 acres.

Potential surface water sources include the C-44 Channel (approximately 3 miles south) and Lake Okeechobee (approximately 5 miles west). The existing 6800-acre water reservoir, used to cool the fossil-fired power units, is located between the site and Lake Okeechobee. A reasonable shortest path around the north end of the onsite reservoir would extend approximately 8 miles. Based on an assumed 50-foot wide construction corridor, the acreages disturbed to install a water transfer pipeline would be 18.2 acres from the C-44 Channel and 48.5 acres from Lake Okeechobee.

For the purpose of an alternative site analysis, it was assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system. FPL assumed that the lines would be routed approximately 20 miles along two parallel transmission corridors (one for the 230 kV lines the other for the 500 kV lines) from the Martin site to the Corbett Substation in northern Palm Beach County. Each corridor would be nominally 330 feet wide. Overall, the new transmission corridors would occupy approximately 1600 acres. Although the most direct route would generally be used between terminations, consideration would be given to avoidance of possible conflicts with any natural or man-made areas where important environmental resources are located. Route selection would also avoid populated areas and residences to the extent possible. When possible the new lines would be routed along existing transmission rights-of-way. The use of lands that are currently used for forests would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect a small number of residents along the right-of-way. The land use in the region along the new transmission corridors is generally rural, sparsely populated, and primarily used for agricultural activities. Because Martin County is within the

Florida Coastal Zone, the route for the new transmission lines may be subject to Florida Coastal Zone Management requirements.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Based on the land disturbance totals and the existing industrial use, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Martin site and the transmission corridor would be SMALL.

9.3.3.2.2 Air Quality

Martin County (the Martin site is within Martin County) is part of the Southeast Florida Intrastate Air Quality Control Region. Martin County, along with the entire State of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Martin site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Martin site would be comparable to the emissions generated at the Turkey Point site, as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to any of those from any those from large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total emissions from the fossil units at the Martin plant and other emission sources in the region; therefore, it is unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I Areas. The Federal Class I Area nearest to the Martin site is the Everglades National Park more than 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I Area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I Area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.2.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The Martin site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans more than 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance, because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Currently, Lake Okeechobee’s water quality and ecological health are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the Northern Everglades and Estuaries Protection Program that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, building treatment wetlands to clean water flowing into the lake, and creating between 900,000 and 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980). For the year 2000, the average groundwater withdrawals in Martin County were 43.6 million gallons per day—approximately 87 percent of this was from surficial aquifers (37.8 million gallons per day) and the other 13 percent (5.8 million gallons per day) was from the Floridan aquifer (USGS Dec 2004).

The average daily water withdrawal rate in Martin County (from both groundwater and surface water sources) in year 2000 was 198.87 million gallons. Approximately 78.1 percent (155.3 million gallons) was from fresh surface water, and 21.9 percent (43.6 million gallons) was from fresh groundwater. No saline water withdrawals were reported (USGS Dec 2004). Average withdrawal for agricultural use in the year 2000 was 140 million gallons per day that represented 70 percent of daily withdrawals from available sources. The second largest user was the power generation industry with an average withdrawal rate of 24.63 million gallons per day (12.4 percent) (USGS Dec 2004). Major surface freshwater sources near the Martin site include Lake Okeechobee (5 miles away), the C-44 Channel (3 miles away), and the SFWMD L-65 Canal (5.8 miles away) (FPL Apr 2009).

The depth to the water table near the site is less than 30 feet below ground level (USGS 2008). Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al.,1985).

As shown in Table 3.3-1, the peak construction water demand is estimated at 407 gpm which is slightly less than 1 cubic foot per second, and the peak estimated potable water demand for operations is 70 gpm. As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the C-44 Channel offers an estimated 360 cfs. Water use impacts are considered small when water sources are readily available to meet demand. Therefore, because adequate water sources are available nearby, the impact on regional water use for both construction and operation would be SMALL.

Lake Okeechobee is identified as a potential potable and process water source for the Martin site. The anticipated total water demand associated with plant operations (approximately 100 cfs) would represent a negligible fraction of the average lake recharge rate of 48,300 cfs. Therefore, it is not expected that water demand for plant operations would adversely impact water quality for Lake Okeechobee.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). For the Martin site, FPL assumed that a closed loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown water is either routed to a suitable nearby surface water body or injected into the Boulder Zone. The Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders. Construction and operation activities at the Martin site would be performed under the authorization of an NPDES permit (construction), IWW permit (surface water), or UIC permit (groundwater) issued by the FDEP (FDEP 2008b). Any releases from the power plant site into Lake Okeechobee or regional streams as result of construction or operation would be regulated by the FDEP through the NPDES, IWW, or UIC permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.2.4 Terrestrial Resources and Protected Species

The terrestrial systems within the Martin site area include palmetto prairie and pine flatwoods. Surrounding areas also include unimproved pasture, herbaceous rangeland, mixed hardwood/conifer forest, mixed wetland hardwoods, cypress, mixed wetland forest, freshwater marsh, and wet prairie (FPL May 2008). Although the palmetto prairie and pine flatwoods areas at the site provide habitat for common wildlife species such as feral pig, turkey, armadillo, and white-tailed deer, no unique wildlife species or critical habitat for listed species would be impacted. These habitats are also common in the surrounding area (FPL May 2008). A portion of the site has been severely altered by the past construction of the existing Martin plant and provides poor wildlife habitat. The ditches and stormwater basin provide foraging opportunities for wading birds. Habitat for fish and wildlife is provided by the makeup water reservoir (FPL May 2008). In the 5000 acres surrounding the Martin site, there are 210 acres of wetlands, none of which are considered high quality wetlands, such as forested wetlands. Any wetland functions that are impacted during construction would be replaced or restored. Construction of the new facilities at the Martin site would disturb an estimated 308 acres (FPL Jan 2008).

A vegetation/land use survey of the project area and surrounding areas was conducted in March 2008 as part of the Site Certification Modification for the Martin Solar Energy Center. Before the 2008 field surveys, literature reviews were undertaken to determine the species that could potentially be present in the habitats found on the project area (FPL May 2008). Threatened, endangered, and/or species of special concern that occur within Martin County are listed in Table 9.3-8. The field surveys and FNAI database review did not result in any occurrences of listed plant species in the vicinity of the project area. Listed fauna species observed or likely to occur within the project area include the American alligator as well as several species of wading birds: white ibis, little blue heron, tricolored heron, snowy egret, wood stork, and sandhill crane. According to the FFWCC Bald Eagle Nest Location Database, two active bald eagle (*Haliaeetus leucocephalus*) nests are within approximately 2 miles of the project area. Nest MT012 is within the Northwest Mitigation Area just north of the cooling pond at 27°04.64′ N 80°36.42′ W (Section 14, Township 39 South, Range 37 East). Nest MT002 is in the Barley Barber Swamp at 27°02.77′ N 80°35.66′ W (Section 25, Township 39 South, Range 37 East). The FNAI database review found one occurrence of an active bald eagle nest in the Barley Barber Swamp (Nest MT002) and another nest approximately 0.25 miles west of the Northwest Mitigation Area. In addition, the Florida Game and Freshwater Fish Breeding Bird Atlas Project identified both the bald eagle and the Florida sandhill crane (*Grus canadensis pratensis*) as breeding in the cooling pond to the west of the project area. A bald eagle was observed between the cooling pond and the Northwest Mitigation Area during field reconnaissance conducted in March 2008 (FPL May 2008).

Further field surveys would be conducted for federally listed and state protected species as part of the permitting process before any clearing or construction activities at the site or along associated transmission or pipeline corridors. Land preparation activities associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.2.1, FPL assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system via the Corbett Substation in northern Palm Beach County. The transmission lines would be routed in two parallel corridors. Each corridor would be approximately 20 miles long and nominally 330 feet wide. Construction of the new transmission lines would impact approximately 1600 acres of transmission corridor. Although the most direct route would generally be used between terminations, consideration would also be given to avoiding possible conflicts with natural areas where important environmental resources are, such as the bald eagle and the Florida sandhill crane.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry; however, the freshwater sources identified for the Martin site have modest levels of salts and dissolved minerals; therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. There are no known sensitive species onsite, and the transmission corridors would be short. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and transmission corridor at the Martin site would be SMALL.

9.3.3.2.5 Aquatic Resources and Protected Species

The Martin site is on the St. Lucie Canal approximately 5 miles from Lake Okeechobee. The surface waters near the project area, which potentially could be affected by site preparation and construction activities, include the L-65 Canal and the St. Lucie Canal. There are also four onsite surface water bodies on the Martin plant site: the cooling pond, the Barley Barber Swamp, the Northwest Parcel wetland mitigation area, and the make-up (intake/discharge) canal (FPL May 2008). Lake Okeechobee is at the center of south Florida's regional water management system, and is in south-central Florida. The massive lake is a 730 square mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. Lake Okeechobee's drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value that is in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the St. Lucie Canal (the C-44 Channel) or Lake Okeechobee via pipeline would be the source to cool the new nuclear units constructed at the Martin site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No federally or state-listed aquatic species are known to exist in the St. Lucie Canal in the vicinity of the Martin site (FNAI 2008b). Field surveys would be conducted for federally listed and state-protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Martin site would be SMALL.

The most likely aquatic impact from nuclear operations at the Martin site would be entrainment and impingement of aquatic organisms in the St. Lucie Canal. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Martin site would be SMALL.

9.3.3.2.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Martin site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every ten years. The most recent decennial census was performed in year 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored the development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Ideally, a socioeconomic analysis would be based on the most recent census information. However, because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census was chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.2.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most construction activities would occur within the boundaries of the Martin site. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Martin site is in a rural area generally surrounded by agricultural land and with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits would govern operation of this equipment to ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the Martin site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Martin site would be SMALL.

9.3.3.2.6.2 Demography

The population distribution near the Martin site is low with typical rural characteristics and satisfies the 10 CFR Part 100 definition of a low population zone. The nearest population center larger than 25,000 residents is Port St. Lucie 20 miles east. Coterminous counties include St. Lucie to the north, Okeechobee to the northeast, and Palm Beach to the south.

The entire Martin plant workforce lives in a four-county region that includes Martin County (32.7 percent), Okeechobee County (24.0 percent), St. Lucie County (23.1 percent), and Palm Beach County (20.2 percent) (FPL Dec 1989). Based on this workforce demographic, these same counties are selected to represent the ROI for socioeconomic analysis of the Martin site.

Based on the 2000 census, the total population within the ROI was 1,486,520 which included 126,731 in Martin County; 35,910 in Okeechobee County; 1,131,184 in Palm Beach County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 1,706,883 people, which included 139,182 in Martin County; 40,311 in Okeechobee County; 1,266,451 in Palm Beach County; and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site, and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site, and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Martin site is 870.0 square miles, and based on 2000 census data, the population of this area was 95,093 (U.S. NRC Aug 2003). This yields a population density of 109.3 people per square mile. There is at least one city within 20 miles of the Martin site that has a population greater than 25,000. Therefore, the sparseness level is 3 (population density of 60 to 120 people per square mile and at least one community greater than 25,000 people within 20 miles) (NUREG-1437).

The land area within 50 miles of the Martin site is 5486.6 square miles, and the population of this area was 1,380,905 (U.S. NRC Aug 2003). This yields a population density of 251.7 people per square mile. Therefore, based on NRC guidelines, the proximity level is 4 (population density greater than or equal to 190 people per square mile within 50 miles). Therefore, the Martin site has a sparseness-proximity measure of 3.4, which is categorized as high NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the Martin site relative to population centers, FPL assumed that 50 percent of the construction and operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction and 100 percent of operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 1824 construction and operation workers would relocate to the area in the project construction phase, and 1291 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the Martin site would be 4729 people. An influx of 4729 people represents a 0.3 percent increase in the ROI population of 1,486,520 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437). Therefore, worker influx would pose a SMALL impact on population for the ROI.

At the county level, if the demographic distribution of the construction workforce follows that of the Martin plant workforce, the addition of the construction and operation workforce employees and their families would increase the population in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 1.2 percent, 3.2 percent, 0.1 percent, and 0.6 percent, respectively. These represent SMALL increases in the county population levels.

FPL estimated the total onsite operations workforce to be 1050 workers and assumed that 50 percent of these workers (525) would relocate from outside the ROI. For this analysis, FPL assumed that 100 percent of operations workers who relocated would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project would be 1706 people. This represents a 0.1 percent increase in the ROI population. At the county level, if the demographic distribution of the operations workforce follows that of the Martin plant workforce, the addition of the operations workforce employees and their families would increase the population in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 0.4 percent, 1.1 percent, 0.03 percent, and 0.2 percent, respectively. These represent SMALL increases in the county population levels.

In summary, the population increase in the ROI would pose a SMALL demographic impact. Likewise, it is anticipated that the population increase in each of the four counties would pose a SMALL impact.

9.3.3.2.6.3 Economy

Based on 2000 census data, Martin County had a civilian labor force of 53,301 people and an unemployment rate of 4.2 percent; Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent; Palm Beach County had a civilian labor force of 510,046 people and an unemployment rate of 5.0 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent. For the entire ROI, 99.92 percent of the labor force was part of the civilian labor force and 0.08 percent was in the armed forces. Of the civilian labor force, 95.1 percent were employed and 4.9 percent were unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the State, which is 5.6 percent (USCB 2000).

The principal economies of the counties in the ROI are the same, dominated mainly by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force within the four-county ROI resides in Palm Beach County (USCB 2000).

As described above, the peak number of workers at the Martin site would include 3548 construction workers and 99 operations workers, and half of these workers (1824) are assumed to relocate from outside the area. An influx of 1824 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7289 jobs (direct and indirect) for every construction job and 2.2799 for every operation job (BEA Aug 2009), an influx of 1824 construction and operation workers would create 1384 indirect jobs, for a total of 3207 new jobs in the ROI. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries and the housing industry. Based on the workforce demographics of the Martin plant, the additional jobs created would represent 2 percent, 5.2 percent, 0.1 percent, and 0.9 percent of the workforce in Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). Economic impacts attributable to project construction are considered beneficial and therefore require no mitigation. The number of new jobs created would represent only a 0.5 percent increase in jobs within the ROI, therefore, the economic impacts for the ROI would be SMALL. The projected increase in Okeechobee County would be MODERATE, and the projected increases in the other counties would be SMALL.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Martin site (U.S. DOE May 2004), and FPL assumed that 50 percent of these employees would migrate into the region. Based on a multiplier of 2.2799 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 525 operations workers would create 672 indirect jobs for a total of approximately 1197 new jobs in the region. Based on the workforce demographics of the Martin plant, the additional jobs created would represent 0.7 percent, 1.9 percent, 0.05 percent, and 0.3 percent of the workforce in Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. FPL concluded that the impacts of operation of two nuclear power facilities on the economy would be beneficial and SMALL in the ROI and mitigation would not be warranted.

9.3.3.2.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Martin site would benefit the state and local tax authorities. FPL would pay property taxes to each of the taxing authorities whose boundaries would contain the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the Martin site, because the units would not generate revenues until they become operational. However, once the units were placed in service, Martin County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Martin site would be similar those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2006 fiscal year, Martin County had property tax revenues of $139,155,807 (State of Florida Dec 2007).

With respect to the school districts in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida’s 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that re-allocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers’ children. Therefore, it is not possible to assess the direct impact of the plant on the school districts. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 4.7 percent of 2007 property tax payments for Martin County would be provided by FPL and would constitute a SMALL positive impact.

9.3.3.2.6.5 Transportation

Roadways close to the proposed site include U.S. Highway 98 (a two-lane highway) that spans north-south between the Martin site and Lake Okeechobee, State Route 76 (a two-lane highway) that spans generally east-west near the southern boundary of the site, and State Road 710 (a two-lane highway) that spans in a northwesterly direction from Indiantown. Principal road access to the Martin site would be from State Road 710 that spans in northwest-southeast orientation along the northeast site boundary. State Road 710 intersects with State Road 70 near Okeechobee approximately 20 miles northwest, and intersects with State Road 76 approximately 7 miles southeast at Indiantown. The region east and northeast of State Road 710 is rural and sparsely populated with few roads; therefore, most workforce commuters access State Road 710 from State Road 76 or State Road 70.

FDOT reports the AADT count at two locations along State Road 710, one in Okeechobee County approximately 18 miles northwest of the site, and one in Martin County approximately 4 miles southeast of the site. The AADT count and directional peak hour volume of the northwestern location is 8300 vehicles per day and 482 vehicles per hour (FDOT 2008). This peak hour volume classifies this location as a LOS of D (FDOT 2007) and already exceeds the Martin County peak hour capacity by 62 vehicles. The AADT count and directional peak hour volume of the southeastern location is 9600 vehicles per day and 543 vehicles per hour (FDOT 2008). This directional peak hour volume also classifies this location as a LOS of D (FDOT 2007) and already exceeds the Martin County peak hour capacity by 12 vehicles.

Based on the existing workforce at the Martin site, nearly equal amounts of the construction workforce would use the northwestern and southeastern portions of State Road 710. Also, the traffic attributable to construction material deliveries could cause additional congestion on State Road 710 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Martin site would add 1125 and 944 vehicles during the peak hour to the respective northwestern and southeastern portions of State Road 710. This would cause the road to further exceed capacity, add to existing traffic congestion, and drop both roadway locations to a LOS classification of F.

Based on the above analysis, it is likely that the additional traffic would pose delays along State Road 710. To facilitate the additional traffic, State Road 710 could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would be needed along State Road 710 between Okeechobee and

Indiantown in the vicinity of the Martin site. The NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant since both refurbishment and new plant construction would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at the Martin site would add approximately 323 and 271 more vehicles to the northwestern and southeastern portions of State Road 710 during the hour of peak traffic, respectively. If the roadway modifications to State Road 710 (mentioned above) were undertaken, the directional peak hour capacity of this roadway would accommodate the additional traffic from operations. Without these modifications, shift changes could also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels, in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be LARGE.

9.3.3.2.6.6 Aesthetics and Recreation

The Martin site is an 11,300-acre area that includes five fossil-fired power units and a solar unit. The site is owned by FPL and is in western Martin County approximately 5 miles east of Lake Okeechobee. The site is on flat land with minor relief at an approximate elevation of 28 feet above MSL (USGS 1953) and lies within the Everglades physiographic province (USGS 2008).

The construction of the new units at the Martin site could be viewed from offsite at certain locations, but the addition of two nuclear facilities would not substantially change the viewscape that results from the current fossil-fired units. There could be a need to construct cooling water intake and discharge structures at Lake Okeechobee or the C-44 Water Channel. Additional cooling towers would be required. Operation of the new nuclear units probably would have visual impacts similar to those of the fossil-fired units at the Martin plant, but with occasional visible vapor plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered small if there are no complaints about diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the new units on aesthetics would be SMALL and would not warrant mitigation.

The western shoreline of Lake Okeechobee lies within 5 miles of the Martin site, as well as portions of the Lake Okeechobee Scenic Trail and Big Water Heritage Trail, which parallel the Lake Okeechobee shoreline. Lake Okeechobee occupies 730 square miles and is the second largest freshwater lake wholly within the United States. The lake is the epicenter of Florida and is renowned for its unique natural habitat, rich heritage, and recreational opportunities to fish and view birds (SFRPC 2008).

The Lake Okeechobee Scenic Trail spans 110 miles along the perimeter of Lake Okeechobee. The Trail is designated as a segment of the Florida National Scenic Trail. The trail is atop the Herbert Hoover Dike, which surrounds the lake for flood protection, and provides views ranging from scenic lakeside to working agricultural landscapes. The trail affords opportunities to view wildlife, fish, bike, and hike. The nearest access point to the trail from the Martin site is the Port Mayaca Recreation Area, which is west of the site (USACE 2008a).

The Big Water Heritage Trail is a designated vehicle roadway that provides vehicular access to the landscapes created by south central Florida's watersheds. The trail begins at the Kissimmee River and continues through the communities around Lake Okeechobee and south through the Everglades. It includes portions of State Road 78, U.S. Highway 27, State Road 76, U.S. Highway 98, U.S. Highway 441, and spans within a few miles of the Martin site. The Big Water Heritage Trail is a partnership project that promotes public awareness of natural and cultural features (SFRPC 2008).

The Barley Barber swamp is approximately 2 miles west of the Martin site and comprises a 400-acre freshwater cypress swamp preserve. The swamp is managed by FPL as a nature preserve that provides visitors with an example of how Florida may have appeared more than 100 years ago. The swamp is open to the public by appointment only (FPL Dec 1989).

The DuPuis Wildlife and Environmental Area and J. W. Corbett Wildlife Management Area are less than 5 miles south of the Martin site (SFWMD 2005b). The Dupuis Management Area consists of nearly 22,000 acres that were part of the Everglades ecosystem before conversion to a ranch, which altered the hydrology of the area. The South Florida Water Management District is currently restoring portions of the land by rehydrating interior wetlands. The DuPuis Wildlife and Environmental Area offers hunting, hiking, camping, horseback riding, and scenic driving (FFWCC 2008b). The J.W. Corbett Wildlife Management Area consists of approximately 60,230 acres and also offers hunting, hiking, camping, horseback riding, and scenic driving (FFWCC 2008c).

Within 50 miles of the Martin site there are a number of lakes, rivers, swamps, wetlands, and other areas of interest that include three National Wildlife Refuges: Arthur R. Marshall Loxahatchee, Hobe Sound, and Pelican Island National Wildlife Refuges.

Of the 154 state parks in Florida, 10 are within 50 miles of the Martin site. The closest state park to the site is the Atlantic Ridge State Preserve, approximately 19 miles east of the site (SFWMD 2005b).

Because the Martin site already hosts a power plant with tall structures and transmission towers, the construction and operation of the two new nuclear power units and associated transmission lines would not pose an appreciable change in viewscape. Therefore, visual impacts on the region would be SMALL.

The attractiveness of the Okeechobee Lake for fishing and other recreational uses could be impacted during construction of intake and discharge structures. During operation, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operation would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.2.6.7 Housing

FPL estimated that 1824 construction and operation workers would move from outside the ROI to the counties within the ROI. These 1824 workers would need housing. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in a private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there were 728,665 housing units of which 109,676 were vacant (15.1 percent). At the county level, the number of vacant housing units was 10,183 (15.6 percent) in Martin County; 2911 (18.8 percent) in Okeechobee County; 82,253 (14.8 percent) in Palm Beach County; and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

Based on absolute numbers, FPL estimated that the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region. At the county level, if the construction workforce that moved to the ROI followed that of the workforce at the Martin plant, the percentage of vacant housing required in each county would be 5.9 percent, 15 percent, 0.4 percent, and 2.9 percent for Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). In summary, FPL concluded that the impacts on housing could be Moderate in Okeechobee County but would be SMALL in the other individual counties of the ROI. For the ROI, the impacts on housing during plant construction would be SMALL and mitigation would not be warranted.

FPL estimated that 1050 workers would be needed for operation of two nuclear power facilities at the Martin site (U.S. DOE May 2004). An estimated 50 percent of these workers (525) would come from within the ROI, and 50 percent (525) would relocate to the area. This would represent less than 1 percent of the vacant housing in the ROI. At the county level, if the construction workforce that moved to the ROI followed that of the workforce at the Martin plant, the percentage of vacant housing required in each county during plant operations would be 1.7 percent, 4.3 percent, 0.1 percent, and 0.8 percent for Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be SMALL and mitigation would not be warranted.

9.3.3.2.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities, law enforcement, fire and medical facilities, libraries, parks and recreation, roadway maintenance, and other social services. Construction or operations employees who relocate from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely pose an economic benefit for the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents-to-law enforcement officers in Martin, Okeechobee, Palm Beach, and St. Lucie Counties was 466:1, 399:1, 928:1, and 722:1, respectively (FBI 2008). Within the ROI, the resident-to-law enforcement officer ratio was 804:1, and for the state of Florida, the resident-to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Martin site would increase the resident to law enforcement officer ratio by 0.32 percent to 807:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield only a 0.11 percent increase.

The ratio of residents to firefighters in Martin, Okeechobee, Palm Beach, and St. Lucie Counties was 363:1, 492:1, 519:1 and 563:1, respectively. Within the ROI, the resident-to-firefighter ratio was 505:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009). As was described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Martin site would increase the resident-to-firefighter ratio by 0.32 percent to 506:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.12 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.2.6.9 Education

Based on data for the 2006–2007 school year, Martin County had 36 prekindergarten through 12 (PK-12) schools with a total enrollment of 18,239 students; Okeechobee County had 17 PK-12 schools with a total enrollment of 7289 students; Palm Beach County had 264 PK-12 schools with a total enrollment of 171,431 students; and St. Lucie County had 46 PK-12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there were 363 PK-12 schools with a total enrollment of 235,752 students (NCES 2009).

FPL estimated that 1824 construction and operation workers would migrate to the area, and that 1291 of these workers would bring a family. This would yield a total population increase of 4729 people. Based on an estimate of 0.8 school-aged children per family, 1033 of the 4740 people who relocated to the four-county area would be school-aged children. This would yield a 0.4 percent increase in the student population within the ROI.

Based on the demographic distribution of the Martin plant workforce, an increase of 1033 students would increase the student populations in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 1.9 percent, 3.4 percent, 0.1 percent, and 0.6 percent, respectively. Small impacts are generally associated with project-related enrollment increases less than 3 percent and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, projected increases in the student populations for the ROI would be SMALL. The projected increase in Okeechobee County would be MODERATE, and the projected increases in the other counties would be SMALL. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and special option sales tax revenues as a result of the increased population would fund additional teachers and facilities. No additional mitigation would be warranted.

FPL assumed that 525 operations workers and their families would relocate from outside the region, and that the total population increase would be 1706 people. This would include an estimated 420 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 0.2 percent. Based on the demographic distribution of the Martin plant workforce, an increase of 420 students would increase the student populations in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 0.8 percent, 1.4 percent, 0.05 percent, and 0.25 percent, respectively. Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL and mitigation would not be warranted.

9.3.3.2.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service National Register Information System, and reviewed information on historic and archeological sites provided in documents associated with the FPL Martin Expansion project. Where applicable, historic and archeological sites are identified by their historic site structure identifier.

A detailed cultural resource assessment was conducted at the Martin site in 1989 in support of the Martin Coal Gasification/Combined Cycle (CG/CC) project (FPL May 2008). Approximately 3300 acres of the Martin Power plant site were proposed for use for that project that encompassed the area for the proposed nuclear plant at the Martin site. As a result, an evaluation of sites with archaeological or historical importance was performed for the Martin site.

The evaluation consisted of a review of the Florida Master site File and the examination of the historical and archeological literature and historic records. The search revealed that no archeological sites have been recorded on the FPL Martin plant site.

Areas of potential high archaeological importance were identified based on U.S. Geological Survey (USGS) Quadrangle Maps and aerial photographs before the 1989 field survey. The archeological field survey included each of these areas plus other areas identified in the field with potential significance. The survey strategy required an intensive, systematic, cultural resource survey of these areas and limited systematic and judgmental survey of the remaining areas. The surveys found no archaeological sites within those areas currently designated for the Martin site (FPL May 2008).

The NRHP identifies 100 sites in the four-county ROI; including 70 sites in Palm Beach County, 12 sites in Martin County, 16 sites in St. Lucie County, and two sites in Okeechobee County. One of these properties, the Seminole Inn, is within 10 miles of the Martin site (NPS 2008c). The Seminole Inn is an historic hotel in Indiantown, Florida (Martin County). It was built by S. Davies Warfield, who was president of the Seaboard Air Line Railroad, which developed Indiantown.

Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. A detailed cultural resource assessment conducted at the Martin site in 1989 found no archaeological sites within those areas currently designated for the Martin site; therefore, FPL concludes that impacts to cultural sites during construction or operation of the proposed nuclear plant at the Martin site would be SMALL.

Construction of the new units at the Martin site could be viewed from the historic and cultural sites within 10 miles of the site, but the addition of two nuclear power facilities would not substantially change the view. The operation of the new units probably would have visual impacts similar to those of the existing FPL Martin power plant, with the addition of cooling tower plumes. Therefore, visual impacts of construction and operation of the Martin site relative to historic and culture sites would be SMALL and would not warrant mitigation.

9.3.3.2.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 794 block groups within 50 miles of the Martin site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 118 block groups; significant American Indian or Alaskan Native populations exist in 1 block group; significant other race minority populations exist in 7 block groups; significant multiracial minority populations exist in 3 block groups; significant aggregate of minority races populations exist in 139 block groups; and significant Hispanic ethnicity populations exist in 55 block groups. There are no block groups containing significant Asian or Native Hawaiian or other Pacific Islander minority populations within 50 miles of the Martin site.

The Brighton Seminole Indian Reservation is 30 miles west of the Martin site. As described in Subsection 9.3.3.1.8, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the Martin site and the Brighton Indian Reservation are shown in Figure 9.3-12.

The USCB data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 53 block groups out of a possible 794 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Martin site are shown in Figure 9.3-13.

Although the Martin site is within a minority block group, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not disproportionately impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the Martin site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concluded that construction and operation of the proposed nuclear plant at the Martin site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted.

9.3.3.3 Evaluation of the Okeechobee 2 Site

The Okeechobee 2 site is a 3000-acre undeveloped site in Okeechobee County and is approximately 8 miles west of the town of Okeechobee, just north of State Road 70 along County Road 128th Avenue Northwest. The site is not owned by FPL but is considered potentially available and feasible for a power generation project. Nearby towns include Okeechobee (8 miles east), Buckhead Ridge (10 miles south), Lakeport (22 miles southwest), Cypress Quarters (10 miles east southeast), Taylor Creek (11 miles east southeast), Indiantown (34 miles southeast), Fort Pierce (40 miles northeast), Lorida (14 miles northwest), Lake Placid (19 miles west), Moore Haven (29 miles south), and Port St. Lucie (30 miles east). (Rand McNally 1999)

The Miami Load Center is approximately 90 miles to the south. Nearby water bodies include the Kissimmee River (2 miles west) and Lake Okeechobee (7.6 miles southeast). The site is just outside of a 100-year floodplain. The location of the Okeechobee 2 site is shown in Figure 9.3-14.

9.3.3.3.1 Land Use Including Site and Transmission Line Rights-of-Way

The Okeechobee 2 site is used mainly for farmland and agriculture. The county has substantial cattle, dairy, and citrus operations. The site is generally flat with a mean elevation of 28 feet. Results of a recent survey show that 961 acres of wetlands are within the 5000-acre area that encompasses the site. Construction of the power plant and transmission lines would alter land use at the site from agricultural to industrial. FPL assumed that the total land disturbance at the Okeechobee 2 site because of construction activities (laydown areas, batch plant, spoils areas, etc.) would be approximately 491 acres. FPL assumed the footprint of the new facilities would cover approximately 308 acres (FPL Jan 2008). New facilities added would include the nuclear power units, support buildings, a switchyard, storage areas, and injection wells for subsurface water disposal. Because the Okeechobee 2 site is undeveloped, additional acreage would be required for roads and railroad spurs. The entire plant footprint would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007).

The presence of two major roadways, State Road 70 and U.S. Highway 98, close to the site reduces the level of road construction and road improvements necessary to provide local road access to the site. However, based on current traffic volume along State Road 70 and anticipated traffic levels attributable to construction, FPL assumed it would be necessary to widen a 6-mile span of State Road 70 from two lanes to four lanes. Based on a 100-foot right-of-way, road improvements would disturb approximately 72.6 acres of land. The nearest railway is approximately 2.2 miles northeast of the site. Based on a 100-foot wide corridor, construction of railway access to the site would disturb approximately 26.7 acres.

Potential surface water sources include the Kissimmee River (approximately 2 miles west) and Lake Okeechobee (approximately 7.6 miles southeast). Based on a 50-foot wide pipeline construction corridor, the acreages disturbed for these options would be 12 acres and 46 acres, respectively.

For the purpose of alternative site analysis, it was assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system. FPL assumed that the lines would be routed approximately 48 miles along two parallel transmission corridors (one for the 230 kV lines the other for the 500 kV lines) from the Okeechobee 2 site to the Corbett Substation in northern Palm Beach County. Each corridor would be nominally 330 feet wide. Overall, the new transmission corridors would occupy approximately 3840 acres. Although the most direct route would generally be used between terminations, consideration would be given to avoidance of possible conflicts with any natural or man-made areas where important environmental resources are located. Route selection would also avoid populated areas and residences to the extent possible. When possible the new lines would be routed along existing transmission rights-of-way. The use of lands that are currently used for forests would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect a small number of residents along the right-of-way. The land use in the region (along the new transmission corridors) is generally rural, sparsely populated, and primarily used for agricultural activities. The Okeechobee 2 site is 45 miles inland from the Atlantic Ocean and is therefore not part of the Florida Coastal Zone. The route for the new transmission lines range from 25 to 45 miles inland and would not pass through any portion of the Florida Coastal Zone.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Impacts are considered moderate if land disturbance is greater than 3000 acres or there are major changes to land use. Based on the land disturbance totals and the change of land use from agricultural to industrial, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Okeechobee 2 site and the transmission corridor would be MODERATE.

9.3.3.3.2 Air Quality

Okeechobee County (which includes the Okeechobee 2 site) is part of the Southeast Florida Intrastate Air Quality Control Region. Okeechobee County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Okeechobee 2 site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Okeechobee 2 site would be comparable to the emissions generated at the Turkey Point site as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to those associated with any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total vehicular emissions in the region. It is unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. The Federal Class I area nearest to the Okeechobee 2 site is the Everglades National Park nearly 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.3.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The Okeechobee 2 site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans over 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Currently, Lake Okeechobee's water quality and ecological health are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the Northern Everglades and Estuaries Protection Program that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, building treatment wetlands to clean water flowing into the lake, and creating between 900,000 and 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

In the year 2000, the average daily surface freshwater withdrawals in Okeechobee County totaled 12.0 million gallons, which represents 16.7 percent of the total daily withdrawal rate for the county (71.83 million gallons) (USGS Dec 2004). Major surface freshwater sources near the Okeechobee 2 site include Lake Okeechobee (7.6 miles away) and the Kissimmee River (2 miles away).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS July 1980).

In the year 2000, average daily water withdrawals in Okeechobee County for the year 2000 included groundwater (59.8 million gallons) and surface water (12 million gallons) for a total of 71.8 million gallons. Principal groundwater sources in the county included the Floridan and surficial aquifers. Nearly 96 percent of groundwater withdrawals (57.29 million gallons per day) and 93 percent of surface water withdrawals (9.75 million gallons per day) were used for agriculture. Average daily public water supply in Okeechobee County for the year 2000 was 2.23 million gallons per day, which included 24 percent fresh groundwater and 76 percent fresh surface water (USGS Dec 2004).

The depth to the water table near the site is less than 20 feet below ground level. Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al.,1985).

Site groundwater wells are expected to be installed in the middle Floridan aquifer. Since the site is inland from the coast, lateral saltwater intrusion is not likely. However, there is a potential for saltwater to migrate vertically into the middle Floridan aquifer from the saline deeper Floridan aquifer. Since the middle Floridan aquifer already produces brackish water, resultant saltwater intrusion could require additional osmosis or freshwater mixing to satisfy potable water quality standards.

As shown in Table 3.3-1, the peak construction water demand is estimated at 407 gpm which is slightly less than one cubic foot per second, and the peak estimated potable water demand for operations is 70 gpm. As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of more than 360 cfs, and an estimated 475 cfs is available from the Kissimmee River. The estimated groundwater potential at the Okeechobee 2 site is approximately 155 million gallons per day. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Okeechobee 2 site. Water use impacts are considered small when water sources are readily available to meet demand. Therefore, because adequate water sources are available nearby, the impact on regional water use for both construction and operation would be SMALL.

Lake Okeechobee is identified as a potential potable and process water source for the Okeechobee site. The anticipated total water demand associated with plant operations (approximately 100 cfs) would represent a negligible fraction of the average lake recharge rate of 48,300 cfs. Therefore, it is not expected that water demand for plant operations would adversely impact water quality for Lake Okeechobee.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). For the Okeechobee 2 site, FPL assumed that a closed-loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown water is either routed to a suitable nearby surface water body or injected into the Boulder Zone. The Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders. Construction and operation activities at the Okeechobee 2 site would be performed under the authorization of an NPDES permit (construction), IWW permit (surface water), or UIC permit (groundwater) issued by the FDEP (FDEP 2008b). Any releases from the water storage reservoir into Lake Okeechobee or regional streams as result of construction or operation would be regulated by the FDEP through the

NPDES, IWW, or UIC permit process to ensure that water quality was protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.3.4 Terrestrial Resources and Protected Species

The Okeechobee 2 site is a 3000-acre undeveloped site used mainly for farmland and agriculture. The site is generally flat with a mean elevation of 28 feet. In the 5000 acres surrounding the Okeechobee 2 site, there are 961 acres of wetlands, of which 143 acres are considered high quality wetlands, such as forested wetlands. Any wetland functions that are impacted during construction would be replaced or restored. Construction of the new facilities at the Okeechobee 2 site would require clearing at least 308 acres (FPL Jan 2008).

Wildlife viewing along the nearby Lake Okeechobee Scenic Trail, which encircles Lake Okeechobee, includes herons, egrets, and wintering waterfowl, which are prevalent along the rim of the lake and in open water. Dry prairies interspersed with oak and cabbage palm hammocks provide habitat for crested caracaras (*Caracara cheriway*), burrowing owls (*Athene cunicularia floridana*), and sandhill cranes (*Grus canadensis pratensis*). Alligators, snakes, and turtles are common in the marshes (FFWCC 2008d). In neighboring Highlands County, the Lake Wales Ridge Wildlife and Environmental Area, which contains habitat similar to the Okeechobee 2 site, has a number of species present: amphibians and reptiles include the American alligator (*Alligator mississippiensis*), dusky pygmy rattlesnake (*Sistrurus miliarius barbouri*), eastern indigo snake (*Drymarchon corais couperi*), gopher frog (*Rana capito*), gopher tortoise (*Gopherus polyphemus*), green anole (*Anolis carolinensis*), short-tailed snake (*Stilosoma extenuatum*), and southern black racer (*Coluber constrictor priapus*). Birds include the bald eagle (*Haliaeetus leucocephalus*), common loon (*Gavia immer*), Florida scrub-jay (*Aphelocoma coerulescens*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), osprey (*Pandion haliaetus*), roseate spoonbill (*Platalea ajaja*), sandhill crane (*Grus canadensis pratensis*), snowy egret (*Egretta thula*), and swallow-tailed kite (*Elanoides forficatus*). Mammals include the bobcat (*Lynx rufus*), coyote (*Canis latrans*), Florida black bear (*Ursus americanus floridanus*), Florida mouse (*Podomys floridanus*), Florida weasel (*Mustela frenata peninsulae*), gray fox (*Urocyon cinereoargenteus*), and river otter (*Lutra Canadensis*) (FFWCC 2008e).

Threatened, endangered, and/or species of special concern that exist in Okeechobee County are listed in Table 9.3-9. The FNAI biodiversity matrix query results for the matrix units encompassing the Okeechobee 2 site did not include any documented occurrences of rare species tracked by FNAI (FNAI 2008b).

According to the FFWCC Bald Eagle Nest Location Database, no active bald eagle (*Haliaeetus leucocephalus*) nests are at the Okeechobee 2 site. The closest nest is approximately 1.4 miles from the project area, and there are five nests within 2 miles: Nests OK005, OK006, OK017, OK026, and OK027 (FFWCC 2008a).

Further field surveys would be conducted for federally listed and state-protected species as part of the permitting process before any clearing or construction activities were conducted at the site or along associated transmission or pipeline corridors. Land preparation associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.3.1, FPL assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system via the Corbett Substation in northern Palm Beach County. The transmission lines would be routed in two parallel corridors. Each corridor would be approximately 48 miles long and nominally 330 feet wide. Construction of the new transmission lines would impact approximately 3840 acres of transmission corridor. Although the most direct route would generally be used between terminations, consideration would also be given to avoiding possible conflicts with natural areas where important environmental resources are located.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry; however, the freshwater sources identified for the Okeechobee 2 site have modest levels of salts and dissolved minerals; therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. Okeechobee County has a low number of sensitive species, and there are no known sensitive species onsite. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and transmission corridor at the Okeechobee 2 site would be SMALL.

9.3.3.3.5 Aquatic Resources and Protected Species

The Okeechobee 2 site is approximately 2 miles from the Kissimmee River and 7.6 miles from Lake Okeechobee. Historically the Kissimmee River meandered approximately 103 miles from Lake Kissimmee to Lake Okeechobee through a one to 2-mile wide floodplain. The river and its flanking floodplain consisted of a mosaic of wetland plant communities and supported a diverse group of waterfowl, wading birds, fish, and other wildlife. The historic Kissimmee River was hydrologically unique among North American river systems in that it had prolonged periods of extended floodplain inundation. Between 1962 and 1971, the river was channelized and two-thirds of the historical floodplain was drained. Excavation of the canal and placement of the spoil material destroyed one-third of the river channel. Implementation of the Kissimmee Flood Control project led to drastic declines in wintering waterfowl, wading bird and game fish populations, and the loss of ecosystem functions. A restoration project, to be undertaken by the U.S. Army Corps of Engineers, is expected to include filling 22 miles of the C-38 Canal, excavation of nearly 9 miles of river channel in the river’s lower basin, and the removal of the S-65B and S-65C water control structures. These actions will provide a more natural fluctuation of water levels in both the upper and lower basins that will enhance marshes around the lakes and re-establish the river’s hydrology. Fish and wildlife habitat in the river’s one to 2-mile-wide floodplain would benefit substantially from this restoration project (USACE 2008b).

Lake Okeechobee is at the center of south Florida's regional water management system, and is in south-central Florida. The massive lake is a 730 square mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. Lake Okeechobee's drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value that is in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the Kissimmee River or Lake Okeechobee via pipeline would be the source to cool the new nuclear units constructed at the Okeechobee 2 site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No listed fish species are known to exist in Okeechobee County (FNAI 2008a), which includes the Kissimmee River and portion of Lake Okeechobee near the Okeechobee 2 site. One state-listed amphibian, the gopher frog (*Rana capito*), has been documented or observed in Okeechobee County. Field surveys would be conducted for federally listed and state protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established Best Management Practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Okeechobee 2 site would be SMALL.

The most likely aquatic impact from nuclear operations at the Okeechobee 2 site would be entrainment and impingement of aquatic organisms in the Kissimmee River or Lake Okeechobee. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Okeechobee 2 site would be SMALL.

9.3.3.3.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Okeechobee 2 site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every 10 years. The most recent decennial U.S. census was performed in year 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Ideally, a socioeconomic analysis would be based on the most recent census information. However, because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census is chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.3.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most activities would occur within the boundaries of the Okeechobee 2 site; however, an access road and a railway connection spur would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts from those associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Okeechobee 2 site is in a rural area surrounded by agricultural land, with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits obtained for this equipment would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the Okeechobee 2 site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Okeechobee 2 site would be SMALL.

9.3.3.3.6.2 Demography

The population distribution at and around the Okeechobee 2 site is low with typical rural characteristics. The nearest population center larger than 25,000 residents is Port St. Lucie approximately 30 miles east. The site satisfies the 10 CFR Part 100 definition of a low population zone. Coterminous counties include Osceola to the north, Indian River to the northeast, St. Lucie to the east, Martin to the southeast, Glades to the southwest, Polk to the northwest, and Highlands to the west.

To determine which counties best represent the ROI for socioeconomic analysis of the Okeechobee 2 site, each county that falls within 50 miles of the site were initially identified. Several factors were then considered to determine which of these counties would best represent the ROI. These factors, listed below, are evaluated based on historical data from the U.S. census. Key assumptions of the ROI determination are that (1) workers will seek to live within 50 air miles of the site and within a 60-minute commute time and (2) most workers will seek to live in population centers that generally offer more amenities (stores, medical facilities, schools, churches, a larger selection of houses, etc.) than rural locations.

Factors Considered to Determine Which Counties Would Best Represent the ROI

- County population and population density
- Populations of the largest population centers
- Geographic locations of the population centers in relation to the Okeechobee 2 site
- The land fraction of nearby counties that falls within 50 miles of the site
- Relative distance from nearby counties to the site
- Estimated travel distance and estimated travel time from the population centers to the site
- Mean travel time to work
- County employment
- Worker commuter patterns to and from counties coterminous the site

Based on the results of this evaluation, the counties that best represented the ROI for socioeconomic analysis of the Okeechobee 2 site include Glades, Highlands, Okeechobee, and St. Lucie. Because there is no reliable method to predict the distribution of the workforce among these four counties, the ROI is generally treated as a whole for much of the socioeconomic analysis.

Based on the 2000 census, the total population of the ROI was 326,547 people, which included 10,576 in Glades County; 87,366 in Highlands County; 35,910 in Okeechobee County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 411,708 people, which included 11,109 in Glades County; 99,349 in Highlands County; 40,311 in Okeechobee County; and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Okeechobee 2 site is 967.59 square miles, and based on 2000 census data, the population of this area was 38,539. This yields a population density of 39.8 people per square mile. There are no cities within 20 miles of the Okeechobee 2 site that have a population greater than 25,000. Therefore, the sparseness level is 1 based on a population density of less than 40 people per square mile and no community greater than 25,000 people within 20 miles (NUREG-1437).

The land area within 50 miles of the Okeechobee 2 site is 6513.3 square miles, and the population of this area was 647,980. This yields a population density of 99.5 people per square mile. Based on the 2000 census, there were no cities within 50 miles of the Okeechobee 2 site that have a population greater than 100,000 (USCB 2000). Therefore, based on NRC guidelines, the proximity level is 2 based on a population density of 50 to 190 people per square mile and no city greater than 100,000 people within 50 miles. Therefore, the Okeechobee 2 site has a sparseness-proximity measure of 1.2, which is categorized as “low” (NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the Okeechobee 2 site relative to population centers, FPL assumed that 70 percent of the construction and 85 percent of the operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of the construction and 100 percent of the operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 2568 construction and operation workers would relocate to the area in the project construction phase, and 1823 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the Okeechobee 2 site would be 6669 people. An influx of 6669 people represents a 2.0 percent increase in the ROI population of 326,547 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437). Therefore, this would pose a SMALL impact on population for the ROI.

FPL estimated the total onsite operations workforce to be 1050 workers, and that 85 percent of these workers (893) would relocate from outside the ROI. For the purpose of this analysis, FPL assumed that 100 percent of operations workers who relocated would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project operations is 2901 people. This represents a 0.9 percent increase in the four-county ROI population. This would pose a SMALL impact on population for the ROI.

9.3.3.3.6.3 Economy

Based on 2000 census data, Glades County had a civilian labor force of 4034 people and an unemployment rate of 8.8 percent; Highlands County had a civilian labor force of 31,437 people and an unemployment rate of 4.4 percent; Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent. For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.0 percent are employed and 5.0 percent are unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the State, which is 5.6 percent (USCB 2000).

The economies of the four-county ROI are very similar, dominated mainly by educational, health, and social services; retail trade; and agriculture, forestry, fishing and hunting, and mining. Most of the labor force resides in St. Lucie County (USCB 2000).

Based on the assumptions stated above, the number of workers who relocated from outside the area would include 70 percent of the 3548 peak construction workers and 85 percent of the 99 operations workers for a total of 2568 workers. An influx of 2568 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.6260 jobs (direct and indirect) for every construction job and 2.4679 for every operation job (BEA Aug 2009), an influx of 2568 construction and operation workers would create 1691 indirect jobs, for a total of 4259 new jobs in the ROI. This represents a 3.2 percent increase in the total labor force in the ROI. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project construction would be beneficial and SMALL within the ROI.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Okeechobee 2 site (U.S. DOE May 2004), and FPL assumed that 85 percent of these employees would migrate into the region. Based on a multiplier of 2.4679 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 893 workers would create 1310 indirect jobs for a total of 2203 new jobs in the region. This represents a 1.7 percent increase in the total labor force in the ROI. The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project operation would be beneficial and SMALL within the ROI.

9.3.3.3.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Okeechobee 2 site would benefit the State and local tax authorities. FPL would pay property taxes to each taxing authorities whose boundaries contained the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase because of construction of the new units at the Okeechobee 2 site, because the units would not generate revenues until they became operational. However, once the units were placed in service, Okeechobee County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Okeechobee 2 site would be similar those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2007 fiscal year, Okeechobee County had property tax revenues of approximately $17,558,005 (State of Florida Mar 2008b).

With respect to the school districts, in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida's 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the State of Florida has an established equalized funding program that re-allocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers' children. Therefore, it is not possible to assess the direct impact of the plant on the school districts. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 28 percent of the 2007 property tax revenues for Okeechobee County would be provided by FPL and would constitute a LARGE positive impact.

9.3.3.3.6.5 Transportation

Principal roadways close to the Okeechobee 2 site include State Road 70 (a two-lane highway) which spans westward from the town of Okeechobee approximately 1 mile south of the site, and U.S. Highway 98 (a two-lane highway) that spans in a northwest direction approximately 2 miles from the site. Directly east of the site is a county road (128th Avenue Northwest) which spans northward between State Road 70 and Highway 98.

Principal road access to the Okeechobee 2 site would be State Road 70. Commuters from most cities in the region (Buckhead Ridge, Cypress Quarters, Fort Pierce, Indiantown, Lakeport, Okeechobee, Port St Lucie, Taylor Creek) would travel westbound on State Road 70 to reach the site. Commuters from Lake Placid and Lorida would travel eastbound along State Road 70 to reach the site.

FDOT reports the AADT count at two locations along State Road 70, one at 3.7 miles east of the site, and one at 2.0 miles west of the site. The AADT count and directional peak hour volume of the eastern location is 7700 vehicles per day and 447 vehicles per hour (FDOT 2008). This peak hour volume classifies this portion of the roadway as a LOS of D and already exceeds the Okeechobee County directional peak hour capacity by 27 vehicles (FDOT 2007). The western location has an AADT count and directional peak hour volume of 4800 vehicles per day and 279 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this western portion of the roadway as a LOS of C (FDOT 2007), and the remaining peak hour capacity is 140 vehicles.

Based on the existing population distribution around the site, FPL assumed that most of the workforce would likely travel along the eastward portion State Road 70 and that a smaller amount of the workforce would travel along the western portion. Also, the traffic attributable to construction material deliveries could cause additional congestion on State Road 70 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Okeechobee 2 site would add approximately 1611 vehicles during the peak hour to the eastern portion of State Road 70. This would cause the road to further exceed capacity, add to existing traffic congestion, and drop the roadway in the eastern direction to a LOS classification of F. As described above, State Road 70 west of the site currently operates very close to capacity. The additional construction traffic would cause the road to exceed capacity, further add to current traffic congestion, and drop the roadway to a LOS classification of E. Construction would also add approximately 448 vehicles to the western portion of State Road 70 during the hour of peak traffic.

Based on this analysis, it is likely that the additional traffic would pose delays along State Road 70. To facilitate the additional traffic, State Road 70 could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would likely be needed between Highway 98 east of the site to the Kissimmee River west of the site. NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant since both would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at Okeechobee 2 site would add approximately 463 and 129 more vehicles to the eastern and western portions of State Road 70 during the hour of peak traffic, respectively. The roadway modifications (mentioned above) to the eastern part of State Road 70 would raise the peak hour capacity of this roadway sufficiently to accommodate the additional traffic from operations. Shift changes could be also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels, in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be LARGE.

9.3.3.3.6.6 Aesthetics and Recreation

The Okeechobee 2 site is a 3000-acre undeveloped site in Okeechobee County approximately 8 miles west of Lake Okeechobee. The site is on flat, swampy land at an approximate elevation of 28 feet above MSL and lies within the Flatwoods physiographic province (USGS 2008).

Because the entire area is relatively flat, the power plant and water intake facilities may be visible from some angles. There would be occasional visible plumes associated with the cooling towers. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered to be moderate if there are complaints about diminution in the enjoyment of the physical environment and measurable impacts that do not alter the continued function of socioeconomic institutions and processes. Construction and operation of an industrial facility on a previously undeveloped site would likely result in some complaints from the affected public with respect to diminution in the enjoyment of the physical environment. Therefore, impacts of construction and operation of the new units on aesthetics would be MODERATE and could warrant mitigation.

The Kissimmee River is approximately 2 miles west of the Okeechobee 2 site. Two SFWMD recreational areas, both remnants of the old Kissimmee River, are within 6 miles of the site. Yates Marsh is a few miles north of the site and offers paddling, camping, wildlife viewing, and hiking along a section of the Florida National Scenic Trail (SFWMD 2008). Several miles southeast of the Okeechobee 2 site is a section of the Kissimmee River that has been designed as the S-65E Impoundment and Paradise Run Management Units. These units are remnants of the end of the old Kissimmee River and consist of thick marshes that are virtually inaccessible; therefore, the area is not heavily visited. The units also offer paddling, hunting, and bird watching (SFWMD 2008).

The northern shoreline of Lake Okeechobee lies within 8 miles of the site. As described in Subsection 9.3.3.1.6.6, both the Lake Okeechobee Scenic Trail and the Big Water Heritage Trail parallel the shoreline of the lake.

The Lake Wales National Wildlife Refuge, the Hobe Sound National Wildlife Refuge, and the Pelican Island National Wildlife Refuge are within 50 miles of the Okeechobee 2 site, none of which are within 6 miles of the site.

Of the 154 state parks in Florida, 12 are within 50 miles of the Okeechobee 2 site and include the Highlands Hammock State Park and Lake June in Winter Scrub State Park, both of which are more than 29 miles northwest and north, respectively, of the Okeechobee 2 site.

Construction and operation of the new units at the Okeechobee 2 site could impact the attractiveness of recreational areas within the region. Construction of new transmission lines in the region would also alter the viewscape. However, the route for the new transmission lines would be selected to minimize these impacts, and the overall aesthetic impacts to the region would be SMALL. Recreational facilities could also be affected by increased traffic on area roads at peak travel periods; however, impacts would be minimal. During plant operations, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.3.6.7 Housing

FPL estimated that 2568 construction and operation workers would move from outside the 50-mile radius of the Okeechobee 2 site to one of the counties within the 50-mile radius, and each of these workers would need a place to live. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there are 161,402 housing units of which 30,553 are vacant (18.9 percent). The number of vacant housing units within each of these counties was 1938 (33.5 percent) in Glades County; 11,375 (23.3 percent) in Highlands County; 2911 (18.8 percent) in Okeechobee County; and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

FPL estimated that, in absolute numbers, the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region.

Because Glades, Highlands, and Okeechobee Counties have relatively small populations, their housing markets would likely be the most impacted. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). The entire construction and operation workforce would occupy no more than 8.4 percent of vacant housing units in the ROI; therefore, the impacts during plant construction would be SMALL TO MODERATE, and mitigation would not be warranted.

FPL estimated that approximately 1050 workers would be needed for operation of two nuclear power facilities at the Okeechobee 2 site (U.S. DOE May 2004). FPL assumed that 85 percent of these workers (893) would relocate from outside the region and would settle in the four-county ROI. Based on these assumptions, the entire operations workforce would occupy no more than 2.9 percent of vacant housing units in the ROI; therefore, the impacts during plant operations would be SMALL, and mitigation would not be warranted.

9.3.3.3.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities; law enforcement, fire, and medical facilities; libraries, parks and recreation, roadway maintenance; and other social services. Construction or operations employees who relocated from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely economically benefit the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents-to-law enforcement officers in Glades, Highlands, Okeechobee, and St. Lucie Counties was 353:1, 722:1, 399:1, and 722:1, respectively (FBI 2008). Within the ROI, the resident-to-law enforcement officer ratio was 643:1, and for the state of Florida, the resident-to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Okeechobee 2 site would increase the resident-to-law enforcement officer ratio by 2 percent to 656:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield less than a 0.9 percent increase.

The ratio of residents to firefighters in Glades, Highlands, Okeechobee, and St. Lucie Counties was 82:1, 491:1, 492:1 and 563:1, respectively. Within the ROI, the resident-to-firefighter ratio was 452:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009). As was described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Okeechobee 2 site would increase the resident-to-firefighter ratio by 2 percent to 462:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.9 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.3.6.9 Education

Based on data for the 2006–2007 school year, Glades County had 8 schools that covered prekindergarten through 12 (PK-12) schools with a total enrollment of 1256 students; Highlands County had 18 PK-12 schools with a total enrollment of 12,456 students; Okeechobee County has 17 PK-12 schools with a total enrollment of 7289 students; and St. Lucie County has 46 PK-12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there are 89 schools with a total enrollment of 59,794 students.

FPL estimated that 2568 construction and operation workers would migrate to the area, and that 1823 of these would bring a family. This would yield a total population increase of 6669 people. Based on an estimate of 0.8 school-aged children per family (BMI Apr 1981), an estimated 1458 of the 6669 people who relocated to the four-county area would be school-aged children. This would yield a 2.4 percent increase in the student population within the four-county ROI. Small impacts are generally associated with project-related enrollment increases of up to 3 percent, and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, this would pose a SMALL impact on the ROI, and mitigation would not be warranted.

FPL has assumed that 893 operations workers and their families would relocate from outside the region, and that the total population increase attributable to operations would be 2901 people. This would include an estimated 714 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 1.2 percent within the four-county ROI. The impacts on public education are considered SMALL, and mitigation would not be warranted.

9.3.3.3.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service NRIS. The NRHP identifies 34 sites in the four-county ROI, including two sites in Glades County, 14 sites in Highlands County, 16 sites in St. Lucie County, and two sites in Okeechobee County. Two of these properties, the Freedman-Raulerson House and Okeechobee Battlefield, are within 10 miles of the Martin site (NPS 2008d).

Siting the proposed nuclear plant at the Okeechobee 2 site would require a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Mitigation measures would be applied to prevent permanent damage and ensure that any impacts to cultural resources from construction or operation of the new units at the Okeechobee 2 site would be SMALL.

Sites are considered to have large impacts to historic resources if they would be disturbed or otherwise have their historic character altered by construction. Two historic properties and several archeological areas were identified within 10 miles of the Okeechobee site. Construction of the new units at the Okeechobee 2 site would result in adverse effects to the historic and cultural landscape through physical disturbance to these elements and through introduction of visual elements that would be out of character with the property and its setting. The visual impacts would be LARGE and would warrant mitigation.

Siting the proposed nuclear plant at the Okeechobee site would require a formal determination of areas of potential effect from physical disturbance or visual impacts from the site. FPL would consult with the SHPO to identify measures for avoidance, minimization, or mitigation of any adverse effects.

9.3.3.3.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 452 block groups within 50 miles of the Okeechobee 2 site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 62 block groups; significant American Indian or Alaskan Native populations exist in 1 block group; significant other race minority populations exist in 10 block groups; significant multiracial minority populations exist in 3 block groups; significant aggregate of minority races populations exist in 74 block groups; and significant Hispanic ethnicity populations exist in 26 block groups. There are no block groups containing significant Asian, Native Hawaiian, or other Pacific Islander minority populations within 50 miles of the Okeechobee 2 site.

The Brighton Seminole Indian Reservation is approximately 10 miles southwest of the Okeechobee 2 site. As described in Subsection 9.3.3.1.8, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the Okeechobee 2 site and the Brighton Indian Reservation are shown in Figure 9.3-15.

The census data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 49 block groups out of a possible 452 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Okeechobee 2 site are shown in Figure 9.3-16.

The Okeechobee 2 site is approximately 1 mile from a minority and low-income block group. However, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the Okeechobee 2 site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the Okeechobee 2 site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted.

9.3.3.4 Evaluation of the St. Lucie Site

The 1130-acre St. Lucie site is an FPL-owned nuclear power generation station on Hutchinson Island in St. Lucie County. St. Lucie Units 1 & 2 and associated support facilities occupy less than half of the 1130-acre site. The St. Lucie nuclear units (Units 1 & 2) provide 1553 MW of summer capacity to the regional power grid. The site is bordered by the Atlantic Ocean to the east and the Indian River Lagoon to the west (FPL Apr 2009). The nearest municipalities are Fort Pierce, approximately 7 miles northwest; Port St. Lucie, approximately 4.5 miles to the west; and Stuart, approximately 8 miles to the south. The nominal site elevation is 0 to 5 feet above sea level which falls within the 100-year floodplain. The location of the St. Lucie site is shown in Figure 9.3-17.

9.3.3.4.1 Land Use Including Site and Transmission Line Rights-of-Way

St. Lucie Units 1 & 2 are on the west side of State Road A1A in a relatively flat, sheltered area of Hutchinson Island. West of the facility, the land gradually slopes downward to a mangrove fringe that borders the intertidal shoreline of the Indian River Lagoon. East of the facility, land rises from the ocean shore to form dunes and ridges approximately 15 feet above mean low water. Two county parks with beach access, Blind Creek Pass Park and Walton Rocks Park, lie within the St. Lucie Units 1 & 2 property boundary. Recreational facilities for FPL employees and their families are also available within the site property boundary.

The Indian River Lagoon is a long, shallow, tidally-influenced estuary that stretches along the central east coast of Florida between the mainland and a series of offshore islands. At St. Lucie Units 1 & 2, the Indian River Lagoon is approximately 7200 feet wide. Blind Creek and Big Mud Creek, inlets off the Indian River Lagoon, are adjacent to the site. The stretch of lagoon adjacent to the site is designated as the Jensen Beach to Jupiter Inlet Aquatic Preserve. The North Fork St. Lucie River Aquatic Preserve is located on the north fork of the St. Lucie River at Port St. Lucie. The St. Lucie Canal connects the St. Lucie River with Lake Okeechobee and parallels State Road 76, south of the town of Stuart (NUREG-1437, Supplement 11).

FPL assumed that the total land disturbance at the St. Lucie site because of construction activities (laydown areas, batch plant, spoils areas, etc.) would be approximately 491 acres. FPL assumed the footprint of the new facilities would cover approximately 308 acres (FPL Jan 2008). New facilities added would include the nuclear power units, support buildings, a switchyard, storage areas, and the water intake and discharge canals. Because the access road extends through the site, there would be no need to develop road access to the site. Because the site is within the 100-year floodplain, it may be necessary to import fill material to elevate the site. It is assumed the fill material would be delivered from offsite sources; therefore, the acquisition of fill material would not disturb land at the St. Lucie site.

Although the undeveloped acreage of St. Lucie site is adequate to support construction of the new units, the physical layout of the site and the proximity of the site (midspan along a long island) would likely pose special logistical challenges for construction that would not be incurred on non-island sites.

State Road A1A spans north-south along Hutchinson Island and provides road access to the site. Based on current traffic volume along State Road A1A and the traffic attributable to construction activities, to mitigate traffic delays for island residents and delivery trucks, it may be necessary to widen the 18.8-mile span of this road from two lanes to four lanes between Seaway Drive to the north and NE Causeway Boulevard to the south. Based on a 100-foot corridor, the land use impact to widen this road would be 228 acres. Rail access does not extend to the St. Lucie site and is not necessary to support operation of Units 1 & 2 (NUREG-1437, Supplement 11); therefore, rail access would not be needed to support operation of the proposed new units either.

Units 1 & 2 are cooled by a once-through system that withdraws water from the Atlantic Ocean and then discharges the heated water back into the Atlantic Ocean. Water canals channel the intake water to the west side of the plant. The intake canal spans approximately 4920 feet and has a trapezoidal cross section that is 180 feet wide and 30 feet deep. The discharge canal is approximately 2200 feet long with cross-sectional dimensions similar to those of the intake canal (NUREG-1437, Supplement 11).

FPL assumed that the proposed new units at the St. Lucie site would use a closed loop, tower-cooled system for power cycle waste heat rejection, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean. This system would require little land use because the water source, the Atlantic Ocean, borders the St. Lucie site (i.e., it would only be necessary to construct a pipeline to transfer the water).

For the purpose of alternative site analysis, it was assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system. FPL assumed that two parallel transmission corridors (one for the 230 kV lines the other for the 500 kV lines) would be routed approximately 11 miles westward along the existing transmission line right-of-way from the St. Lucie site to the Midway Substation in northwestern St. Lucie County. Each corridor would be nominally 330 feet wide. Overall, the new transmission corridors would occupy approximately 880 acres. Trees removed for construction would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to permanently affect agricultural areas, but has the potential to affect a small number of residents along the right-of-way. The land use in the region (and along the new transmission corridors) is generally rural, sparsely populated, and primarily used for agricultural activities. The St. Lucie site is within the Florida Coastal Zone; therefore, FPL would need to seek coastal zone certification to demonstrate that plant and transmission line construction activities are consistent with the requirements of the Coastal Zone Management Act [16 USC 1456(c)(3)(A)] (NUREG-1437, Supplement 11).

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Based on the land disturbance totals, the existing industrial use, and use of existing transmission corridors, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the St. Lucie site and the transmission corridor would be SMALL.

9.3.3.4.2 Air Quality

St. Lucie County (the St. Lucie nuclear plant site is in St. Lucie County) is part of the Southeast Florida Intrastate Air Quality Control Region. St. Lucie County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the St. Lucie site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the St. Lucie site would be comparable to the emissions generated at the Turkey Point site as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to those for any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to activities would be small compared to other emissions in the region. It is unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short-time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. The Federal Class I area nearest to the St. Lucie site is the Everglades National Park more than 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooing tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.4.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The St. Lucie site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans more than 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance, as its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Water quality and ecological health of Lake Okeechobee are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD, in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services, has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the *Northern Everglades and Estuaries Protection Program* that the Florida Legislature signed into law in 2007. Primary components of the plan include the implementation of agricultural management practices, construction of treatment wetlands to clean water flows into the lake, and the creation of 900,000 to 1.3 million acre-feet of water storage north of the lake (SFWMD 2008)

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980).

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al., 1985).

For the year 2000, water withdrawals in the region included both groundwater and surface water. Average daily surface water withdrawals were 1677 million gallons. Approximately 11.1 percent (198.9 million gallons) of this was freshwater and 88.9 percent (1478 million gallons) was saltwater. Average daily groundwater withdrawals were approximately 80.8 million gallons, and 100 percent of this was freshwater. The average total daily withdrawal in the county was 1758 million gallons per day, and approximately 84.1 percent was from saltwater sources (USGS Dec 2004).

St. Lucie Units 1 & 2 receive water from the city of Fort Pierce and the Fort Pierce Utilities Authority for potable and service uses at the plant. This freshwater is derived from groundwater sources on the mainland, and plant operations do not involve any additional groundwater withdrawal. Average potable water usage at the plant is approximately 131,500 gallons per day with no restrictions on supply (NUREG-1437, Supplement 11). It is anticipated that the addition of two more power units would nominally double this daily potable water requirement.

Water is withdrawn from the Atlantic Ocean in a once-through arrangement to cool St. Lucie Units 1 & 2 (NUREG-1437, Supplement 11). It is anticipated that a closed loop, tower-cooled system would be developed for the new nuclear power units, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean. As shown in Table 3.3-1, the peak construction water demand is estimated at 407 gpm which is slightly less than 1 cubic foot per second, and the peak estimated potable water demand for operations is 70 gpm. Municipal potable water from St. Lucie County could easily satisfy these demands. As described in Subsection 5.2.1, an estimated 200 cfs of saltwater would be needed to support plant operations. The Atlantic Ocean is a virtually unlimited water source and could easily provide the estimated 200 cfs of saltwater needed to replace consumptive water use associated with operation of the proposed nuclear power units.

Water use impacts are considered small when water sources are readily available to meet demand. Therefore, because adequate water sources are available nearby, the impact on regional water use for both construction and operation would be SMALL.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437, Supplement 11). The depth to the water table near the site is less than 5 feet below ground level. Therefore, it is expected that dewatering would be required during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Construction and operation activities at the St. Lucie site would be performed under the authorization of an NPDES permit issued by the FDEP (FDEP 2008b). As authorized by the Clean Water Act, the NPDES permit program regulates discharges into waters of the United States to control water pollution. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. NPDES permits describe (1) the limits on what can be discharged, (2) requirements to monitor and report discharges, and (3) other provisions to ensure that the discharge does not harm water quality. Any releases from the plant as result of construction or operation would be regulated by the FDEP through the NPDES permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site, as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the NPDES permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.4.4 Terrestrial Resources and Protected Species

The nominal site elevation of the St. Lucie site is 0 to 5 feet above sea level, which falls within the 100-year floodplain. The most prominent topographic feature of the site is the grade for State Road A1A, which passes through the eastern portion of the FPL property. Between the dunes and State Road A1A, the principal feature is a series of mangrove-dominated mosquito impoundments interspersed with islands of natural coastal strand vegetation. St. Lucie Units 1 & 2 are on the west side of State Road A1A in a relatively flat, sheltered area of the island. West of the facility, the land gradually slopes downward to a mangrove fringe bordering the intertidal shoreline of the Indian River Lagoon. East of the facility, land rises from the ocean shore to form dunes and ridges approximately 15 feet above mean low water (FPL Nov 2001). Results of a recent survey show that 1074 acres of wetlands are within the 5000-acre area that encompasses the site, none of which are considered high quality wetlands, such as forested wetlands. Any wetland functions that are impacted during construction would be replaced or restored. Construction of the new facilities at the St. Lucie site would require clearing at least 308 acres (FPL Jan 2008).

There are no designated critical terrestrial habitats for endangered species in the vicinity of St. Lucie Units 1 & 2 and the transmission corridor associated with the plant. The beach and dunes, mangrove, and tropical hammock habitats are important, however, in that they represent important coastal ecosystems that have been reduced by development. Also, these habitats support a variety of animal species (FPL Nov 2001).

At the St. Lucie Units 1 & 2 site, the beach and dune habitat consists of a narrow band along the Atlantic Ocean shoreline and is subject to considerable wave erosion. The seaward side of the dunes currently has no vegetation. Vegetation on the inland side of the dunes includes sea oats (*Unida paniculata*), sea grape (*Coccoloba uvifera*), salt marsh hay (*Spartina patens*), Australian pine (*Casuarina equisetifolia*), marsh ox-eye (*Barrichia frutescens*), beach sunflower (*Helianthus debilis*), marsh elder (*Iva frutescens*), bay bean (*Canaualia rosea*), and railroad vine (*Ipomoea peseaprae*) (FPL Nov 2001).

The mangrove habitat has been considerably altered from its former natural state. In the 1930s and 1940s, the mangrove forest was destroyed by trenching, diking, and flooding with seawater as part of a Work Progress Administration mosquito control program. Many trees were killed by hydrologic alterations, particularly the black mangrove (*Avicennia nitida*). Since that time there has been partial restoration, particularly of red mangrove (*Rhizophora mangle*), which tends to grow in lower, wetter portions of mangrove forests. Some black and white mangrove (*Laguncularia racemosa*), fish poison (*Dalbergia ecastophyllum*), and giant leather fern (*Acrostichum danceifolium*) have since been established at higher elevations. The mangrove stands suffered freeze damage in 1989, and revegetation has not occurred in some areas. Currently the mangrove areas are either inundated or intertidal, and function as mud flat habitats for wildlife (FPL Nov 2001).

The tropical hammock habitat exists east of State Road A1A. The largest area of occurrence is amid the mangrove stands north of the St. Lucie Units 1 & 2 Discharge Canal. Prominent species include gumbo-limbo (*Bursera simaruba*), paradise tree (*Simarouba glauca*), white and Spanish stoppers (*Eugenia axillaris and E. foetida*), wild lime (*Zanthoxylum fagara*), white indigo berry (*Randia aculeata*), mastic (*Mastichodendron foetidissimum*), and snow berry (*Chiococcca alba*). The existence of tropical hammocks with a distinct assemblage of tropical species this far north on the Atlantic coast is unusual (FPL Nov 2001).

Hutchinson Island habitats support a variety of animal species. FPL reported 24 species of mammals in Hutchinson Island, of which the Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), and beach mouse (*Peromyscus polionotus*) were most common. Nearly 160 bird species were reported to use Hutchinson Island, at least during part of their life cycles. Abundant resident species were typified by water-associated birds such as great egret (*Casmerodius albus*), American coot (*Fulica americana*), ring-billed gull (*Larus delawarensis*), and fish crow (*Corvus ossifragus*). Many migratory species pass through the area such as warblers [e.g., black and white warbler (*Mniotilta varia*)], spotted sandpiper (*Actitis macularia*), and Forster's tern (*Sterna forsteri*). Gopher tortoises (*Gopherus polyphemus*) are present on the site and have active burrows in areas of soft soils that are not subject to flooding (FPL Nov 2001).

Threatened, endangered, and/or species of special concern that exist in St. Lucie County are listed in Table 9.3-10. Certain species, such as the least tern (*Sterna antillarum*), black skimmer (*Rynchops niger*), American oystercatcher (*Haematopus palliateus*), several species of sea turtle, gopher tortoise (*Gopherus polyphemus*), and the Florida manatee (*Trichechas manatus*) have been documented at the St. Lucie Units 1 & 2 site. A number of the protected bird species listed in Table 9.3-10 have been seen on Hutchinson Island, including least tern, brown pelican (*Pelacanus occidentalis*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), wood stork (*Mycteria americana*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), reddish egret (*Egretta rufescens*), and Louisiana heron (*Egretta tricolor*). The latter five species nest in mangroves. The least tern, a state threatened species, and the black skimmer, a state species of special concern, nest on the canal berms and building rooftops within the St. Lucie Units 1 & 2 property boundary. The American oystercatcher, a state species of special concern, also nests on the canal berms. The brown pelican, white ibis (*Eudocimus albus*), little blue heron, and the southeastern American kestrel (*Falco sparverius paulus*) were observed on site in recent surveys. Two protected plant species were also observed in recent surveys, inkberry (*Scaevola plumieri*) and common prickly pear (*Opuntia stricta*) (FPL Nov 2001).

Further field surveys would be conducted for federally listed and state protected species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.4.1, FPL assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system via the Midway Substation in northwestern St. Lucie County. The transmission lines would be routed in two parallel corridors. Each corridor would be approximately 11 miles long and nominally 330 feet wide. Construction of the new transmission lines would impact approximately 880 acres of transmission corridor. Although the most direct route would generally be used between terminations, consideration would also be given to avoiding possible conflicts with natural areas where important environmental resources are located.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry. Because the St. Lucie site would likely use ocean water for power plant heat rejection, the salt and mineral levels in the water would be high. The use of drift eliminators, along with proper tower design and operation, would help reduce these potential impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. St. Lucie County has a low number of sensitive species, the site has already been disturbed by the existing units, and an existing transmission corridor would be used. It is not anticipated that the proposed new units would entrain more turtles, fish, or cause more takes. The presence of additional structures could increase bird collisions but this affect would be minimal. The anticipated terrestrial impacts would therefore be SMALL.

9.3.3.4.5 Aquatic Resources and Protected Species

The St. Lucie site is on Hutchinson Island in St. Lucie County and is bordered by the Atlantic Ocean to the east and the Indian River Lagoon to the west. Existing Units 1 & 2 are cooled by a once-through system that withdraws water from the Atlantic Ocean and then discharges the heated water back into the Atlantic Ocean. Water canals channel the intake water to the west side of the plant. The intake canal spans approximately 4920 feet and has a trapezoidal cross section that is 180 feet wide and 30 feet deep. The discharge canal is approximately 2200 feet long with cross-sectional dimensions similar to those of the intake canal (NUREG-1437, Supplement 11). FPL assumed that the proposed new units at the St. Lucie site would use a closed loop, tower-cooled system for power cycle waste heat rejection, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean.

The near shore area of the Atlantic Ocean has no reef structures, grass beds, or rock outcroppings. Seaward, the ocean floor consists of unconsolidated sediments composed of quartz and calcareous sands, broken shell fragments, and negligible amounts of silts and clays. The sea floor gently slopes into a trough with a maximum depth of approximately 39 feet at approximately 1 nautical mile offshore. Continuing offshore, the sea floor rises to form the Pierce Shoal at approximately 2 miles (FPL Nov 2001).

Baseline monitoring before the construction of St. Lucie Units 1 & 2 established that there were three subtidal microhabitats offshore of the plant: shallow beach terrace, offshore shoal, and a deeper trough in between the two. Sediment composition differed among these zones. The biological composition of macroinvertebrate communities is largely influenced by sediment composition. Because of the sediment heterogeneity, the trough supports the most abundant fauna. It was characterized by high diversity and relatively rapid turnover of less abundant and more transient species. In the intertidal zone, the worm reef community provided yet another distinct habitat for macroinvertebrates. Patterns of fish abundance and diversity were also largely aligned along microhabitat boundaries. In addition to the habitats identified above, the surf zone harbored yet another distinct assemblage of fish (FPL Nov 2001).

Baseline studies identified 127 species of arthropods and nearly 300 species of mollusks. The diverse makeup of these groups, and to some extent their seasonal variability, was attributed to the transitional temperate, subtropical, and tropical mix of climate and water masses in the general vicinity of Hutchinson Island. Some estuarine affinities were also noted and attributed to water mass intrusions from the Indian River Lagoon by way of St. Lucie Inlet and prevailing northerly coastal currents. Among species of direct commercial value, the calico scallop was the only mollusk recorded. Arthropods of potential commercial value included penaeid shrimp and the blue crab. However, these species were generally collected in small numbers and infrequently (FPL Nov 2001).

The fish communities offshore are transitional assemblages of temperate and tropical forms. Since oceanic icthyofauna are most diverse and abundant near reefs and other hard-bottom areas, FPL sited intake and discharge structures for St. Lucie Units 1 & 2 in areas devoid of these habitats (FPL Nov 2001). FPL would anticipate the same strategy for the new units at St. Lucie.

Commercial and recreational fishing are important activities in the vicinity of St. Lucie Units 1 & 2. Three of the most abundant species in commercial catches are the bluefish, Spanish mackerel, and king mackerel (*Scomberomorus cavalla*). All three species are highly migratory, spawn in coastal waters from late summer into winter (depending on species), and migrate northward along the East Coast during the warmer seasons. Several other species are quite abundant, including tilefish (e.g., *Caulolatilus* spp.) and swordfish (*Xiphias gladius*) (FPL Nov 2001).

The Indian River Lagoon is a productive estuary that adjoins the western edge of the St. Lucie Units 1 & 2 property. The Lagoon is characterized by extensive growths of manatee grass (*Syringodium filiforme*) and red algae such as the dominant form *Gracilaria*. In turn, the grass and algae are inhabited by a variety of gammarids, shrimp, isopods, crabs, and juvenile fish. A variety of microscopic organisms are supported by this vegetative community, including diatoms attached to the plant leaves. Benthic organisms are also abundant and include tube-dwelling worms and crustaceans, the latter including larger shellfish such as shrimp and blue crabs. A diverse and abundant fish community of more than 300 species has been identified in the southern portion of the Indian River Lagoon. Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), common snook (*Centropomus undecimalus*), sheepshead (*Archosargus probatocephalus*), and gray snapper (*Lutjanus griseus*) were commonly reported (FPL Nov 2001). The smalltooth sawfish (*Pristis pectinata*) is a federally listed endangered species documented to occur in St. Lucie County (FNAI, 2008a).

Several species of sea turtle, gopher tortoise (*Gopherus polyphemus*), and the Florida manatee (*Trichechas manatus*) have been documented at the St. Lucie Units 1 & 2 site. Five species of sea turtle have been reported from Hutchinson Island. The federally threatened loggerhead sea turtle (*Caretta caretta*) has historically been most common. Between 5000 and 8000 loggerhead nests have been reported on Hutchinson Island over the last 10 years. The endangered green sea turtle (*Chelonia mydas mydas*) also nests on Hutchinson Island, but these nests are less abundant than those of the loggerhead. Juveniles of both species use the area near the St. Lucie Units 1 & 2 site as a developmental area. The endangered leatherback sea turtle (*Dermochelys coriacea*) infrequently nests on Hutchinson Island. The endangered Kemp's Ridley sea turtle (*Lepidochelys kempi*) and hawksbill sea turtle (*Eretmochelys imbriccata*) do not nest on Hutchinson Island and have only infrequently been reported from the area (FPL Nov 2001).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the Atlantic Ocean would cool the new nuclear units constructed at the St. Lucie site. Field surveys would be conducted for federally listed and state protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the St. Lucie site would be minimized. However, because of the known presence of endangered species at the site, the impact from construction would be considered MODERATE.

The most likely aquatic impact from nuclear operations at the St. Lucie site would be entrainment and impingement of aquatic organisms from the Atlantic Ocean. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the St. Lucie site would be minimized. The addition of two nuclear units would not be expected to entrain more turtles, fish, or cause more takes. Therefore, impacts would be SMALL.

9.3.3.4.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of a nuclear plant at the St. Lucie site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every 10 years. The most recent decennial U.S. census was performed in year 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Ideally, a socioeconomic analysis would be based on the most recent census information. However, because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census was chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.4.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways would be necessary to transport construction materials and equipment to the site. It is expected that most or all construction activities would occur within the boundaries of the St. Lucie site. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. The St. Lucie site is on an industrial segment of Hutchinson Island. Commuter traffic on State Road A1A would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits obtained for this equipment would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the St. Lucie site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at nearby receptors. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the St. Lucie site would be SMALL.

9.3.3.4.6.2 Demography

The St. Lucie site is in St. Lucie County on Hutchinson Island off the eastern coast of Florida. Coterminous counties include Indian River to the north, Okeechobee to the west, and Martin to the south. The nearest population centers larger than 25,000 residents are Port St. Lucie approximately 4.5 miles west and Fort Pierce approximately 7 miles northwest.

Based on the NRC (NUREG-1437, Supplement 11) approximately 97 percent of the St. Lucie site workforce lives in a four-county region that includes St. Lucie, Martin, Indian River, and Palm Beach Counties. Of the workforce in that lives in these counties, the percentage distribution is 47.4, 38.2, 8.2, and 6.2 percent, respectively. Based on this known workforce demographic, these same counties are selected to represent the ROI for the St. Lucie site.

Based on the 2000 census, the total population in the ROI was 1,563,557 which included 112,947 in Indian River County; 126,731 in Martin County; 1,131,184 in Palm Beach County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 1,798,409 people, which included 131,837 in Indian River County, 139,182 in Martin County, 1,266,451 in Palm Beach County, and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site, and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site, and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437, Supplement 11).

The land area within 20 miles of the St. Lucie site is 553.1 square miles, and based on 2000 census data, the population of this area was 326,647 (NUREG-1437, Supplement 11). This yields a population density of 590.57 people per square mile. Based on this metric, the sparseness level is 4 (population density greater than 120 people per square mile over a 20-mile radius) (NUREG-1437, Supplement 11).

The land area within 50 miles of the St. Lucie site is 3551.9 square miles, and the population of this area was 1,003,699 (U.S. NRC Aug 2003). This yields a population density of 282.58 people per square mile. Based on this metric, the proximity level is 4 (population density greater than 190 people per square mile over a 50-mile radius). Therefore, the St. Lucie site has a sparseness-proximity measure of 4.4, which is categorized as high (NUREG-1437, Supplement 11).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the St. Lucie site relative to population centers, FPL assumed that 50 percent of the construction and operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction workforce and 100 percent of operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 1824 construction and operation workers would relocate to the area in the project construction phase, and 1291 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the St. Lucie site would be 4729 people. An influx of 4729 people represents a 0.3 percent increase in the ROI population of 1,563,557 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437, Supplement 11). This would pose a SMALL impact on population for the ROI.

At the county level, if the demographic distribution of the construction workforce follows that of the St. Lucie plant workforce, the addition of the construction workforce employees and their families would increase the population in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.3 percent, 1.4 percent, 0.03 percent, and 1.2 percent, respectively. Therefore, these represent SMALL increases in the county population levels.

FPL estimated the total onsite operations workforce to be 806 workers, and that 50 percent of these workers (403) would relocate from outside the ROI. For the purpose of this analysis, FPL assumed that each operations worker who relocated would bring their family. Based on an average household size of 3.25 people, the total population increase attributable to project operations is 1310 people. This represents a 0.1 percent increase in the four-county ROI population. At the county level, if the demographic distribution of the operations workforce follows that of the workforce at the St. Lucie plant workforce, the addition of the operations workforce employees and their families would increase the population in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.1 percent, 0.4 percent, 0.01 percent, and 0.3 percent, respectively. These represent SMALL increases in the county population levels.

In summary, the population increase in the ROI would pose a SMALL impact. Likewise, it is anticipated that the population increase in each of the four counties would pose a SMALL impact.

9.3.3.4.6.3 Economy

Based on 2000 census data, Indian River County had a civilian labor force of 47,627 people and an unemployment rate of 4.5 percent; Martin County had a civilian labor force of 53,301 people and an unemployment rate of 4.2 percent; Palm Beach County had a civilian labor force of 510,046 people and an unemployment rate of 5.0 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent (USCB 2000). For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.1 percent were employed and 4.9 percent were unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the state, which is 5.6 percent (USCB 2000).

The principal economies of the counties in the ROI are the same, dominated mainly by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force in the four-county ROI resides in Palm Beach County (USCB 2000).

An influx of 1824 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7136 jobs (direct and indirect) for every construction job and 2.2500 for every operation job (BEA Aug 2009), an influx of 1824 workers would create 1354 indirect jobs, for a total of 3178 new jobs in the ROI. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries and the housing industry. Workers generally spend most of their employment income in the county of permanent residence. The maximum impact on any single county would occur if 100 percent of the construction workforce settled there, and the minimum impact would occur if no construction workers settle there. Economic impacts attributable to project construction are considered beneficial and therefore require no mitigation. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437, Supplement 11). The number of new jobs created would represent only a 0.5 percent increase in jobs within the ROI; therefore, the economic impacts would be SMALL.

An estimated 806 workers would be required for the operation of two nuclear power facilities at the St. Lucie site (U.S. DOE May 2004), and FPL assumed that 50 percent of these employees would migrate into the region. Based on a multiplier of 2.2500 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 403 operations workers would create 504 indirect jobs for a total of 907 new jobs in the region. FPL concluded that the impacts of operation of two nuclear power facilities on the economy would be beneficial and SMALL in the ROI and mitigation would not be warranted.

9.3.3.4.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the St. Lucie site would benefit the state and local tax authorities. FPL would pay property taxes to each taxing authorities whose boundaries contained the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the St. Lucie site, because the units would not generate revenues until they became operational. However, once the units were placed in service, St. Lucie County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at St. Lucie site would be similar those paid by the nuclear units at Turkey Point plant. In 2006, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For fiscal year 2006, St. Lucie County had property tax revenues of $134,254,911 (State of Florida, Mar 2007).

With respect to the school districts in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida's 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that reallocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers' children. Therefore, it is not possible to assess the direct impact of the plant on the school district. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437, Supplement 11). Therefore, based on the county portion of the FPL property tax payment for the new units, 8 percent of the 2006 property tax revenues for St. Lucie County would be provided by FPL and constitute a SMALL positive impact.

9.3.3.4.6.5 Transportation

The only road access to the St. Lucie site would be State Road A1A (a two-lane road) which spans in the north-south orientation along the eastern site boundary. State Road A1A intersects with U.S. Highway 1 in both directions. U.S. Interstate 95 spans parallel to U.S. Highway 1 and can be reached by numerous routes. Commuters from most cites in the region (Boynton Beach, Indiantown, Palm City, Port St Lucie, West Palm Beach) would travel northbound on State Road A1A to reach the site. Commuters from Fort Pierce, Palm Bay and Vero Beach would travel southbound along State Road A1A to reach the site.

FDOT reports the AADT count at two locations along State Road A1A, one at one-half mile south of the site, and one 6 miles north of the site. The AADT count and directional peak hour volume of the southern location is 4700 vehicles per day and 273 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this southern portion of the roadway as a LOS of C (FDOT 2007), and the remaining peak hour capacity is 147 vehicles. The northern location has an AADT count and directional peak hour volume of 3700 vehicles per day and 215 vehicles per hour (FDOT 2008). This peak hour volume classifies this northern portion of the roadway as a LOS of B (FDOT 2007), and the remaining peak hour capacity is 205 vehicles.

Based on the existing workforce at the St. Lucie site, FPL assumed that most of the workforce would likely travel along the southern portion of State Road A1A and that a smaller amount of the workforce would travel along the northern portion. Also, the traffic attributable to construction material deliveries could cause additional congestion on State Road A1A during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the St. Lucie site would add 1507 and 623 vehicles during the peak hour to the respective southern and northern portions of State Road A1A. This would cause the road to exceed capacity and drop the southern and northern roadway to LOS classifications of E and F, respectively.

Based on this analysis, it is likely that the additional traffic would pose delays along State Road A1A. To facilitate the additional traffic, State Road A1A could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would be needed along State Road A1A between Seaway Drive to the north and NE Causeway Boulevard to the south, particularly in the vicinity of the St. Lucie site. NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437, Supplement 11). FPL considers this approach to be appropriate for construction of a nuclear plant since both plant refurbishment and new plant construction would be large construction projects. NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at the St. Lucie site would add approximately 332 and 137 more vehicles to the southern and northern portions of State Road A1A during the hour of peak traffic, respectively. The roadway modifications to the southern part of State Road A1A (mentioned above) would raise the roadway peak hour capacity sufficiently to accommodate the additional traffic from operations. Shift changes could be also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be MODERATE.

9.3.3.4.6.6 Aesthetics and Recreation

The St. Lucie site consists of 1130 acres of developed land on the widest section of Hutchinson Island in St. Lucie County. A portion of the site is occupied by St. Lucie Units 1 & 2 nuclear power generation facilities. The site is on a flat barrier island at elevations that range from 0 to 5 feet above MSL (USGS 1948) and within the Flatwoods physiographic province (USGS 2008).

Construction of the new units at the St. Lucie site could be viewed from offsite at certain locations, but the addition of two nuclear facilities would not substantially change the viewscape which results from the current nuclear generation facilities. Operation of the new nuclear units would have visual impacts similar to those of the St. Lucie Units 1 & 2, with occasional visible vapor plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered small if there are no complaints about diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the new units on aesthetics would be SMALL and would not warrant mitigation.

The Indian River Lagoon is a long, shallow, tidally-influenced estuary that stretches along the central-east coast of Florida between the mainland and a series of offshore islands. At the St. Lucie site, the Indian River Lagoon is approximately 7200 feet wide and bounds the site to the west. Blind Creek Park and Big Mud Creek Park, inlets off Indian River Lagoon, are adjacent to the site. The stretch of lagoon adjacent to the site is designated as the Jensen Beach to Jupiter Inlet Aquatic Preserve. The North Fork St. Lucie River Aquatic Preserve is on the north fork of the St. Lucie River at Port St. Lucie. The St. Lucie Canal connects the St. Lucie site with Lake Okeechobee.

Fort Pierce Inlet State Recreation Area is approximately 9 miles north of the St. Lucie site and immediately north of the Fort Pierce Inlet. Recreational area activities include beach activities, swimming, picnicking, camping, and hiking. Other state recreational areas include Avalon, Savannas, and Pepper Beach. The Savannas State Preserve, a freshwater lagoon, is on the mainland approximately 2 miles west of the St. Lucie site and offers fishing, hiking, picnicking, and other outdoor-related activities (NUREG-1437, Supplement 11).

Three National Wildlife Refuges are within 50 miles of the St. Lucie site and include Hobe Sound, Pelican Island, and Arthur R. Marshall Loxahatchee National Wildlife Refuges. Hobe Sound is approximately 22 miles south of the site and occupies approximately 1035 acres of the most productive sea turtle nesting areas on the Florida east coast (USFWS 2008c). Pelican Island is approximately 32 miles north of the site and consists of a 5413-acre bird rookery island (USFWS 2008d). Loxahatchee is approximately 48 miles south of the site and consists of more than 221 square miles of Everglades habitat (USFWS 2008e).

Other prominent features within 50 miles of the St. Lucie site include Lake Okeechobee, Blue Cypress Lake, Jonathan Dickinson State Park, the Dupruis and J.W. Corbett Wildlife Management Areas, and a portion of the Seminole Brighton Indian Reservation (NUREG-1437).

Because the St. Lucie site already hosts a power plant with tall structures and transmission towers, the construction and operation of two nuclear power units and associated transmission lines would not pose an appreciable change to the viewscape. Therefore, visual impacts on the region would be SMALL.

During plant operations, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.4.6.7 Housing

FPL estimated that 1824 construction and operation workers would move from outside the ROI to the counties in the ROI. These 1824 workers would need housing. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there were 771,063 housing units of which 115,530 were vacant (15.0 percent). At the county level, the number of vacant housing units was 8765 in Indian River County (15.1 percent), 10,183 (15.6 percent) in Martin County, 82,253 (14.8 percent) in Palm Beach County, and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

Based on absolute numbers, FPL estimated that the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region. The influx of 1824 construction workers represents 1.6 percent of the 115,530 vacant housing units in the ROI. At the county level, if the construction workforce follows workforce housing patterns at the St. Lucie plant, then the percentage of vacant housing required in each county would be 1.7 percent, 6.8 percent, 0.1 percent, and 6 percent for Indian River, Martin, Palm Beach, and St. Lucie Counties, respectively. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437, Supplement 11). In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be SMALL and mitigation would not be warranted.

FPL estimated that 806 workers would be needed for operation of two nuclear power facilities at the St. Lucie site (U.S. DOE May 2004). An estimated 50 percent of these workers (403) would come from within the ROI, and 50 percent (403) would relocate to the area. An influx of 403 workers would represent less than 1 percent of the vacant housing in the ROI. At the county level, if the construction workforce followed workforce housing patterns at the St. Lucie plant, then the percentage of vacant housing required in each county would be 0.4 percent, 1.5 percent, 0.03 percent, and 1.3 percent for Indian River, Martin, Palm Beach, and St. Lucie Counties, respectively. In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be beneficial and SMALL and that mitigation would not be warranted.

9.3.3.4.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities, law enforcement, fire, and medical facilities, and social services. Construction or operations employees who relocated from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population in the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely pose an economic benefit for the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents–to-law enforcement officers in Indian River, Martin, Palm Beach, and St. Lucie Counties was 562:1, 466:1, 928:1, and 722:1, respectively (FBI 2008). In the four-county ROI, the ratio was 798:1. For the state of Florida, the resident–to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. In the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the St. Lucie site would increase the resident-to-law enforcement officer ratio by 0.3 percent to 801:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield less than a 0.1 percent increase.

The ratio of residents to firefighters for these counties was 411:1, 363:1, 519:1 and 563:1, respectively (USFA 2009). In the ROI, the ratio was 497:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009). As described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. In the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the St. Lucie site would increase the resident-to-firefighter ratio by 0.3 percent to 498:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.1 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437, Supplement 11). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.4.6.9 Education

Based on data for the 2006–2007 school year, Indian River County had 28 prekindergarten through 12 (PK–12) schools with a total enrollment of 17,611 students; Martin County had 36 PK–12 schools with a total enrollment of 18,239 students; Palm Beach County had 264 PK–12 schools with a total enrollment of 171,431 students; and St. Lucie County had 46 PK–12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there were 374 PK–12 schools with a total enrollment of 246,074 students.

FPL estimated that 1824 construction and operation workers would migrate to the area, and that 1291 of these would bring a family. This would yield a total population increase of 4729 people. Based on an estimate of 0.8 school-aged children per family, an estimated 1033 of the 4729 people who relocated to the four-county area would be school-aged children. This would yield a 0.4 percent increased in the student population in the ROI.

Based on the demographic distribution of the St. Lucie plant workforce, an increase of 1033 students would increase the student populations in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.5 percent, 2.2 percent, 0.04 percent, and 1.3 percent, respectively. Small impacts are generally associated with project-related enrollment increases are less than 3 percent and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and special option sales tax revenues as a result of the increased population would fund additional teachers and facilities. No additional mitigation would be warranted.

FPL assumed that 403 operations workers and their families would relocate from outside the region, and that the total population increase would be 1310 people. This would include an estimated 322 children in the PK–12 school range. This influx of students would increase the student population in the ROI by 0.1 percent. Based on the demographic distribution of the St. Lucie plant workforce, an increase of 322 students would increase the student populations in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.2 percent, 0.7 percent, 0.01 percent, and 0.4 percent, respectively. Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL, and mitigation would not be warranted.

9.3.3.4.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service NRIS and reviewed information on historic and archeological sites provided in the NRC *Final Report: Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants, Supplement 11, St. Lucie Units 1 and 2* (NUREG-1437, Supplement 11).

The GEIS Supplement 11 for the St. Lucie Units 1 & 2 indicates that in 2001 FPL submitted a letter to the Florida SHPO to request comments on the St. Lucie Units 1 & 2 license renewal process. In the letter, FPL determined that the continued operation of St. Lucie would have no impact on historic properties. In response, the Florida SHPO cautioned that there was a moderate to high likelihood for the presence of significant prehistoric archaeological sites in the currently undeveloped portions of the St. Lucie site, as evidenced by the presence of the archeological remains along Blind Creek at the northern end of the site boundary (NUREG-1437, Supplement 11).

The NRHP identifies 124 sites in the four-county ROI; including 70 sites in Palm Beach County, 12 sites in Martin County, 16 sites in St. Lucie County, and 26 sites in Indian River County. Fifteen of these properties are within 10 miles of the St. Lucie site (NPS 2008e).

Siting the proposed nuclear plant at the St. Lucie site would require a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Sites are considered to have large impacts if historic or cultural resources would be disturbed or otherwise have their historic character altered by construction. Because of the moderate to high likelihood of significant prehistoric archaeological sites, the impacts to cultural resources from construction or operation of the new units at the St. Lucie site would be considered MODERATE. Mitigation measures would be applied to prevent any permanent damage.

Construction activities at the St. Lucie site could be viewed from the historic and cultural sites 10 miles from the site, but the addition of two nuclear power facilities would not substantially change the view. Operation of the new units probably would have visual impacts similar to those of the existing FPL St. Lucie power plant, with the addition of cooling tower plumes. Therefore, visual impacts of construction and operation of the St. Lucie site relative to historic and culture sites would be SMALL and would not warrant mitigation.

9.3.3.4.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 590 block groups within 50 miles of the St. Lucie site. The census data for Florida characterizes 14.6 percent of the population as black, 0.3 percent American Indian or Alaskan Native, 1.7 percent Asian, 0.1 percent Native Hawaiian or other Pacific Islander, 3.0 percent as other single minorities, 2.4 percent multiracial, 22.0 percent aggregate of minority races, and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 86 block groups, significant American Indian or Alaskan Native populations exist in 1 block group, significant other race minority populations exist in 5 block groups, significant aggregate of minority races populations exist in 96 block groups, and significant Hispanic ethnicity populations exist in 30 block groups. There are no block groups containing significant Asian, Native Hawaiian or other Pacific Islander, multiracial minority populations within 50 miles of the St. Lucie site.

A portion of the Brighton Seminole Indian Reservation is 50 miles west-southwest of the St. Lucie site. As described in Subsection 9.3.3.1.8, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the St. Lucie site and the Brighton Indian Reservation are shown in Figure 9.3-18.

The census data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 37 block groups out of a possible 590 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the St. Lucie site are shown in Figure 9.3-19.

The closest minority and low-income block groups are in Fort Pierce approximately 10 miles north-northwest of the St. Lucie site. Construction activities (noise, fugitive dust, and air emissions) would be contained within site boundaries and would not impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the St. Lucie site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the St. Lucie site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted.

9.3.4 SUMMARY AND CONCLUSIONS

The decision to locate two additional nuclear power units at the Turkey Point site was based on a comparison of four alternative sites: a greenfield site in south-central Glades County, a greenfield site in southern Okeechobee County, an FPL-owned fossil power plant site in western Martin County, and an FPL-owned nuclear power plant site in eastern St. Lucie County. The FPL evaluation sought to determine whether any of the alternative sites are obviously superior to the Turkey Point site to site a pair of new nuclear power units to increase grid capacity in south Florida.

The evaluation process was consistent with the special case noted in NUREG-1555, Section 9.3(III)(8), and considered the advantages already present at existing nuclear facilities within the ROI. Based on FPL knowledge and experience, 23 sites were initially identified for consideration (12 greenfield sites, 2 existing nuclear power plant sites, and 9 existing non-nuclear power plant sites). An independent parallel site identification process involving a GIS analysis was also conducted to ensure that no reasonable candidate sites were overlooked.

These sites were then evaluated based on a range of performance criteria and weighted scores. After three successive stages of qualitative and quantitative evaluation, 18 sites were determined to be less favorable, and the top five sites were identified. The Turkey Point site was selected as the proposed site because it received the highest overall score, and the Glades, Martin, Okeechobee 2, and St. Lucie sites were identified as the top alternative sites. Turkey Point is reviewed at length in other sections of the ER. This section, Section 9.3, describes the evaluation of the alternative sites based on reconnaissance level information.

A comparison of the environmental impacts from construction and operation for the proposed site and each of the top alternative sites is presented in Tables 9.3-11 and 9.3-12. The impact summaries presented in these tables demonstrate that only the Martin site is environmentally comparable (but not environmentally preferable) to the Turkey Point site. Thus, the site-by-site comparison did not identify a site that is obviously superior to the Turkey Point site. Because the Turkey Point site received the highest evaluation score and satisfies FPL business plans and objectives, it was selected as the proposed site for this COL Application.

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Table 9.3-1
Sites Initially Identified for the Site Selection Evaluation

Possible Site	County	Inside FPL Service Territory	Site Status
Canaveral	Brevard	YES	Operational Power Plant
Cutler	Miami Dade	YES	Operational Power Plant
Ft. Myers	Lee	YES	Operational Power Plant
Lauderdale	Broward	YES	Operational Power Plant
Manatee	Manatee	YES	Operational Power Plant
Martin	Martin	YES	Operational Power Plant
Port Everglades	Broward	YES	Operational Power Plant
Putnam	Putnam	YES	Operational Power Plant
Riviera	Palm Beach	YES	Operational Power Plant
Sanford	Volusia	YES	Operational Power Plant
St. Lucie	St. Lucie	YES	Operational Power Plant (Nuclear)
Turkey Point	Miami Dade	YES	Operational Power Plant (Nuclear)
Andytown	Broward	YES	FPL-Owned Greenfield
DeSoto	DeSoto	YES	FPL-Owned Greenfield
West County	Palm Beach	YES	FPL-Owned Greenfield
Charlotte	Charlotte	YES	Non FPL-Owned Greenfield
Glades	Glades	YES	Non FPL-Owned Greenfield
Hardee	Hardee	NO	Non FPL-Owned Greenfield
Hendry 1	Hendry	YES	Non FPL-Owned Greenfield
Hendry 2	Hendry	YES	Non FPL-Owned Greenfield
Highlands	Highlands	NO	Non FPL-Owned Greenfield
Okeechobee 1	Okeechobee	YES	Non FPL-Owned Greenfield
Okeechobee 2	Okeechobee	YES	Non FPL-Owned Greenfield

Table 9.3-2 (Sheet 1 of 3)
Criteria Applied to Compare the Top 15 Potential Sites

Criterion	Weight Factor	Description	Description of Factors Evaluated	Score Assignment
P1	9.5	Cooling Water Supply	Flow — combined flow available from ground, reclaimed, and surface sources	5 ≡ no practical restriction 4 ≡ more than 5 times the required flow 3 ≡ more than 3.5 times the required flow 2 ≡ less than 3 times the required flow 1 ≡ insufficient flow Required flow assumed at 178 cubic feet per second
			Flexibility — number of alternate sources of water present that are able to provide a substantial portion of the required flow	5 ≡ multiple sources able to provide full flow required 4 ≡ additional sources able to provide substantial portion of the flow 3 ≡ one source able to provide required flow 2 ≡ no source able to provide required flow, but multiple sources able to provide substantial portion of required flow 1 ≡ insufficient flow from all sources
			Risk — evaluates the risk associated with flow variability, long pump distances, or other anticipated reliability aspects of water supply	5 ≡ all aspects favorable 4 ≡ some aspects favorable 3 ≡ neutral 2 ≡ some risk 1 ≡ substantial risk
			Regulatory Challenge — areas known to have elevated competition for water resources, a high number of water uses, difficult supply conditions, or a difficult regulatory compliance situation are ranked lower than those without such challenges	5 ≡ all aspects favorable 4 ≡ some aspects favorable 3 ≡ neutral 2 ≡ some risk 1 ≡ substantial risk
P2	3.9	Flood Potential	Flood potential is evaluated based on the difference between mean site elevation and mean water elevation	5 ≡ greater than 20 feet 4 ≡ between 10 feet and 20 feet 3 ≡ between 6 feet and 10 feet 2 ≡ between 3 feet and 6 feet 1 ≡ less than 3 feet or located in swamp area

Table 9.3-2 (Sheet 2 of 3)
Criteria Applied to Compare the Top 15 Potential Sites

Criterion	Weight Factor	Description	Description of Factors Evaluated	Score Assignment
P3	7.6	Population	Distance to nearest population center	5 ≡ no population center within 20 miles 4 ≡ population center within 15 to 20 miles 3 ≡ population center within 10 to 15 miles 2 ≡ population center within 5 to 10 miles 1 ≡ population center within 5 miles A point was added if no densely populated area is found within 40 miles of the site; a point was deducted if a densely populated area is found within 15 miles of the site or if a large group of densely populated areas are located within 15–40 miles of the site
			Population density of host county	5 ≡ less than 50 persons per square mile 4 ≡ 50 to 250 persons per square mile 3 ≡ 250 to 350 persons per square mile 2 ≡ 350 to 500 persons per square mile 1 ≡ more than 500 persons per square mile
P4	5.0	Hazardous Land Uses	Number of airports, pipelines, and other known hazardous industrial facilities (includes Air Force Bases, Kennedy Space Center, Cape Canaveral) nearby	5 ≡ no major airport, city or county airport, military base, or rail within 10 miles (small air fields allowed if not more than 2 within 5 miles) 4 ≡ no major airport or Air Force Base within 10 miles; no rail, pipeline, small city or county airport within 5 miles (1 or 2 small airfields okay) 3 ≡ rail and small airports (multiple) within 5 miles 2 ≡ major airport or Air Force Base within 10 miles 1 ≡ major airport or Air Force Base within 10 miles, rail and multiple small airports within 5 miles
P5	6.1	Ecology	Number of federally threatened, endangered, and rare species in the county	5 ≡ 0 species 4 ≡ 10 – 20 species 3 ≡ 20 – 30 species 2 ≡ 30 – 40 species 1 ≡ more than 40 species
P6	6.4	Wetlands	Impact on wetlands is evaluated based on the acreage of mapped wetlands within a 5000-acre nominal site area	5 ≡ 0 acres 4 ≡ 0 to 250 acres 3 ≡ 250 to 500 acres 2 ≡ 500 to 1500 acres 1 ≡ more than 1500 acres

Table 9.3-2 (Sheet 3 of 3)
Criteria Applied to Compare the Top 15 Potential Sites

Criterion	Weight Factor	Description	Description of Factors Evaluated	Score Assignment
P7	5.6	Railroad Access[(a)]	Railroad access is evaluated based on the estimated cost to construct rail spur to the site based on distance to nearest in-service rail spur	5 ≡ fewer than 2 miles 4 ≡ 2 to 5 miles 3 ≡ 5 to 10 miles 2 ≡ 10 to 15 miles 1 ≡ more than 15 miles Points adjusted based on the amount of new right-of-way necessary and the relative difficulty to acquire right-of-way. Scores may also be adjusted if barge access is located in the immediate vicinity instead of railroad access
P8	8.5	Transmission Access	Transmission access is evaluated based on (a) the distance to the load center in the greater Miami area (Palm Beach, Broward and Miami Dade Counties) and (b) the amount of new right-of-way that would have to be acquired	5 ≡ less than 50 miles 4 ≡ between 50 and 70 miles 3 ≡ between 70 and 100 miles 2 ≡ between 100 and 200 miles 1 ≡ more than 200 miles Scores are adjusted based on the amount of new right-of-way that must be acquired and the relative difficulty of acquisition
P9	6.5	Land Acquisition	Estimated cost to acquire the land	Land requirement assumed at 3000 acres. Assumed land prices are $10,000/acre for very remote areas; $17,500/acre for farm areas; $35,000/acre for land near population centers. Results were tallied and ranked relative to one another to determine the score.

(a) To evaluate sites that are physically isolated from railroad access, barge access (if available) is included for consideration as a part of this criterion.

Table 9.3-3
Comparative Scores for the Top 15 Potential Sites

Criterion Number	P1	P8	P3	P9	P6	P5	P7	P4	P2	
Importance	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Criterion	**Water Supply**	**Transmission Access**	**Population**	**Land Acquisition**	**Wetlands**	**Ecology**	**Railroad Access**	**Hazardous Land Use**	**Flood**	**Score**
Martin	3	5	3	5	4	2	5	3	2	214.9
Okeechobee 1	2	4	4	3	4	3	3	4	5	203.1
Glades	3	4	4	3	3	3	4	3	2	195.1
Okeechobee 2	3	4	3	3	2	3	4	3	3	185.0
Manatee	3	1	2	5	3	3	4	3	5	179.1
Hendry 1	2	4	4	3	2	3	3	4	2	178.6
Turkey Point	4	5	1	5	2	1	4	2	1	175.8
Hendry 2	2	4	5	3	1	3	2	5	1	175.3
DeSoto	1	3	3	5	2	3	3	4	4	173.8
Hardee	1	2	4	3	2	3	5	3	4	166.1
St. Lucie	4	1	1	5	2	2	4	3	1	152.9
Charlotte	2	2	4	3	1	2	1	5	2	142.9
Highlands	1	2	4	3	2	1	3	2	5	141.6
Ft. Myers	3	2	1	3	2	2	4	1	2	132.8
West County	3	2	1	3	1	2	2	4	2	130.2

Table 9.3-4
Criteria Applied to Compare the Top Eight Potential Sites

EPRI Guide Section	Weight Factor	Criteria
1.1.1	7.9	Geology/Seismology
1.1.2	9.6	Cooling System Requirements
1.1.3	3.9	Flooding
1.1.4	4.2	Nearby Hazardous Land Uses
1.1.5	4.6	Extreme Weather Conditions
1.2.1	8.1	Accident Effect Related
1.3.1	7.4	Surface Water – Radionuclide Pathway
1.3.2	7.2	Groundwater Radionuclide Pathway
1.3.3	7.4	Air Radionuclide Pathway
1.3.4	7.5	Air-Food Ingestion Pathway
1.3.5	7.4	Surface Water – Food Radionuclide Pathway
1.3.6	5.4	Transportation Safety
2.1.1	6.4	Disruption of Important Species/Habitats
2.1.2	5.1	Bottom Sediment Disruption Effects
2.2.1	6.5	Disruption of Important Species/Habitats and Wetlands
2.2.2	5.6	Dewatering Effects on Adjacent Wetlands
2.3.1	6.1	Thermal Discharge Effects
2.3.2	6.1	Entrainment/Impingement Effects
2.3.3	4.9	Dredging/Disposal Effects
2.4.1	5.9	Drift Effects on Surrounding Areas
3.1.1	5.2	Socioeconomics – Construction-Related Effects
3.3.1	4.3	Environmental Justice
3.4.1	5.4	Land Use
4.1.1	8.5	Water Supply
4.1.2	5.6	Pumping Distance
4.1.3	4.1	Flooding
4.1.5	4.8	Civil Works
4.2.1	6.7	Railroad Access
4.2.2	6.6	Highway Access
4.2.3	6.7	Barge Access
4.2.4	8.6	Transmission Access
4.3.1	3.4	Topography
4.3.2	5.6	Land Rights
4.3.3	5.4	Labor Rates

Table 9.3-5
Relative Importance of the 34 Metrics as Applied to the Top 8 Potential Sites

Criteria and EPRI Section Guide Identifier	Relative Importance
Cooling System Requirements (1.1.2)	1
Transmission Access (4.2.4)	2
Water Supply (4.1.1)	3
Accident Effect Related (1.2.1)	4
Geology/Seismology (1.1.1)	5
Air-Food Ingestion Pathway (1.3.4)	6
Surface Water — Radionuclide Pathway (1.3.1)	7
Air Radionuclide Pathway (1.3.3)	7
Surface Water — Food Radionuclide Pathway (1.3.5)	7
Groundwater Radionuclide Pathway (1.3.2)	8
Railroad Access (4.2.1)	9
Barge Access (4.2.3)	9
Highway Access (4.2.2)	10
Disruption of Important Species/Habitats and Wetlands (2.2.1)	11
Disruption of Important Species/Habitats (2.1.1)	12
Thermal Discharge Effects (2.3.1)	13
Entrainment/Impingement Effects (2.3.2)	13
Drift Effects on Surrounding Areas (2.4.1)	14
Dewatering Effects on Adjacent Wetlands (2.2.2)	15
Pumping Distance (4.1.2)	15
Land Rights (4.3.2)	15
Transportation Safety (1.3.6)	16
Land Use (3.4.1)	16
Labor Rates (4.3.3)	16
Socioeconomics – Construction-Related Effects (3.1.1)	17
Bottom Sediment Disruption Effects (2.1.2)	18
Dredging/Disposal Effects (2.3.3)	19
Civil Works (4.1.5)	20
Extreme Weather Conditions (1.1.5)	21
Environmental Justice (3.3.1)	22
Nearby Hazardous Land Uses (1.1.4)	23
Flooding (4.1.3)	24
Flooding (1.1.3)	25
Topography (4.3.1)	26

Note: Based on the chosen weight factors, some of the criteria have equal weight

Table 9.3-6
Comparative Scores for the Top 8 Potential Sites (Top Nine Criteria Only)

Potential Site	(1) Cooling System Requirements	(2) Transmission Access	(3) Water Supply	(4) Accident Effect Related	(5) Geology/Seismology	(6) Air-Food Ingestion Pathway	(7) Surface Water — Radionuclide Pathway	(8) Air Radionuclide Pathway	(9) Surface Water — Food Radionuclide Pathway
DeSoto	3	3	4	1	1	3	2	2	3
Hardee	2	2	2	1	1	3	2	2	2
Glades	3	4	4	1	1	3	2	2	3
Hendry 1	2	2	3	1	1	3	2	2	3
Martin	1	1	2	2	1	2	2	2	3
Okeechobee 2	1	2	2	1	1	3	2	2	2
St. Lucie	1	5	1	2	1	1	1	1	1
Turkey Point	1	1	1	2	1	1	1	1	1

**Table 9.3-7 (Sheet 1 of 2)
Listed Species Documented or Reported in Glades County
July 2008**

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	LE	LE
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Campephilus principalis	Ivory-billed Woodpecker	LE	
Caracara cheriway	Crested Caracara	LT	LT
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco peregrinus	Peregrine Falcon	N	LE
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haliaeetus leucocephalus	Bald Eagle	N	LT
Mycteria Americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	LS
Polyborus plancus audubonii	Audubon's Crested Caracara	LT	
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Gastropods (Snails)			
Orthalicus reses reses	Stock Island Tree Snail	LT	LE
Mammals			
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	
Sciurus niger shermani	Sherman's Fox Squirrel	N	LS

Table 9.3-7 (Sheet 2 of 2)
Listed Species Documented or Reported in Glades County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Trichechus manatus	Manatee	LE	LE
Ursus americanus floridanus	Florida Black Bear	N	LT
Plants and Lichens			
Cucurbita okeechobeensis	Okeechobee Gourd	LE	LE
Hypericum edisonianum	Edison's Ascyrum	N	LE
Warea carteri	Carter's Mustard	LE	
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Crocodylus acutus	American Crocodile	LT	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Gopherus polyphemus	Gopher Tortoise	N	LT

FEDERAL STATUS
LE Endangered: species in danger of extinction throughout a significant portion of its range.
LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
XN Nonessential experimental population.
N Not currently listed, nor currently being considered for listing as Endangered or Threatened.

STATE LEGAL STATUS
LE Endangered: species, subspecies, or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS Species of Special Concern is a species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.

Sources: FNAI, 2008a
USFWS, Feb 2008

Table 9.3-8 (Sheet 1 of 3)
Listed Species Documented or Reported in Martin County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Calidris canutus rufa	Red Knot	C	
Campephilus principalis	Ivory-billed Woodpecker	LE	
Caracara cheriway	Crested Caracara	LT	LT
Charadrius melodus	Piping Plover	LT	LT
Dendroica kirtlandii	Kirtland’s Warbler	LE	
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco peregrinus	Peregrine Falcon	N	LE
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haematopus palliates	American Oystercatcher	N	LS
Haliaeetus leucocephalus	Bald Eagle	N	LT
Mycteria Americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	LS
Platalea ajaja	Roseate Spoonbill	N	LS
Polyborus plancus audubonii	Audubon’s Crested Caracara	LT	
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Rynchops niger	Black Skimmer	N	LS
Sterna antillarum	Least Tern	N	LT
Fish			
Bairdiella sanctaeluciae	Striped Croaker	SC	N
Microphis brachyurus	Opossum Pipefish	SC	N

Table 9.3-8 (Sheet 2 of 3)
Listed Species Documented or Reported in Martin County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Pristis pectinata	Smalltooth Sawfish	LE	
Invertebrates			
Anaea mbricate floridalis	Florida Leafwing Butterfly	C	
Mammals			
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	LT	
Podomys floridanus	Florida Mouse	N	LS
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	
Sciurus niger shermani	Sherman’s Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Argusia gnaphalodes	Sea Lavender	N	LE
Asimina tetramera	Four-petal Pawpaw	LE	LE
Chamaesyce cumulicola	Sand-dune Spurge	N	LE
Cladonia perforata	Perforate Reindeer Lichen	LE	LE
Coelorachis tuberculosa	Piedmont Jointgrass	N	LT
Conradina grandiflora	Large-flowered Rosemary	N	LT
Ctenitis sloanei	Florida Tree Fern	N	LE
Dicerandra immaculata	Lakela’s Mint	LE	
Eugenia confusa	Tropical Ironwood	N	LE
Glandularia maritime	Coastal Vervain	N	LE
Halophila johnsonii	Johnson’s Seagrass	LT	N
Jacquemontia reclinata	Beach Jacquemontia	LE	LE
Lechea cernua	Nodding Pinweed	N	LT
Lechea divaricat	Pine Pinweed	N	LE
Linum carteri var. smallii	Small’s Flax	N	LE
Ophioglossum palmatum	Hand Fern	N	LE
Peperomia humilis	Terrestrial Peperomia	N	LE
Peperomia obtusifolia	Blunt-leaved Peperomia	N	LE
Polygala smalli	Tiny Polygala	LE	LE
Pteroglossaspis ecristata	Giant Orchid	N	LT
Tephrosia angustissima var. curtissii	Coastal Hoary-pea	N	LE
Tolumnia bahamensis	Dancing-lady Orchid	N	LE

Table 9.3-8 (Sheet 3 of 3)
Listed Species Documented or Reported in Martin County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Vanilla mexicana	Scentless Vanilla	N	LE
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Caretta caretta	Loggerhead	LT	LT
Chelonia mydas	Green Turtle	LE	LE
Crocodylus acutus	American Crocodile	LT	LE
Dermochelys coriacea	Leatherback	LE	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Eretmochelys mbricate	Hawksbill	LE	LE
Gopherus polyphemus	Gopher Tortoise	N	LT

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C Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
XN Nonessential experimental population.
SC Not currently listed, but considered a “species of concern” to USFWS.
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N Not currently listed, nor currently being considered for listing.

Sources: FNAI, 2008a
USFWS, Feb 2008

Table 9.3-9 (Sheet 1 of 2)
Listed Species Documented or Reported in Okeechobee County
July 2008

Scientific Name	**Common Name**	**Federal Status**	**State Status**
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	LE	LE
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Campephilus principalis	Ivory-billed Woodpecker	LE	
Caracara cheriway	Crested Caracara	LT	LT
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco peregrinus	Peregrine Falcon	N	LE
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haliaeetus leucocephalus	Bald Eagle	N	LT
Mycteria americana	Wood Stork	LE	LE
Picoides borealis	Red-cockaded Woodpecker	LE	
Polyborus plancus audubonii	Audubon’s Crested Caracara	LT	
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Sterna antillarum	Least Tern	N	LT
Mammals			
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	
Sciurus niger shermani	Sherman’s Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Calopogon multiflorus	Many-flowered Grass-pink	N	LE
Conradina grandiflora	Large-flowered Rosemary	N	LT
Nolina atopocarpa	Florida Beargrass	N	LT

Table 9.3-9 (Sheet 2 of 2)
Listed Species Documented or Reported in Okeechobee County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Ophioglossum palmatum	Hand Fern	N	LE
Panicum abscissum	Cutthroat Grass	N	LE
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Gopherus polyphemus	Gopher Tortoise	N	LT

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LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
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Sources: FNAI, 2008a
USFWS, Feb 2008

Table 9.3-10 (Sheet 1 of 3)
Listed Species Documented or Reported in St. Lucie County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Calidris canutus rufa	Red Knot	C	
Campephilus principalis	Ivory-billed Woodpecker	LE	
Caracara cheriway	Crested Caracara	LT	LT
Charadrius melodus	Piping Plover	LT	LT
Dendroica kirtlandii	Kirtland's Warbler	LE	
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco peregrinus	Peregrine Falcon	N	LE
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haematopus mbricate	American Oystercatcher	N	LS
Haliaeetus leucocephalus	Bald Eagle	N	LT
Mycteria americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	
Platalea ajaja	Roseate Spoonbill	N	LS
Polyborus plancus audubonii	Audubon's Crested Caracara	LT	
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Rynchops niger	Black Skimmer	N	LS
Sterna antillarum	Least Tern	N	LT
Fish			
Bairdiella sanctaeluciae	Striped Croaker	SC	N
Microphis brachyurus	Opossum Pipefish	SC	N

Table 9.3-10 (Sheet 2 of 3)
Listed Species Documented or Reported in St. Lucie County
July 2008

Scientific Name	Common Name	Federal Status	State Status
Pristis pectinata	Smalltooth Sawfish	LE	
Rivulus marmoratus	Mangrove Rivulus	C	LS
Mammals			
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	LT	LT
Podomys floridanus	Florida Mouse	N	LS
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	
Sciurus niger shermani	Sherman’s Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Argusia gnaphalodes	Sea Lavender	N	LE
Chamaesyce cumulicola	Sand-dune Spurge	N	LE
Coelorachis tuberculosa	Piedmont Jointgrass	N	LT
Conradina grandiflora	Large-flowered Rosemary	N	LT
Dicerandra immaculata	Lakela’s Mint	LE	LE
Glandularia maritima	Coastal Vervain	N	LE
Halophila johnsonii	Johnson’s Seagrass	LT	N
Harrisia fragrans	Fragrant Prickly Apple	LE	LE
Lechea cernua	Nodding Pinweed	N	LT
Okenia hypogaea	Burrowing Four-o’clock	N	LE
Peperomia obtusifolia	Blunt-leaved Peperomia	N	LE
Polygala smallii	Tiny Polygala	LE	LE
Pteroglossaspis ecristata	Giant Orchid	N	LT
Schizachyrium niveum	Scrub Bluestem	N	LE
Tephrosia angustissima var. curtissii	Coastal Hoary-pea	N	LE
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Caretta caretta	Loggerhead	LT	LT
Chelonia mydas	Green Turtle	LE	LE
Crocodylus acutus	American Crocodile	LT	LE
Dermochelys coriacea	Leatherback	LE	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT

**Table 9.3-10 (Sheet 3 of 3)
Listed Species Documented or Reported in St. Lucie County
July 2008**

Scientific Name	Common Name	Federal Status	State Status
Eretmochelys mbricate	Hawksbill	LE	LE
Gopherus polyphemus	Gopher Tortoise	N	LT
Lepidochelys kempii	Kemp's Ridley	LE	LE
Pituophis melanoleucus mugitus	Florida Pine Snake	N	LS

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Sources: FNAI, 2008a
USFWS, Feb 2008

Table 9.3-11
Characterization of Construction Impacts for the Proposed and Alternative Sites

Category	Turkey Point	Glades	Martin	Okeechobee 2	St. Lucie
Land Use Impacts					
The Site and Vicinity	SMALL	MODERATE	SMALL	MODERATE	SMALL
Air Impacts					
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Water Related Impacts					
Water Use	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecological Impacts					
Terrestrial Ecosystems	MODERATE	SMALL	SMALL	SMALL	SMALL
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL	SMALL
Threatened and Endangered Species	MODERATE	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL	SMALL
Economy	SMALL (beneficial)	SMALL (beneficial)	SMALL[(a)] (beneficial)	SMALL (beneficial)	SMALL (beneficial)
Taxes	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)
Transportation	SMALL to MODERATE	MODERATE	LARGE	LARGE	LARGE
Aesthetics	SMALL	MODERATE	SMALL	MODERATE	SMALL
Recreation	SMALL	SMALL	SMALL	SMALL	SMALL
Housing		SMALL	SMALL	SMALL to MODERATE	SMALL
Public and Social Services	SMALL	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL [(a)]	SMALL	SMALL
Historic and Cultural Resources	SMALL	LARGE	SMALL	LARGE	MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL	SMALL[(a)]

(a) Impacts would be SMALL for the ROI and Martin, Palm Beach, and St. Lucie Counties. Impacts to Okeechobee County would be MODERATE.

Table 9.3-12
Characterization of Operations Impacts for the Proposed and Alternative Sites

Category	Turkey Point	Glades	Martin	Okeechobee 2	St. Lucie
Land Use Impacts					
The Site and Vicinity	SMALL	MODERATE	SMALL	MODERATE	SMALL
Air Impacts					
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Water Related Impacts					
Water Use	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecological Impacts					
Terrestrial Ecosystems	SMALL	SMALL	SMALL	SMALL	SMALL
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL	SMALL
Threatened and Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL	SMALL
Economy	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)
Taxes	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)
Transportation	MODERATE	SMALL	SMALL	SMALL	SMALL
Aesthetics	SMALL	MODERATE	SMALL	MODERATE	SMALL
Recreation	SMALL	SMALL	SMALL	SMALL	SMALL
Housing	SMALL	SMALL	SMALL	SMALL	SMALL
Public and Social Services	SMALL	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	SMALL	LARGE	SMALL	LARGE	MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL	SMALL

Figure 9.3-1 Sites Initially Identified for the Site Selection Evaluation

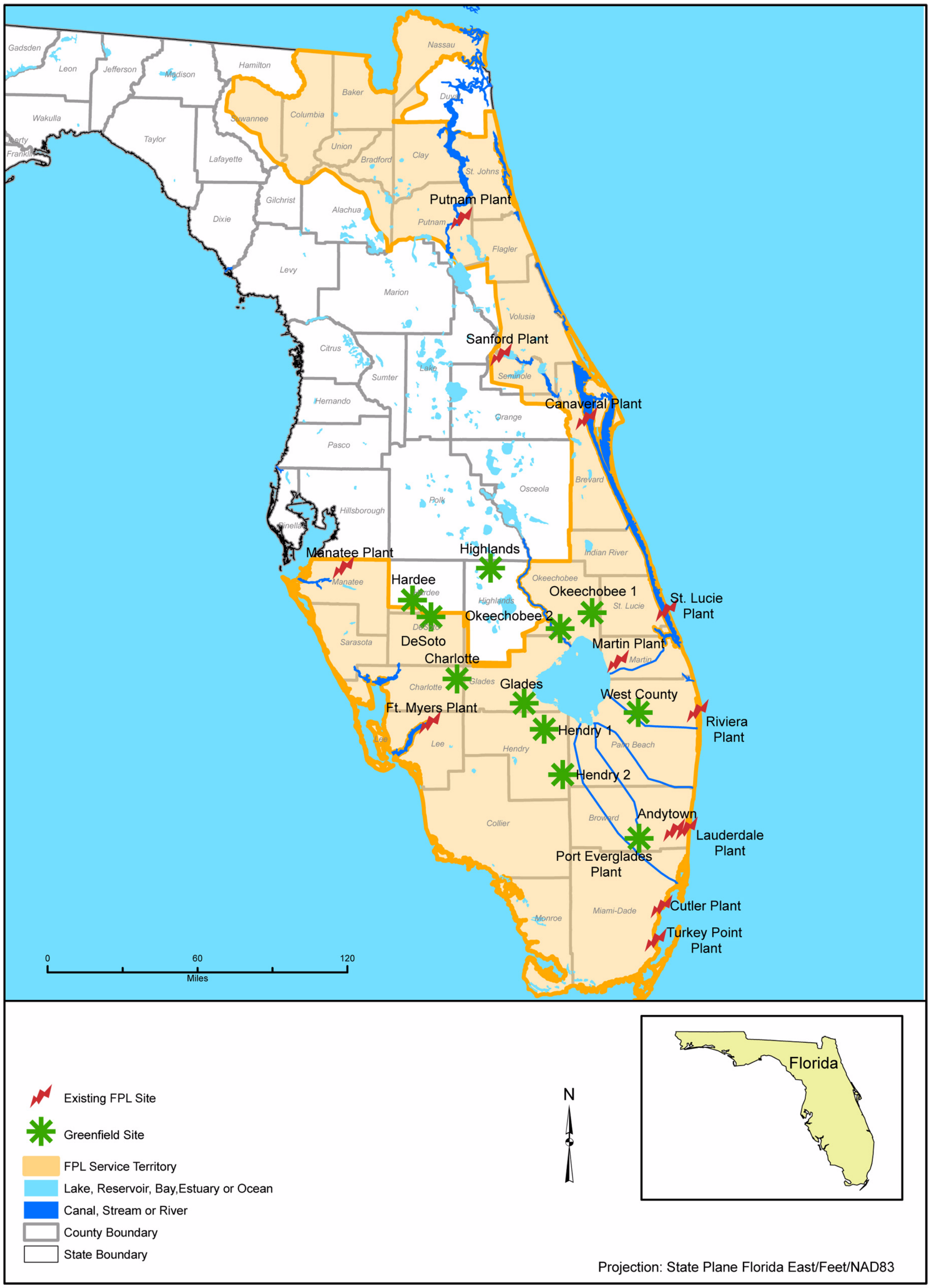


Figure 9.3-2 Power Load Centers in the FPL Service Territory

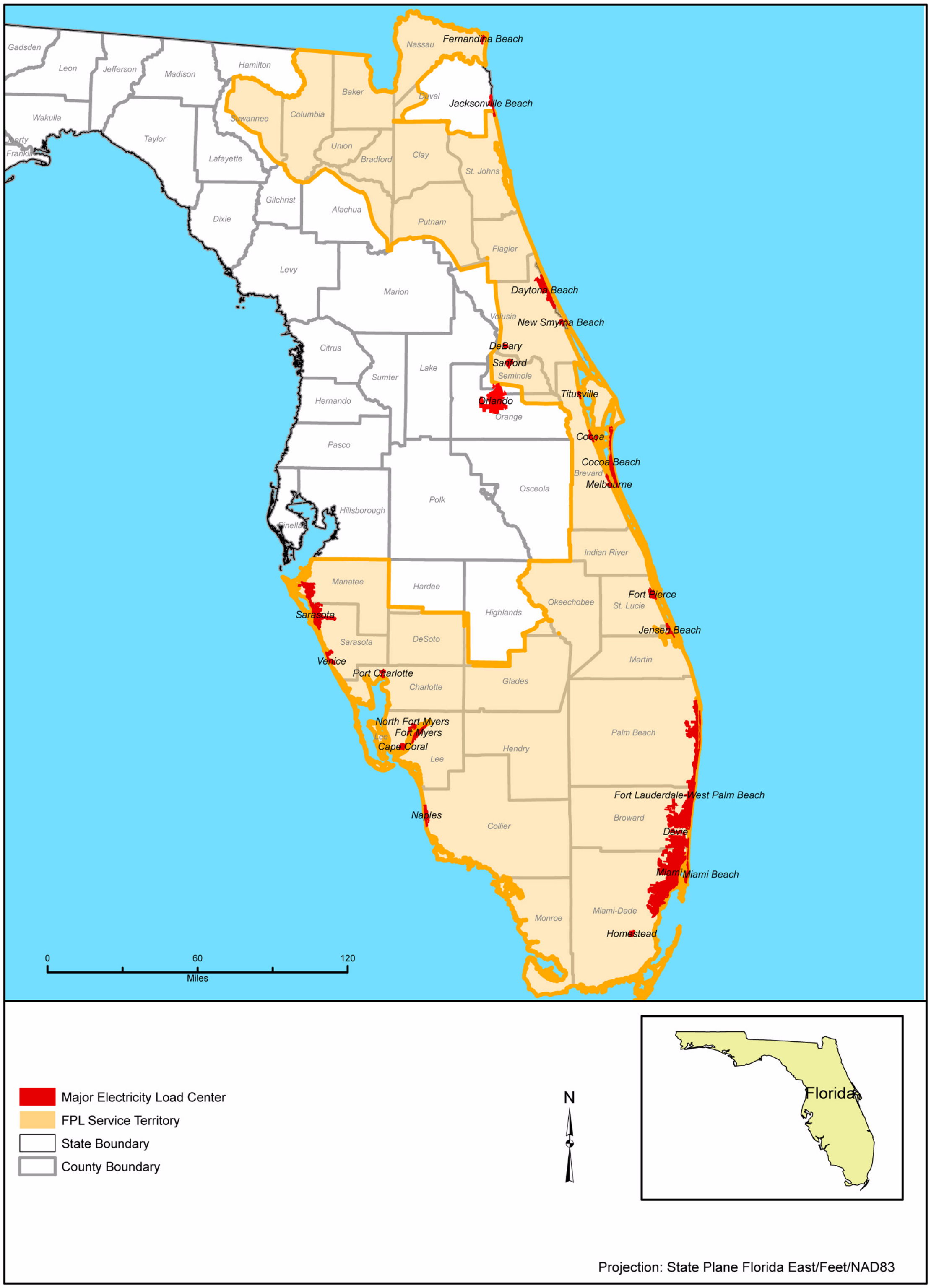


Figure 9.3-3 Population Centers in the FPL Service Territory

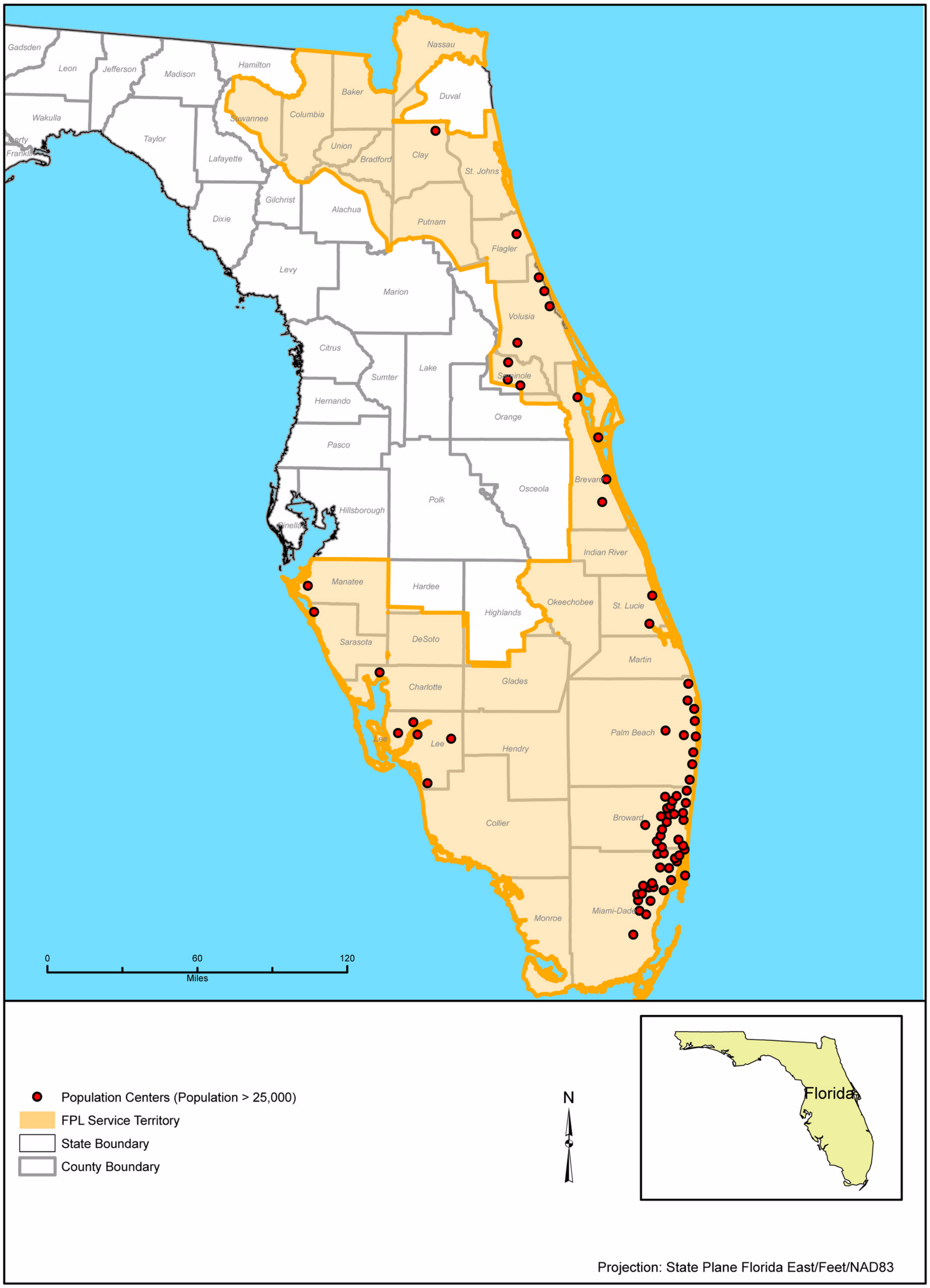


Figure 9.3-4 Transmission System in the FPL Service Territory

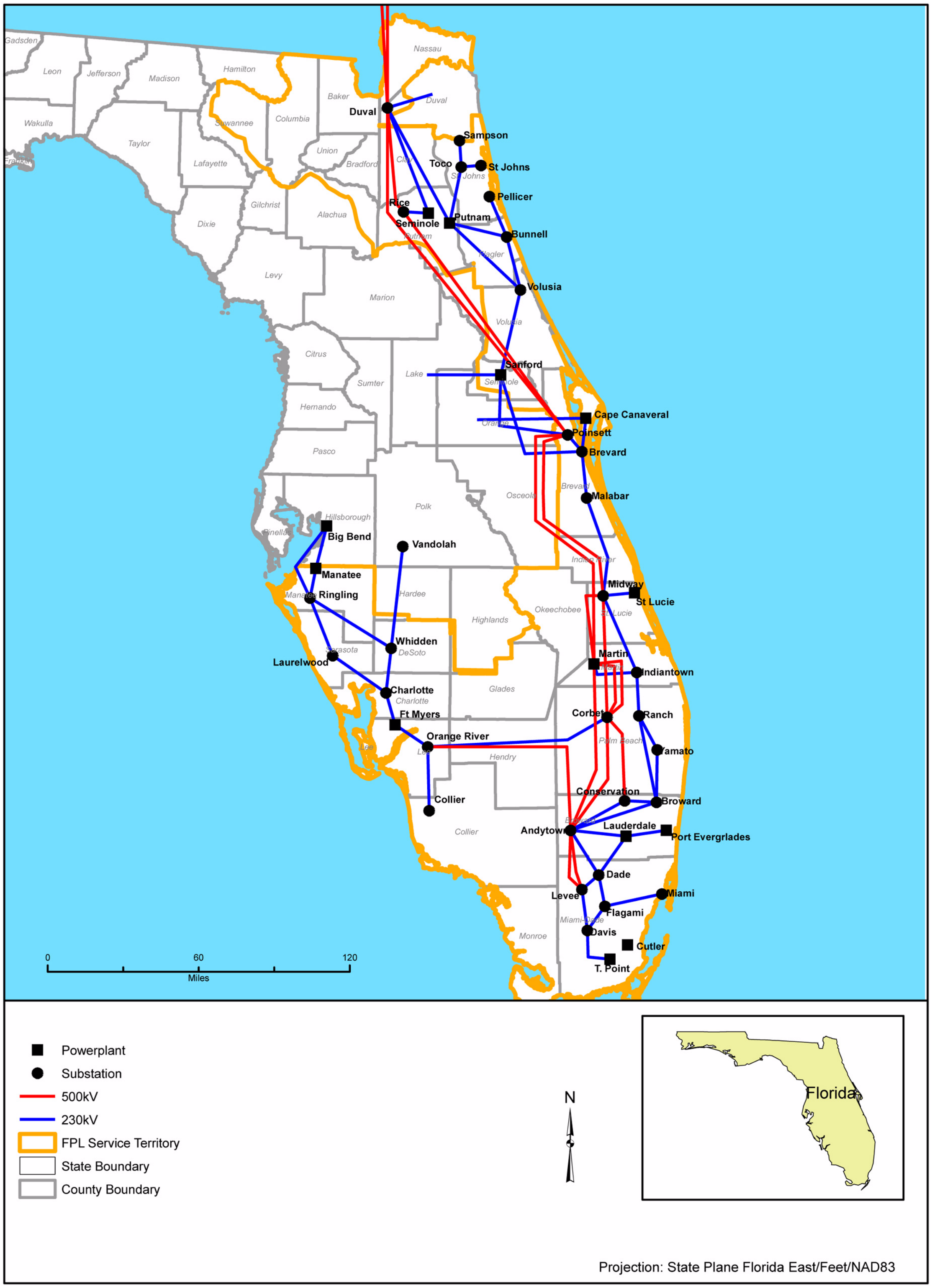


Figure 9.3-5 Composite Scores of the Top 15 Potential Sites

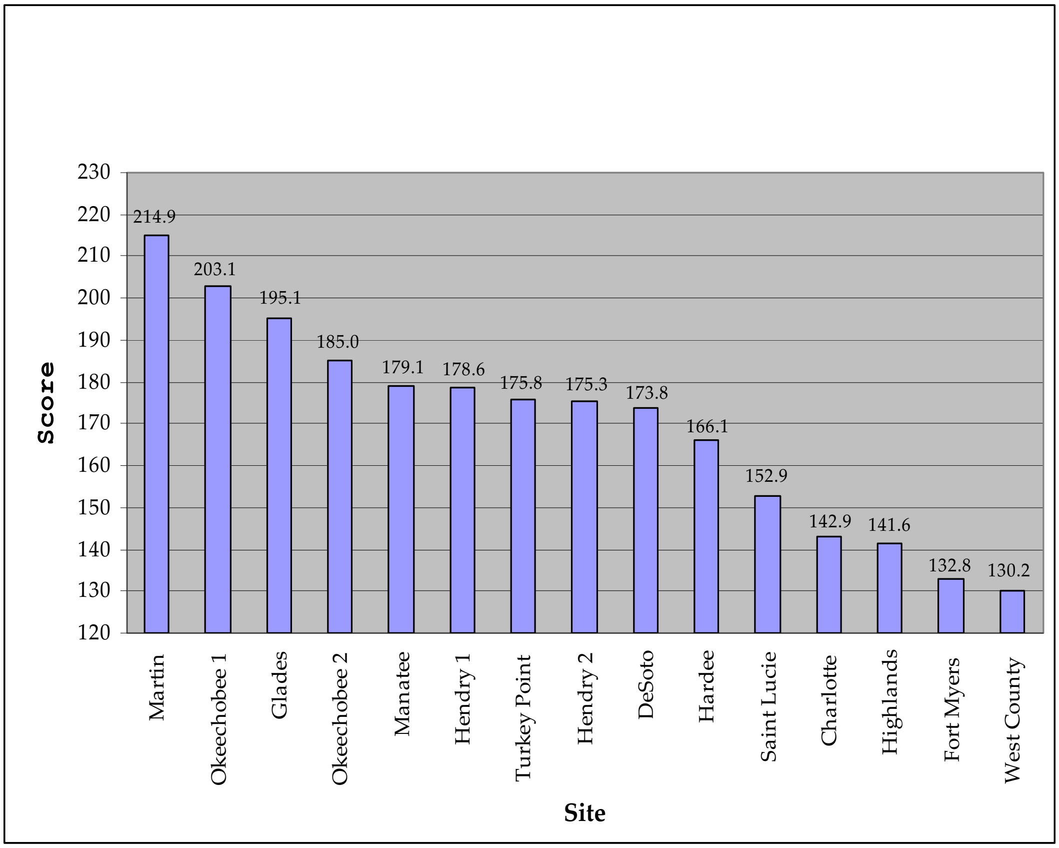


Figure 9.3-6 Composite Scores of the Top Eight Potential Sites

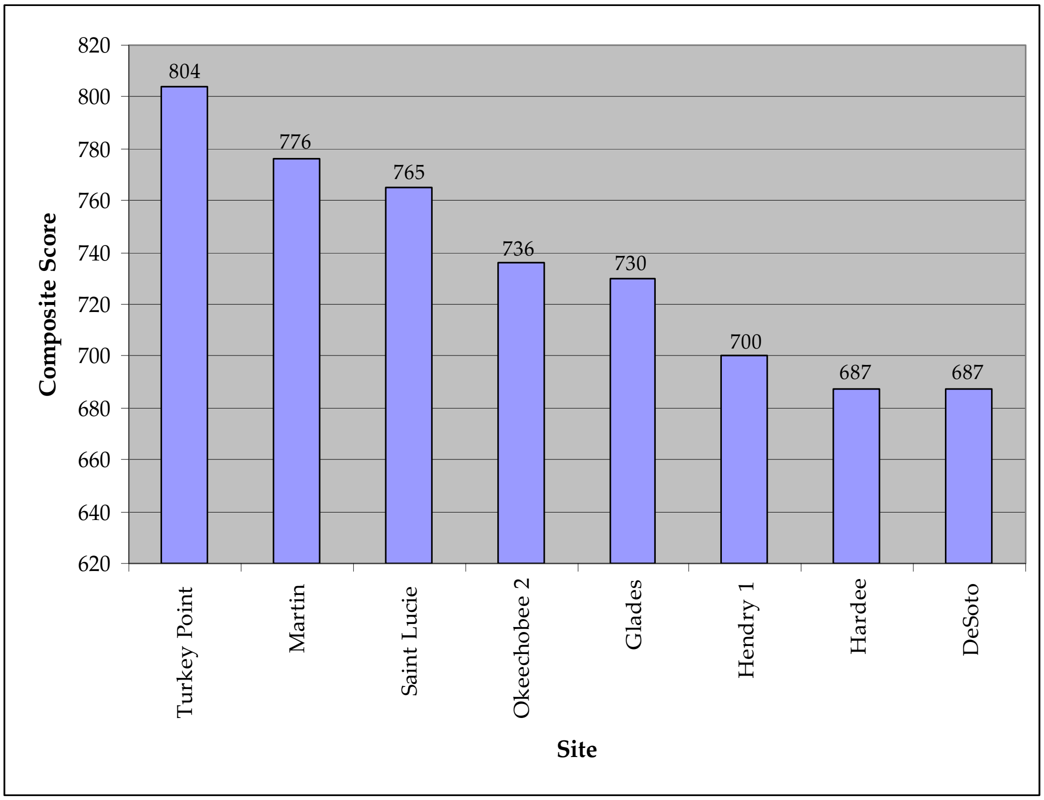


Figure 9.3-7 Alternative Sites

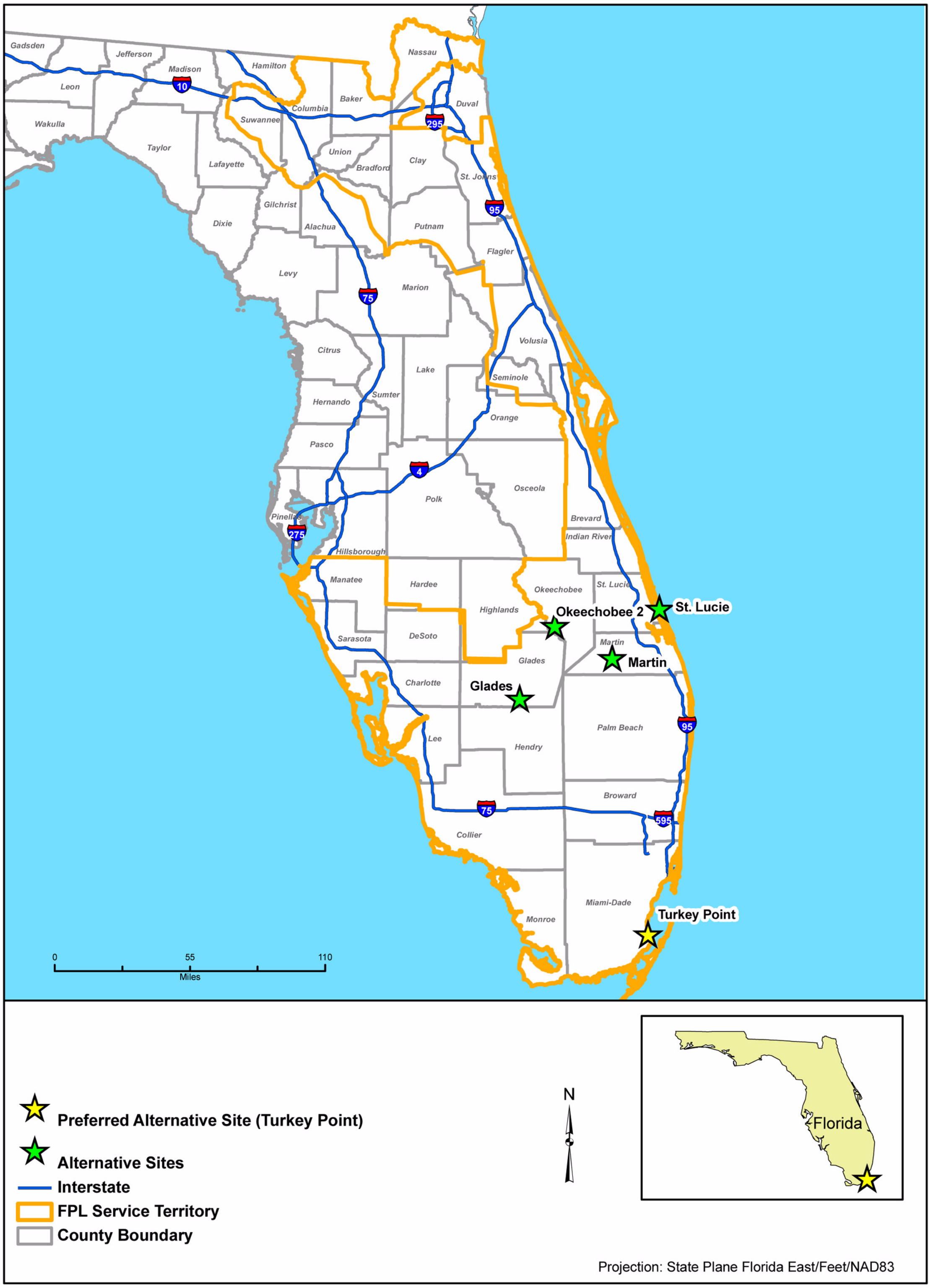


Figure 9.3-8 Glades Alternative Site

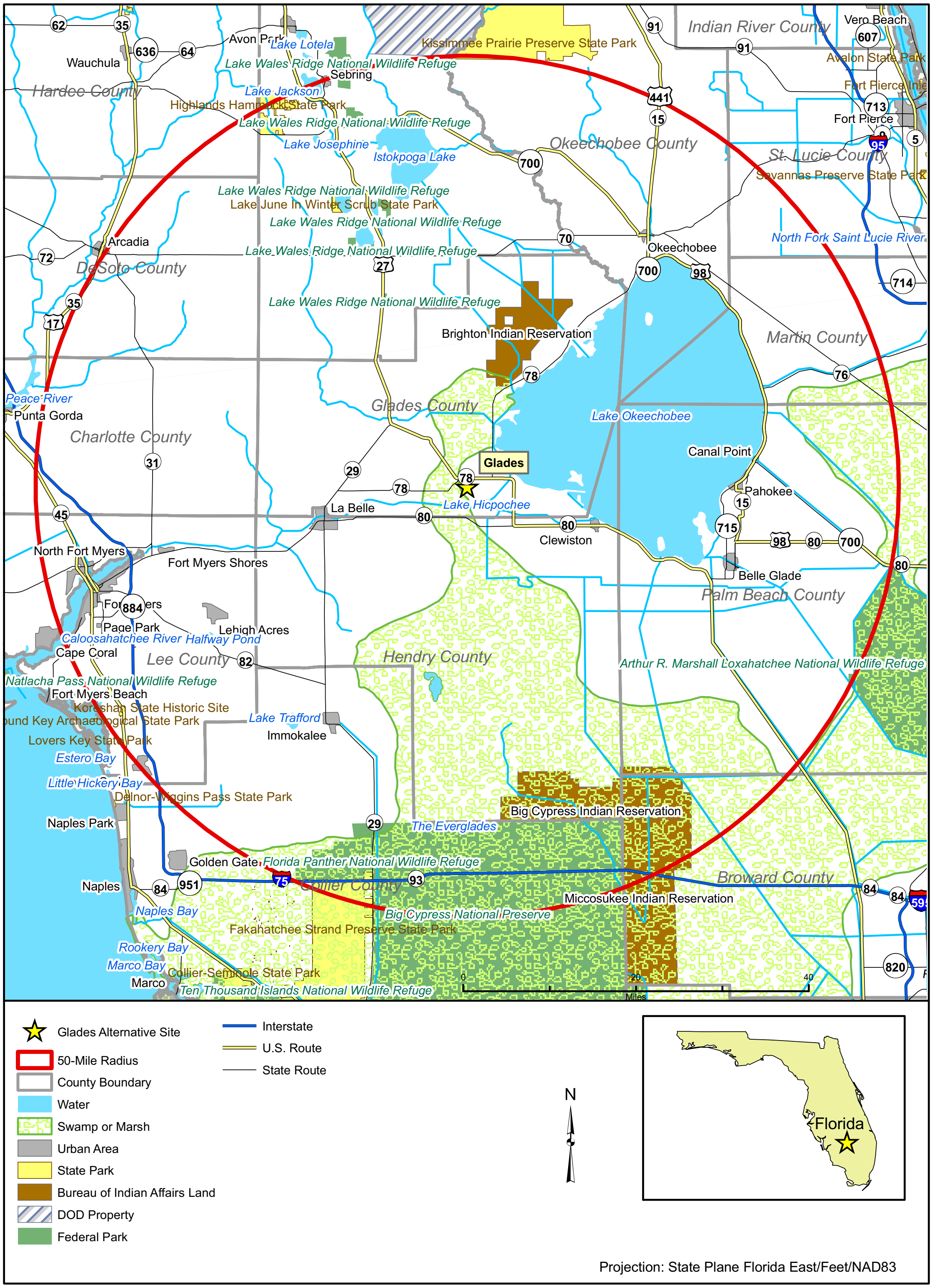


Figure 9.3-9 Glades Alternative Site Significant Minority Populations

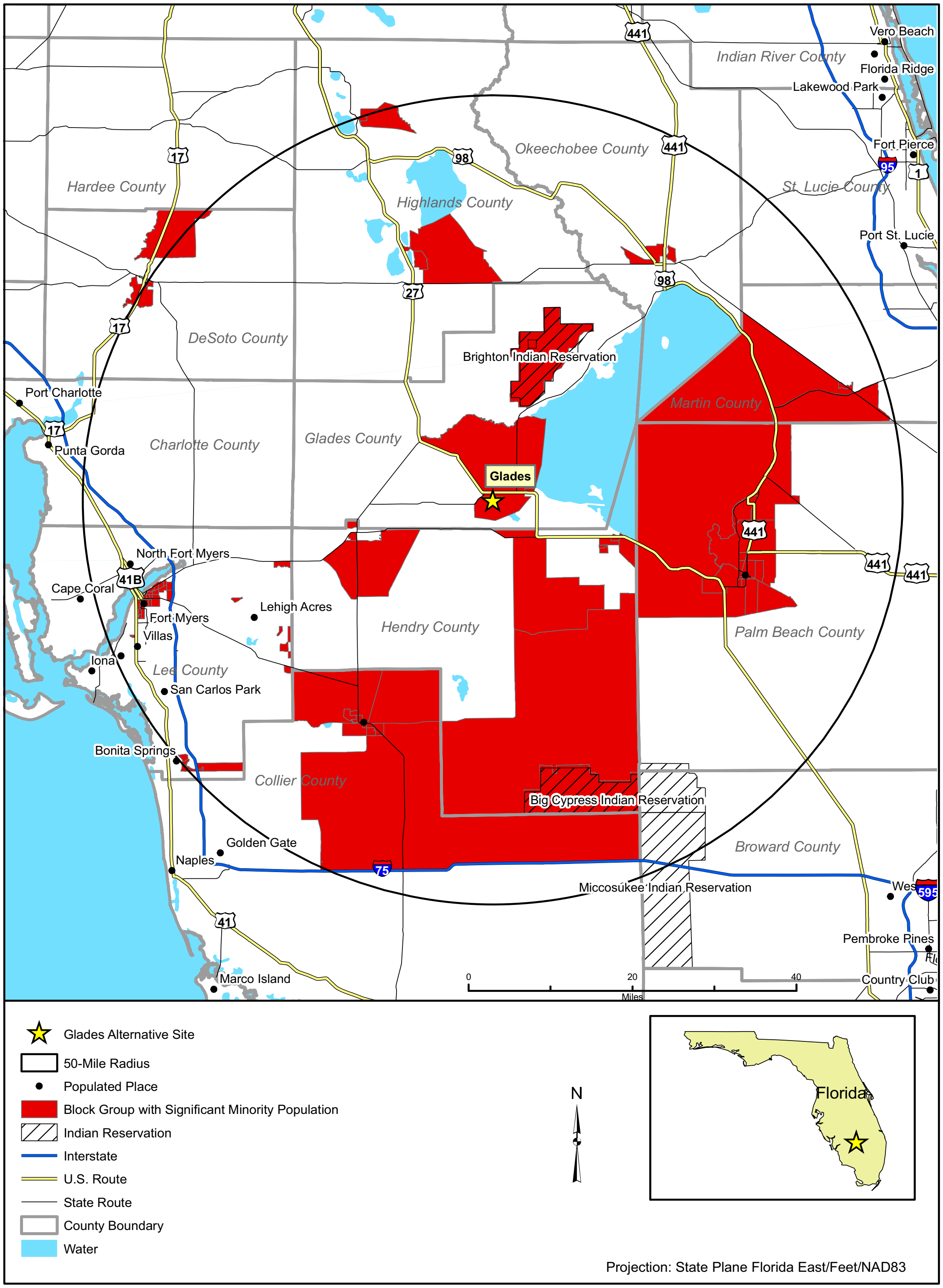


Figure 9.3-10 Glades Alternative Site Significant Low-Income Populations

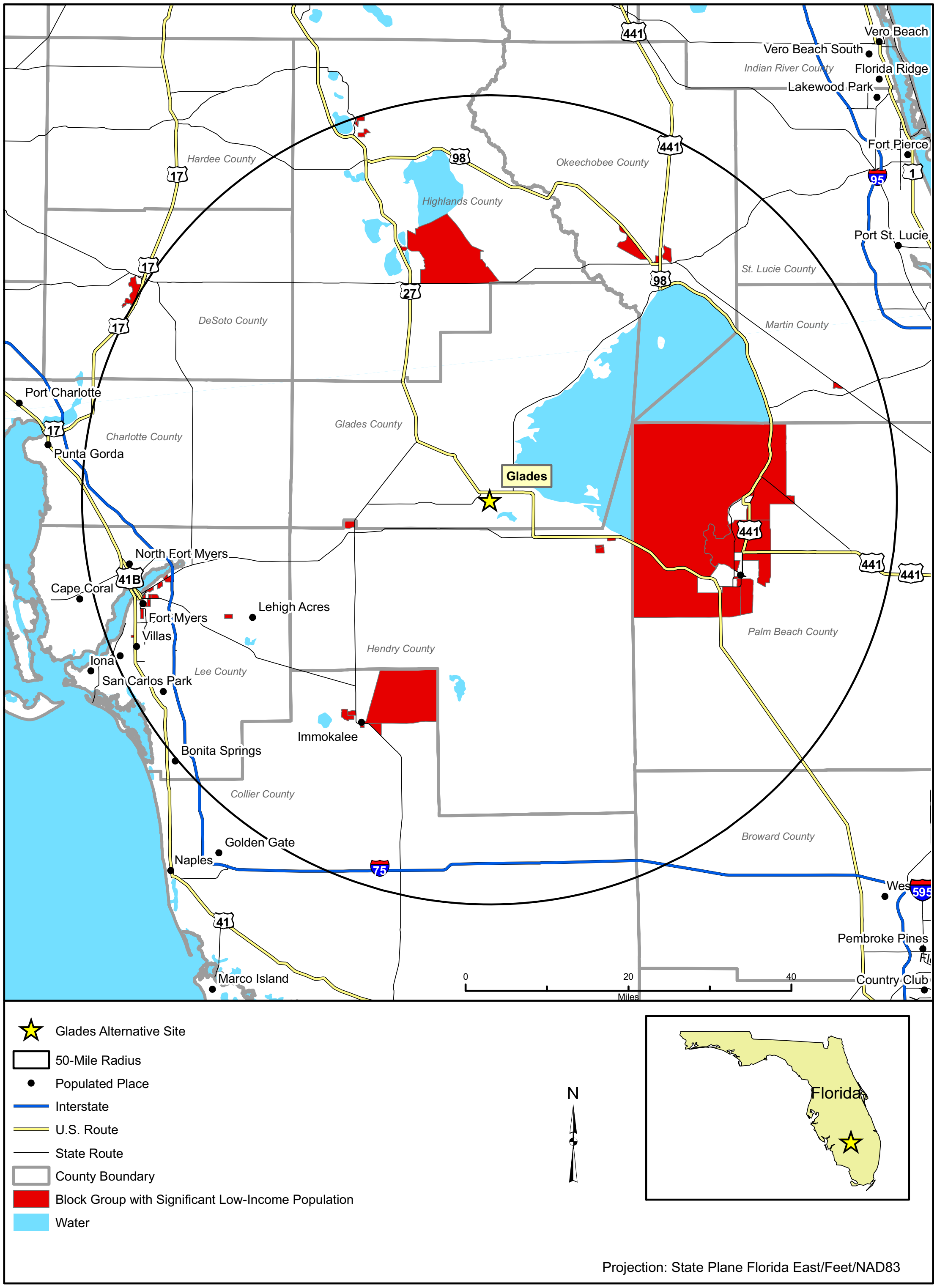


Figure 9.3-11 Martin Alternative Site

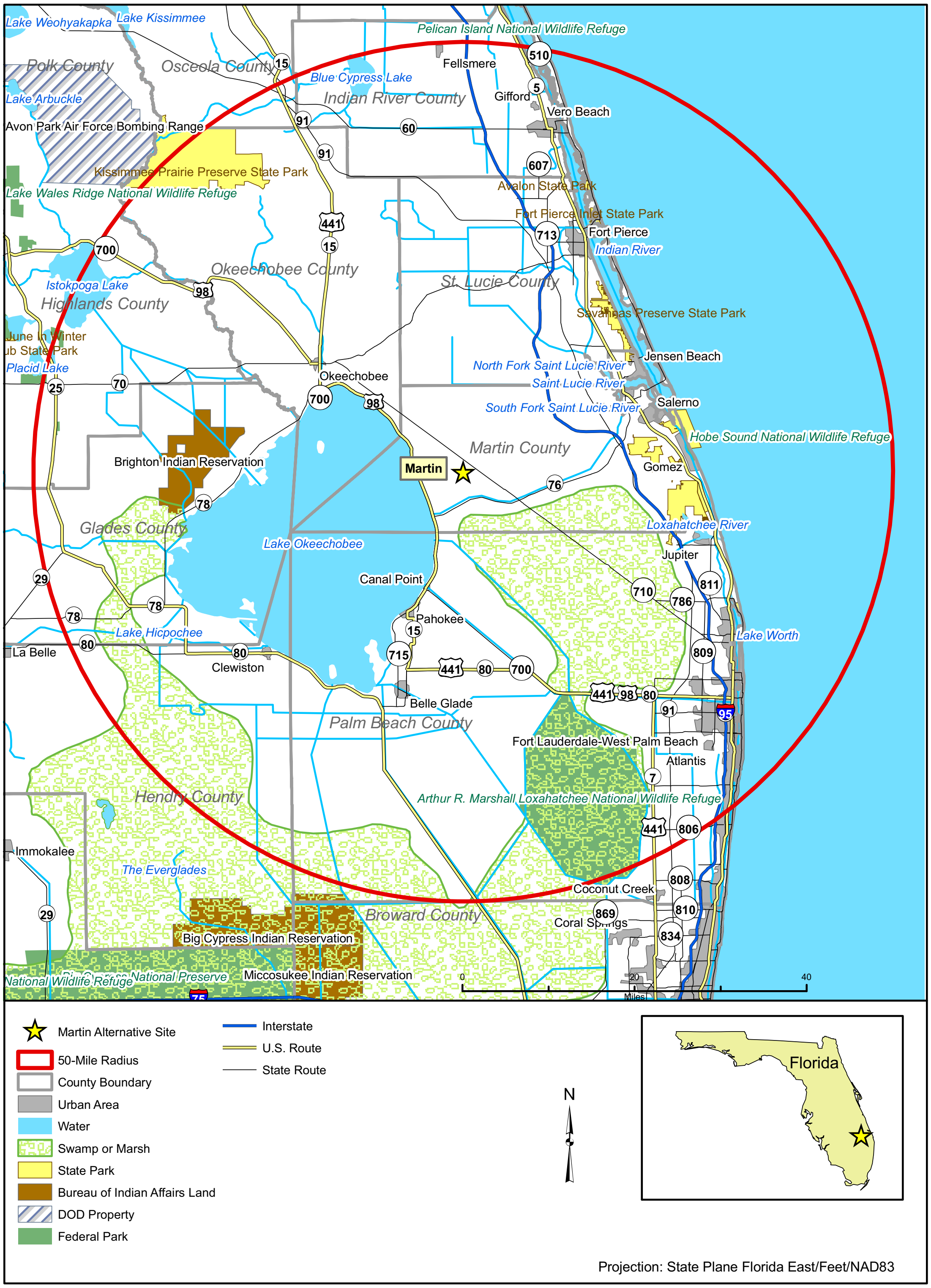


Figure 9.3-12 Martin Alternative Site Significant Minority Populations

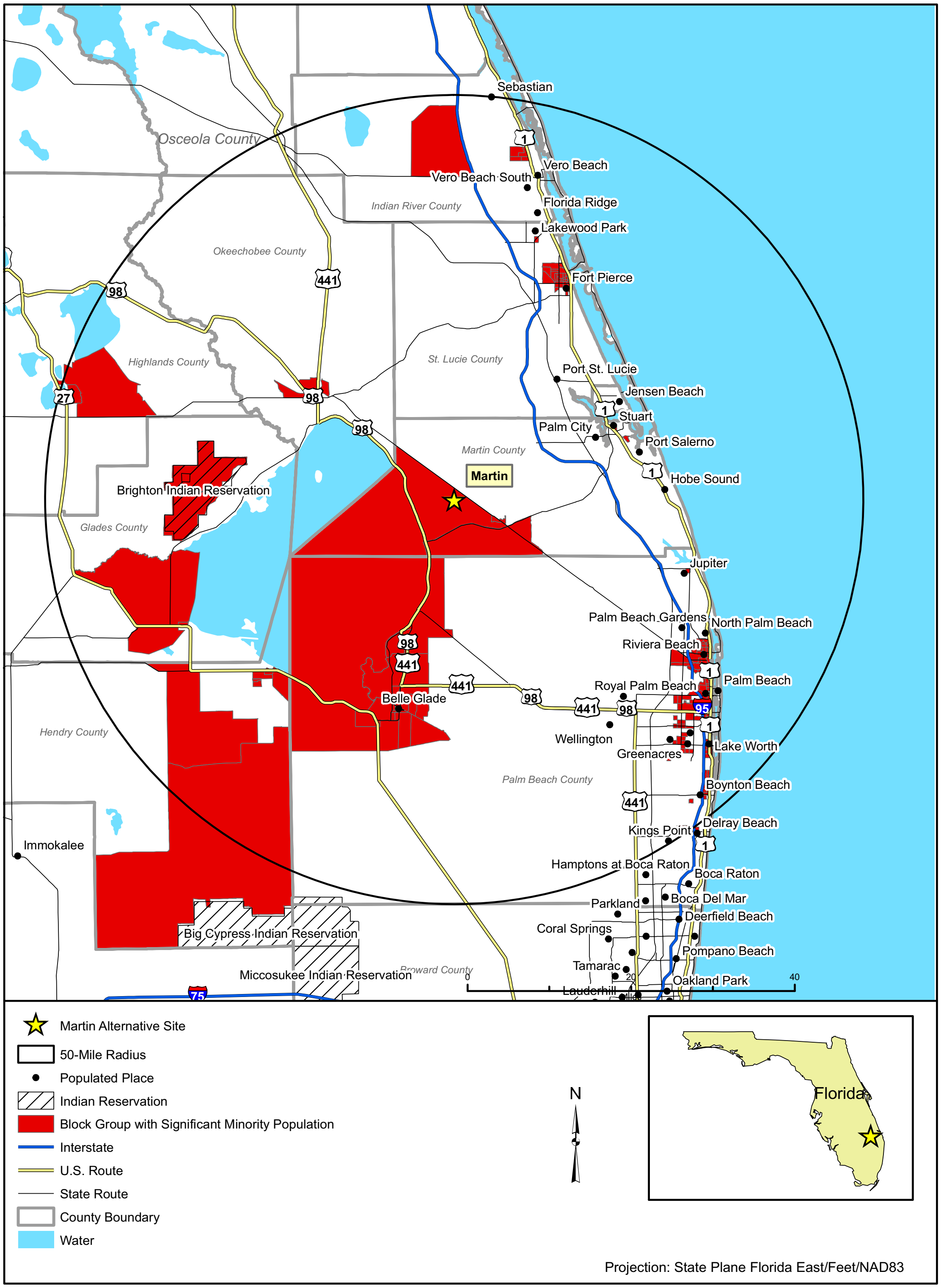


Figure 9.3-13 Martin Alternative Site Low-Income Populations

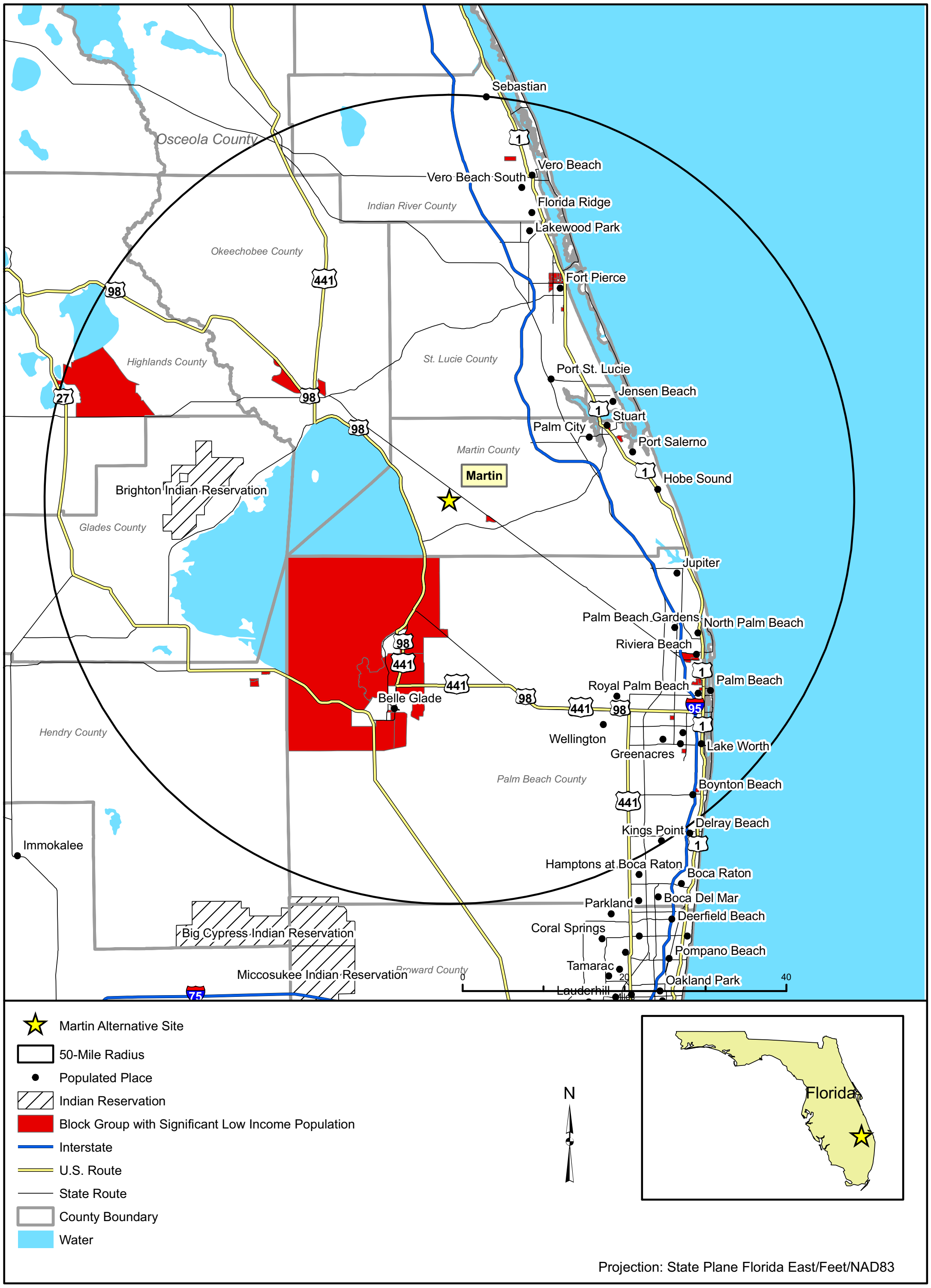


Figure 9.3-14 Okeechobee 2 Alternative Site

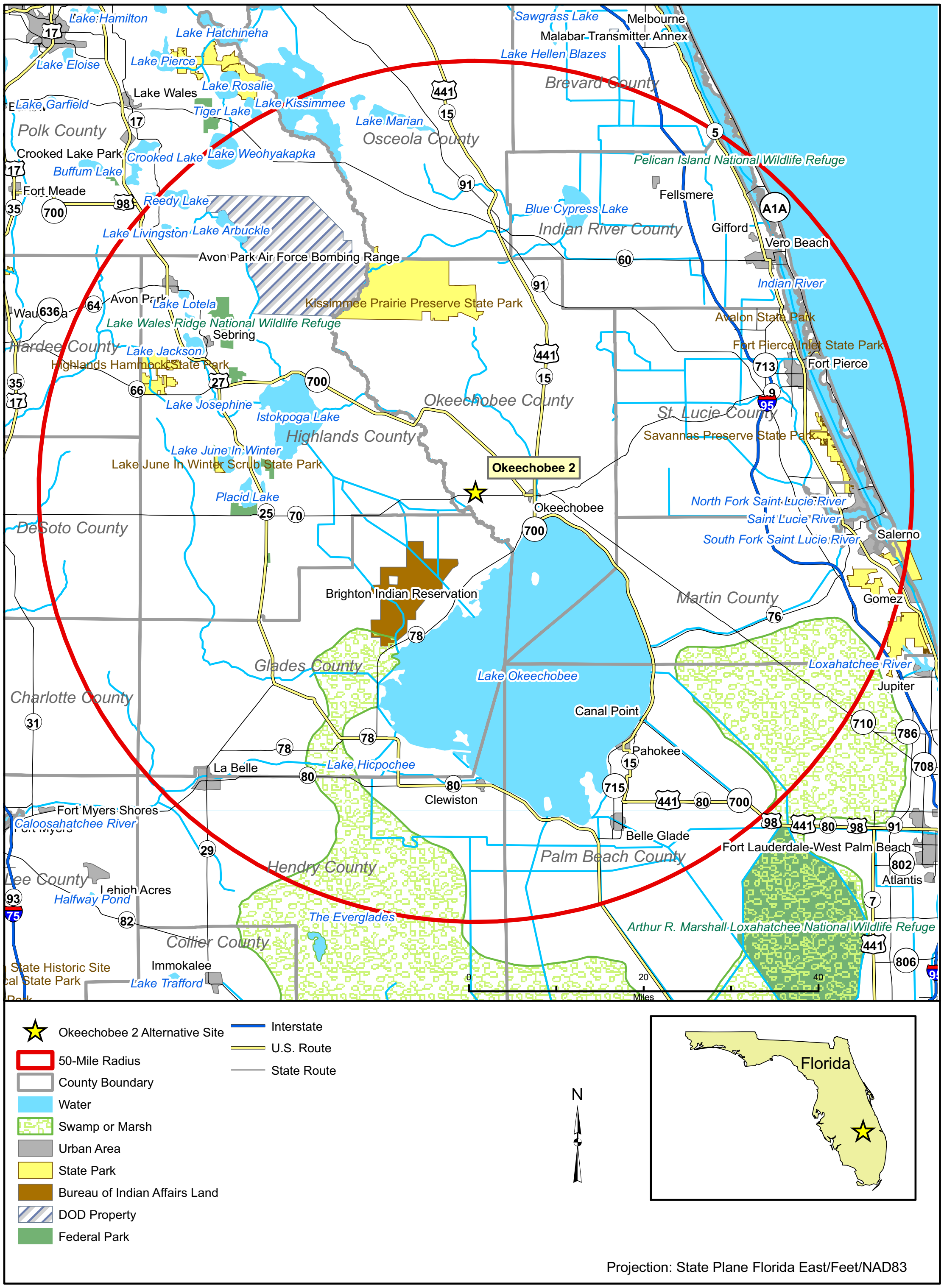


Figure 9.3-15 Okeechobee 2 Alternative Site Significant Minority Populations

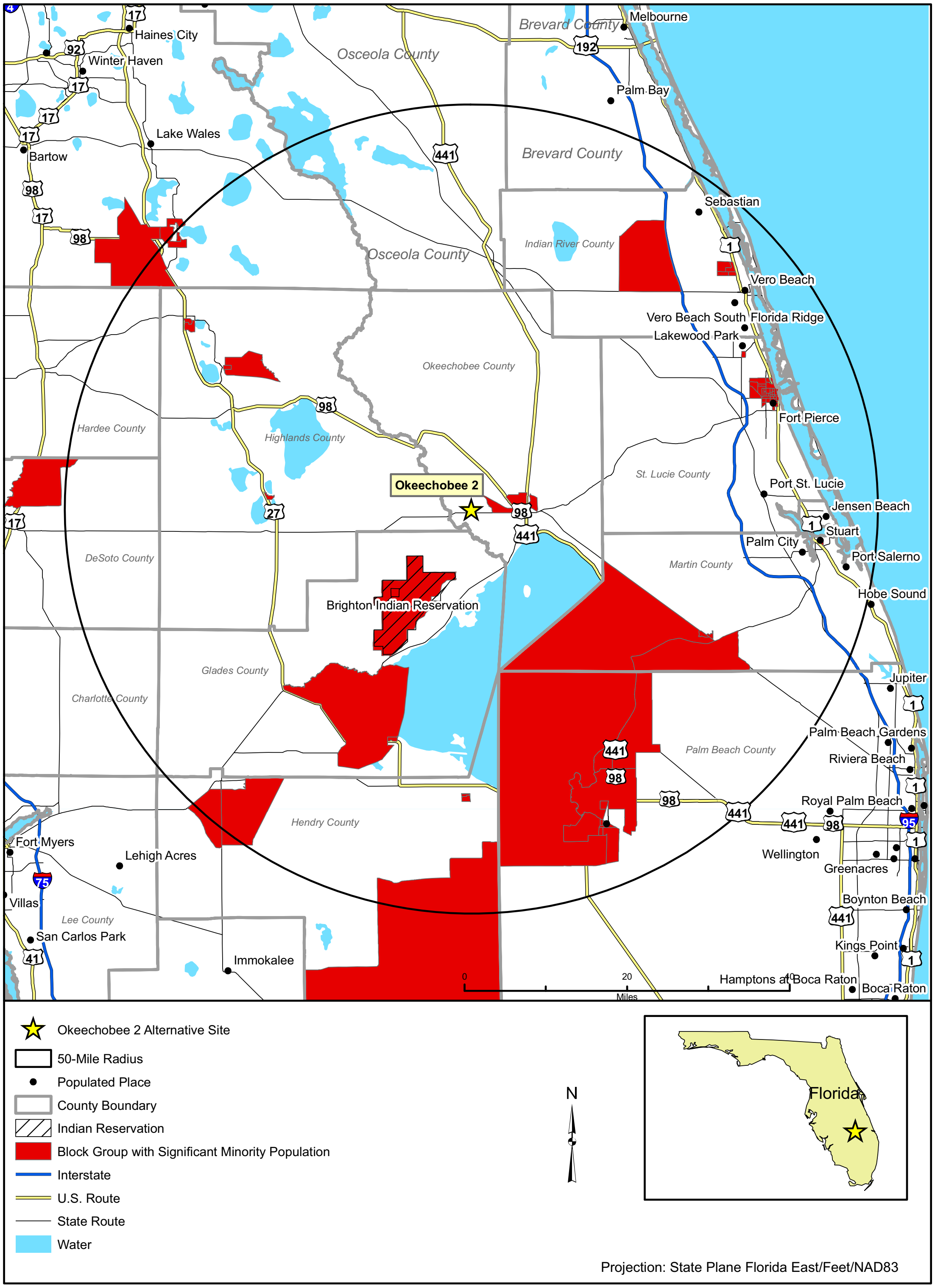


Figure 9.3-16 Okeechobee 2 Alternative Site Significant Low-Income Populations

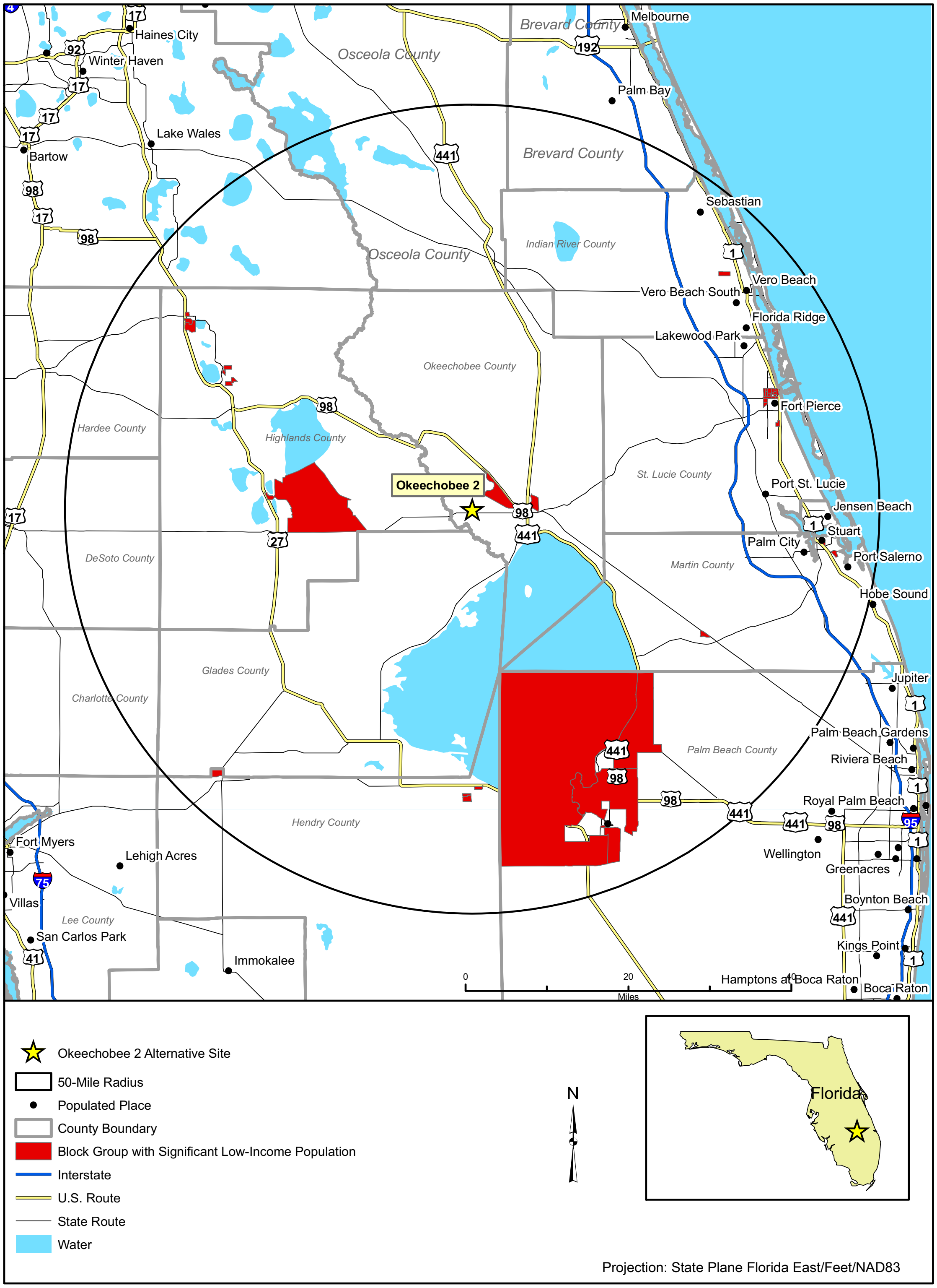


Figure 9.3-17 St. Lucie Alternative Site

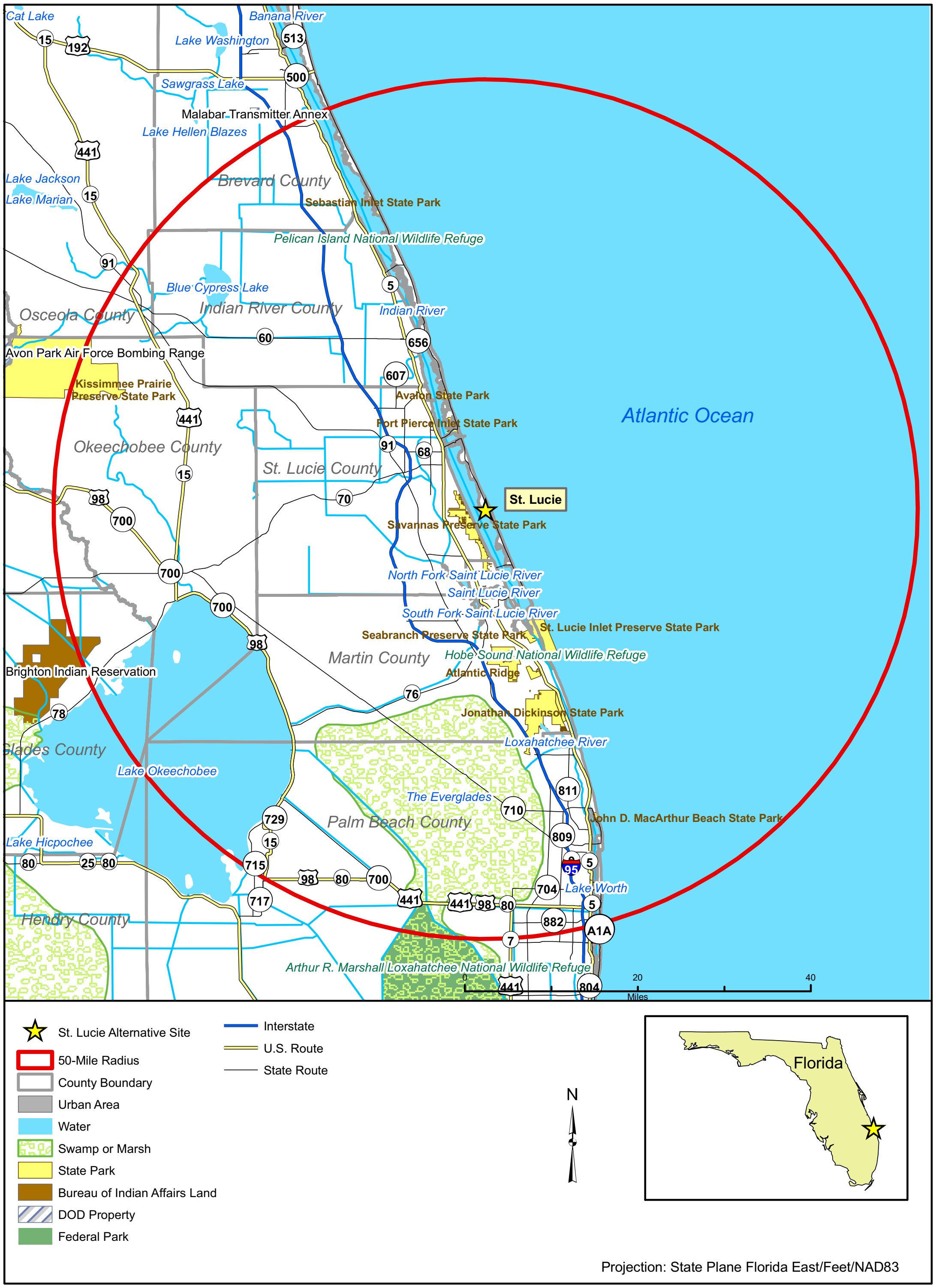


Figure 9.3-18 St. Lucie Alternative Site Significant Minority Populations

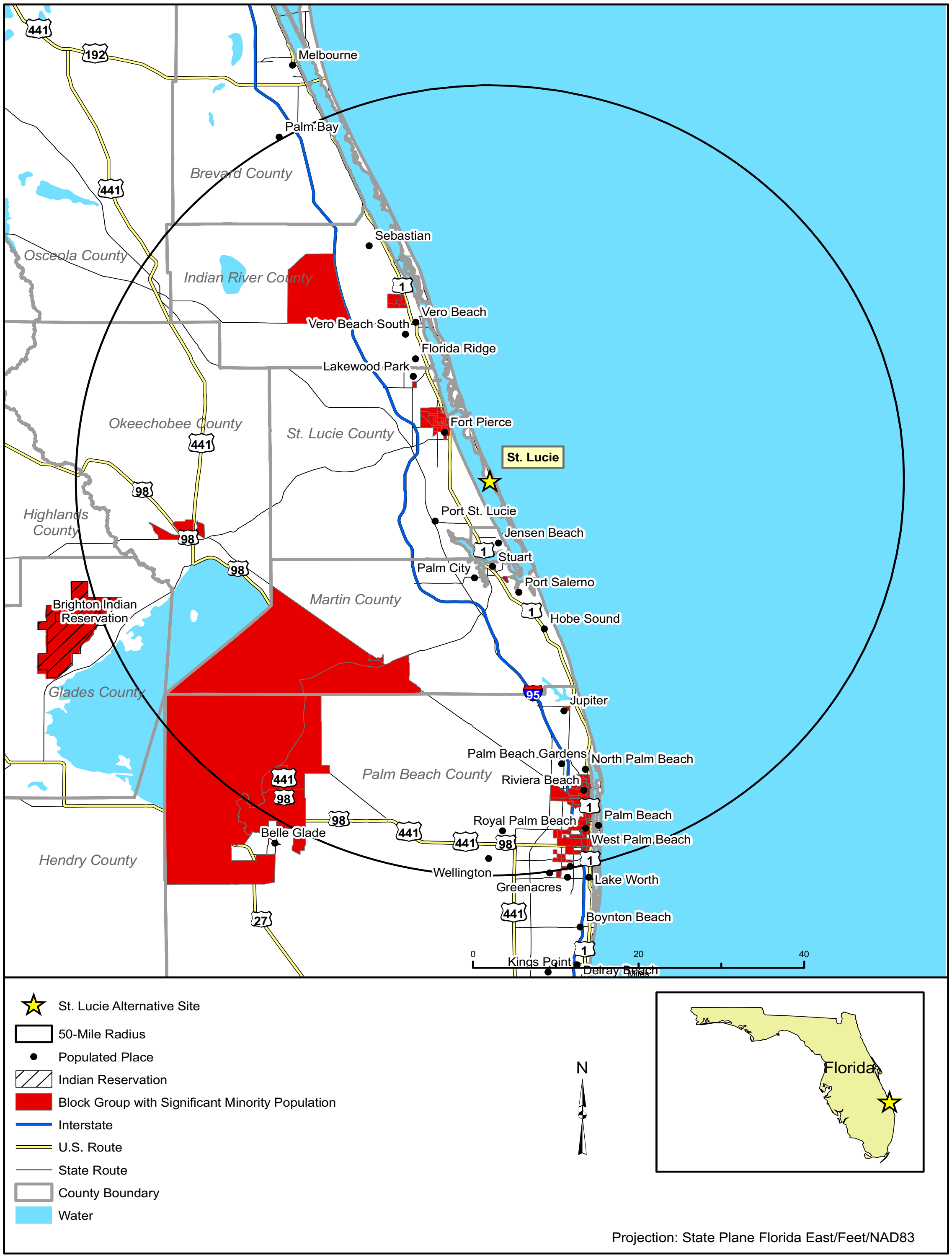
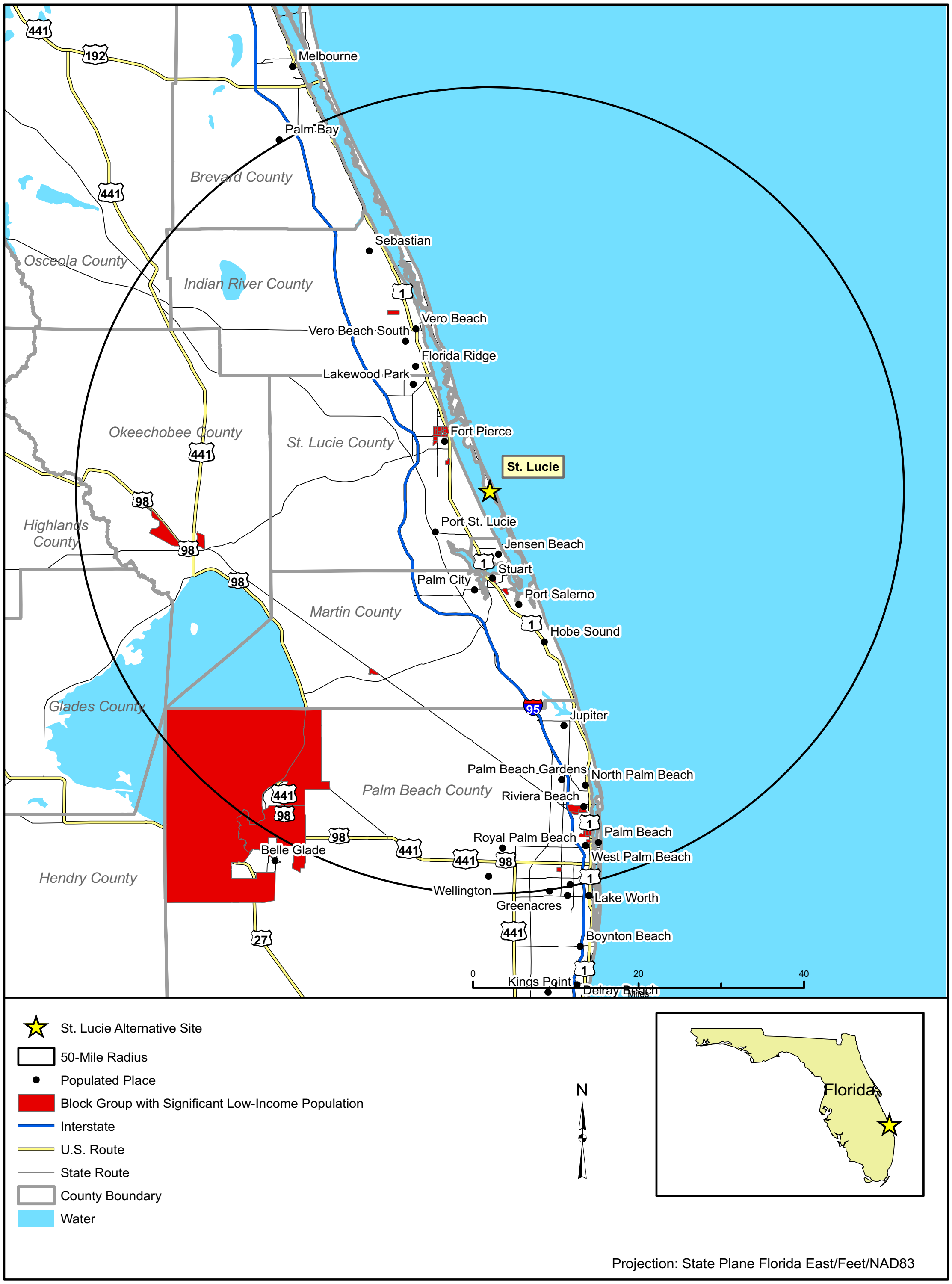


Figure 9.3-19 St. Lucie Alternative Site Significant Low-Income Populations



9.4 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS

This section provides an analysis of alternative plant and transmission systems in relation to the proposed Units 6 & 7 in order to provide a determination as to whether any of these alternatives are environmentally equivalent or environmentally preferable to the proposed system. An environmental screening process was conducted for each potential alternative. Potential alternatives that were considered feasible for construction and operation at the proposed plant site that (1) are not prohibited by federal, state, regional, or local regulations, or Native American tribal agreements, (2) are consistent with any findings of the Federal Water Pollution Control Act, and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant construction and operation were further evaluated to determine whether any of the potential plant and transmission system alternatives were environmentally preferable to the proposed system. If any of the potential alternatives are deemed to be environmentally preferable with the proposed system, a benefit-cost basis is provided to determine if any such system should be considered as a preferred alternative to the proposed system.

Subsection 9.4.1 evaluates alternative heat dissipation systems, Subsection 9.4.2 evaluates alternative circulating water systems, and Subsection 9.4.3 evaluates alternative transmission systems for comparison with the proposed plant and transmission systems. The proposed heat dissipation system for the Units 6 & 7 site is the round mechanical draft cooling tower. Water pumped from radial collector wells and/or a reclaimed water treatment plant (Subsection 9.4.2.1.1) is the proposed water supply for makeup water. The makeup water replaces water lost by evaporation, drift, and blowdown from the cooling towers. The proposed water discharge system for blowdown water is to the Boulder Zone of the Lower Floridan aquifer at a depth of approximately 2800–3450 feet (Subsection 9.4.2.2).

9.4.1 HEAT DISSIPATION SYSTEMS

9.4.1.1 Screening of Alternative Heat Dissipation Systems

This subsection presents alternatives to the proposed heat dissipation system (Section 3.4) based on the guidance provided in NUREG-1555. Alternatives considered are those generally included in the broad categories of once-through and closed-cycle systems. This subsection includes evaluation of alternatives, in comparison with the proposed system, to identify those systems that are environmentally preferable to the proposed system. In addition to once through cooling, the following closed-cycle category heat dissipation systems were considered:

- Cooling ponds
- Spray ponds
- Dry cooling towers

- Wet and Hybrid (Wet/Dry) Cooling Towers
  - Natural draft
  - Mechanical draft
  - Fan-assisted natural draft
  - Hybrid

An initial environmental screening of the alternative designs was done to eliminate those systems that are obviously unsuitable for use at the Units 6 & 7 site. In accordance with NUREG-1555, factors such as the following were considered in the initial screening process:

- Land use (e.g., site size and terrain)
- Water use (e.g., availability of cooling water)
- Legislative restrictions

This initial screen is described in the following paragraphs.

9.4.1.1.1 Proposed Heat Dissipation System

For comparison, the round mechanical draft cooling tower is the proposed heat dissipation system for the Units 6 & 7 site. As presented in Section 3.4, six mechanical draft cooling towers would be required to dissipate a maximum waste heat load of up to 1.53E10 Btu/hour from the two units, would operate with approximately a 7.1°F approach temperature, and provide a less than 91°F return temperature at design ambient conditions. The circulating water system cooling towers will be octagonal and would rise approximately 67 feet above the top of the basin curb. Heat dissipation with wet cooling towers relies on evaporation for heat transfer. The water from the cooling system lost to the atmosphere through evaporation must be replaced. In addition, this evaporation would result in an increase in the concentration of solids in the circulating water. To control solids, a portion of the recirculated water must be removed, blown down, and replaced with make-up water from the raw water system. In addition to the blowndown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling towers.

9.4.1.1.2 Alternative Heat Dissipation Systems

9.4.1.1.2.1 Once-Through Cooling

The water requirements for a once-through cooling system for an AP1000 unit would be 850,000 gpm (WEC 2003). Once-through water requirements for both Units 6 & 7 would be 1,700,000 gpm, or about 3790 cubic feet per second. This withdrawal rate is approximately 44 times and 20 times the average makeup water withdrawal rate of 38,400 gpm and 86,400 gpm under normal operating conditions, with a reclaimed water and a marine water source; respectively, for the proposed system. The only water body in the vicinity of Units 6 & 7 that could supply this quantity of water is the Biscayne Bay, which is designated as an aquatic preserve.

In addition, once-through cooling water would pose risks of thermal effects and damage to aquatic organisms because of changes in water quality, impingement, and entrainment. Compliance with Section 316(a) of the Clean Water Act would apply and would prove difficult to attain.

9.4.1.1.2.2 Cooling Ponds

Turkey Point Units 1 through 4 currently operate with 5900-acre cooling canals. A pond of similar size would be required to support Units 6 & 7. The amount of land required for a cooling pond is not available at the proposed site. For this reason, cooling ponds were eliminated from further consideration.

9.4.1.1.2.3 Spray Ponds

This alternative is similar to cooling ponds because it involves creating new surface water bodies. Assuming sufficient heat dissipation could be achieved with a spray pond size of approximately 1 acre per 15 MWe (AEC 1973), Units 6 & 7 would require approximately 160 acres of spray pond. However efficiency may be lower due to the local climate. Spray modules promote evaporative cooling in the pond that reduces the land requirement relative to cooling ponds; however, this advantage is offset by higher operating and maintenance costs. This alternative would not reduce the environmental impacts relative to the proposed system. For these reasons, cooling ponds were eliminated from further consideration.

9.4.1.1.2.4 Dry Cooling Towers

This alternative is not suitable for the reasons described in the EPA's preamble to the final rule addressing cooling water intake structures for new facilities (66 FR 65256; December 18, 2001). Dry cooling carries high capital and operating and maintenance costs that are sufficient to pose a barrier to entry to the marketplace for some facilities. In addition, dry cooling has a detrimental effect on electricity production by reducing the efficiency of steam turbines. Dry cooling tower performance is dependent on the ambient dry bulb temperature. Thermal performance limitations under high ambient air temperature conditions would result in a very large dry tower array and the plant efficiency may be significantly reduced due to high circulating water temperature which increases steam turbine backpressure. The higher humidity in the area would also impact tower performance and cost. Dry cooling towers cause the facility to generate less energy than would be generated with wet cooling towers. This energy penalty is significant in the warmer southern regions during summer months when the demand for electricity is at its peak and would result in an increase in environmental impacts as replacement generating capacity would be needed to offset the loss in efficiency from dry cooling. Therefore, dry cooling towers at the Units 6 & 7 site do not warrant further consideration.

9.4.1.1.2.5 Wet and Hybrid (Wet/Dry) Cooling Towers

Wet and wet-dry hybrid cooling towers are potential alternate heat dissipation systems for the Units 6 & 7 and are described below:

Natural Draft Cooling Tower

This design is the most commonly used cooling tower in nuclear power plants in the United States. Favorable features include the absence of fans, which provides for very low operating cost, low auxiliary power requirements, and minimal noise impact. Natural draft towers are very tall and may have negative public perception because the towers and plume are visible from a great distance. However, the height can be favorable in terms of environmental impact because the drift is dispersed at such a great height that the concentration that accumulates around the tower is lower than other tower designs. Traditional natural draft cooling towers cannot be used at the Units 6 & 7 site because of a site permit height restriction of 350 feet (MDC 2007), therefore, natural draft cooling towers are eliminated from further consideration.

Mechanical Draft Cooling Tower

Mechanical draft cooling towers are often the cooling tower design for power applications and the relatively low profile makes these a good choice when aesthetics are a major concern. This type of tower is in widespread use in industry, and many cooling tower vendors would be able to supply mechanical draft cooling towers. If necessary, this type of tower could be designed to be plume abated. Plume abatement should be considered when towers are located so that the plume will visually disturb surrounding communities or if the plume can settle on roadways, causing dangerous fogging and icing conditions. The use of traditional rectilinear mechanical draft cooling towers is not feasible because the area needed for the arrangement (spacing) of these towers to prevent recirculation and interference of moist hot air exiting the towers is not available at the Units 6 & 7 site versus the round mechanical draft cooling towers, the proposed heat dissipation system, that require less footprint.

Fan-Assisted Natural Draft Cooling Tower

The hyperbolic shell of the fan-assisted natural draft cooling tower achieves a natural draft effect which supports the fans arranged around the circumference of the cooling tower shell. Advantages of this design include reduced power consumption, favorable space requirements, minimized recirculation effects, optimum operational behavior for saltwater application, and aesthetics. However, the extra section of fans results in a high auxiliary power load and makes this design taller than a rectilinear tower. The round design minimizes required spacing in between the towers. This type of tower is a feasible alternative for Units 6 & 7.

Hybrid (Wet-Dry) Cooling Tower

In this design, the circulating water flows in series first through a dry tower and then through a round forced draft cooling tower. This system provides the important benefit of water savings because when the dry tower is used, the duty on the round tower is lowered, decreasing evaporation. However, the dry tower component of the hybrid design is very large, requiring additional fans and resulting in higher overall power consumption. This design has the highest capital costs. The water usage of a hybrid system is generally one-third to one-half that for wet cooling towers. However, the comparative cost increases of the hybrid systems to the wet cooling systems do not outweigh water use savings of approximately one-half to two-thirds (U.S. EPA 2001a). Additionally, the EPA does not consider hybrid cooling towers as a candidate for best available technology for heat dissipation at new generating plants of the size proposed for the Units 6 & 7 site. Reasons include the lack of adequate demonstration of this technology's use at similar sized power plants. The EPA does note, however, that there is distinct potential for the use of hybrid cooling systems, especially in cases where plume abatement is concerned (U.S. EPA 2001b). Since most advantages to be gained by hybrid cooling towers are in areas of reduced fogging and icing and neither of these problems is of sufficient magnitude at Units 6 & 7 and because this system is not considered a best available technology by the EPA, this cooling tower is precluded from further analysis.

9.4.1.2 Feasible Alternatives

The results of the initial environmental screening process indicate that the round mechanical draft and fan-assisted natural draft cooling towers are suitable heat dissipation system alternatives for Units 6 & 7. The round mechanical draft cooling tower is the proposed primary heat dissipation system (Subsections 3.4.1 and 5.3.3.1). In accordance with NUREG-1555, the fan-assisted natural draft alternative cooling tower design is evaluated for land use, water use, and other environmental requirements for comparison with the proposed heat dissipation system (Table 9.4-1).

9.4.1.3 Summary

Table 9.4-1 offers a summary comparison of the relative environmental impacts and regulatory considerations for the base case and the identified potential alternative heat dissipation system for Units 6 & 7. The results of the evaluation indicate that the alternate design (fan-assisted natural draft cooling tower) is not environmentally equivalent or preferable to the proposed design (round mechanical draft cooling towers). It should be noted that a cost comparison has not been included since no alternate was found to be environmentally preferable to the primary design.

9.4.2 CIRCULATING WATER SYSTEMS

In accordance with NUREG-1555, this subsection considers alternatives to the plant circulating water system in order to identify systems that are environmentally preferable or environmentally equivalent to the proposed system. The review includes an investigation of the following plant circulating water systems:

- Intake systems
- Discharge systems
- Water supply
- Water treatment

NUREG-1555 indicates that the applicant should consider only those alternatives that are applicable at the proposed site and are compatible with the proposed heat dissipation system. As described in Subsection 9.4.1, the round mechanical draft cooling tower is the proposed heat dissipation system for the Units 6 & 7 site. An initial environmental screening was performed for each alternative of the component of the circulating water system to eliminate those systems or components that are unsuitable for use at the proposed site. Those systems or components that were determined to be feasible after the initial screening process were analyzed further to determine if they are environmentally preferable or equivalent to the proposed system. That analysis is described below.

9.4.2.1 Intake Systems

9.4.2.1.1 Screening of Alternate Intake Systems

The most important elements of the intake system are its location and configuration. The following factors were considered in siting the alternate intake systems:

- Water availability
- Water quality
- Intake hydraulics
- Constructability and cost

- Maintenance and dredging
- Operation and maintenance

Water availability and water quality considerations are addressed in Subsection 9.4.2.3.

The results of this analysis indicate that in addition to the proposed intake system from the selected water sources—reclaimed water and/or saltwater supplied by radial collector wells, there are two alternate water sources which were found feasible for operation at Units 6 & 7: the Lower Floridan aquifer (Boulder Zone, a groundwater source), and the Card Sound Canal (a surface water source). Two different types of intake systems are conceptualized to withdraw water from the Card Sound Canal. These intake systems are conventional shoreline intake structures with active screens, and intake with passive panel-type screens equipped with air back flush. The proposed circulating water intake system and the three alternative intake systems (two alternatives for Card Sound Canal and one for the Lower Floridan aquifer Boulder Zone production wells) are presented below.

9.4.2.1.2 Proposed Intake System

The proposed raw water for the circulating water system would be supplied from two different sources, reclaimed water and saltwater. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. Reclaimed water would be provided from the Miami-Dade Water and Sewer District (MDWASD) with further water treatment provided at an FPL reclaimed water treatment facility. The treated reclaimed water would be supplied to and stored in the makeup water reservoir. Pumps for each unit would provide the required makeup water by transferring treated reclaimed water from the makeup water reservoir to the circulating water system.

The saltwater would be supplied by radial collector wells. A radial collector well consists of a central reinforced concrete caisson, extending below the ground to target depth. The conceptual design for a radial collector well is further presented in Subsection 3.4.2.1.1.2. The wells would be recharged from the marine environment (Biscayne Bay), combining the desirable features of extremely high well yields with induced seabed filtration of suspended particulates. This improves the raw water quality and simplifies the treatment process.

The proposed conceptual design for Units 6 & 7 consists of four 33 1/3 percent radial collector wells with a capacity of 30,000 gpm per well. Three wells would meet the makeup water requirements for the circulating water systems; the fourth would be an installed spare. Two 50 percent pumps (15,000 gpm capacity per pump) in each well caisson would transfer the saltwater to the circulating water system.

Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet beneath Biscayne Bay and installed at a depth of approximately 40 feet. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay.

These two proposed raw water makeup sources do not require any cooling water intake structures as defined by 40 CFR 125.83. Because the proposed raw water makeup sources do not require a cooling water intake structure as defined by 40 CFR 125.83, there would be no construction-related, aquatic ecology, threatened or endangered species, and minimal water use impacts as a result of constructing/operating a cooling water intake structure. As described in Chapter 4, the environmental impacts of constructing the reclaimed water pipeline and radial collector wells would be SMALL.

9.4.2.1.3 Alternate Intake Systems

9.4.2.1.3.1 Lower Floridan Aquifer Boulder Zone

As described in Subsection 9.4.2.3, deep groundwater from the Boulder Zone in the Lower Floridan aquifer could alternatively supply the cooling water for Units 6 & 7. The conceptual design for a Boulder Zone cooling water supply system consists of a groundwater production well field adjacent to the nuclear island and shown in Figure 9.4-1. The well field would consist of approximately 15 wells, each capable of producing 10 mgd. At any time, two wells would operate in standby mode and act as reserve wells in the event of unplanned well outages or scheduled maintenance events. Because of the very high Boulder Zone transmissivities, projected drawdown is insignificant, and there is significant flexibility in selecting final well location placement and spacing. Production wells would be constructed with telescoping steel casings to protect drinking water resources in the overlying Upper Floridan and surficial (Biscayne) aquifers from cross-contamination with the Boulder Zone groundwater. The well boreholes would extend past the bottom of the final lower casing to ensure adequate communication between the open borehole and the cavernous water producing intervals of the Boulder Zone. Well casings would be cemented in place from top to bottom with sulfate/corrosion resistant cement.

The Boulder Zone production wells are not considered a cooling water intake structure as defined by 40 CFR 125.83. There would be no aquatic ecology, threatened or endangered species, or water use impacts of construction and operation. There would be no costs associated with intake construction and operating a cooling water intake structure, and Section 316(b) of the Clean Water Act would not apply. It is unknown at this time if use of the Boulder Zone as a source of makeup water for Units 6 & 7 and as a discharge location for regional wastewater and Units 6 & 7 would impact water quality and affect long-term plant operations.

9.4.2.1.3.2 Card Sound Canal

Card Sound Canal is a canal that runs from the southern end of the Turkey Point Units 1 through 4 cooling canals to Card Sound. Card Sound Canal is not hydraulically connected to the Units 1 through 4 cooling canals; however, it is connected to Card Sound. Card Sound Canal was created to serve as the cooling water discharge canal for Units 1, 2, 3, and 4 as part of an open-cycle cooling system. This cooling system was subsequently abandoned, leaving a 1-mile reach of abandoned canal in hydraulic connection with Card Sound, which is approximately 4 miles south of the site. The canal is 200 feet wide and 20 feet deep. Makeup water to Units 6 & 7 could be supplied from an intake located in the northernmost end of the canal where it meets the cooling canals for Units 1 through 4. A pipeline would connect the intake to Units 6 & 7. Figure 9.4-2 is a conceptual layout of the pipeline and intake structures.

There are two alternative intake structures proposed to withdraw water from Card Sound Canal:

- Conventional shoreline intake structure
- Intake with passive panel type screens equipped with air back flush

Conventional Shoreline Intake Structure on Card Sound Canal

The conventional shoreline pump intake would be located on the east bank of the canal on an existing wetland and convey water to the site by pipeline routed by the east side of the canal. The intake system would consist of a trash rack and a raking system, traveling water screens and screen wash pumps, baffle blocks and curtain walls, and pumping systems. Three 50-percent pumps along with two 50-percent traveling screens are considered for each unit with a common forebay for the two units. The conceptual plan view and sectional view of the intake system are shown in Figures 9.4-3 and 9.4-4. A canal width of 200 feet and a canal bottom elevation of –20 feet NAVD 88 are considered in developing the conceptual design.

Conventional shoreline-type intake systems with traveling screens are widely used in power plant applications and their performance behavior is well documented. In order to comply with the Clean Water Act Article 316(b), fine mesh screens with a velocity less than 0.5 feet per second and with fish return capability would be used. The intake system would meet the requirements of Article 316(b) of the Clean Water Act relating to impingement, entrainment, and aquatic monitoring.

Passive Panel-Type Screens with Air Flush on Card Sound Canal

An alternate intake system on Card Sound Canal would consist of passive panel screens with polyhedron-shaped screens supported on a stainless steel frame and an air backwash unit. The polyhedron sides that are directed to the water surface are equipped with the screen panels made with special cling-free elements. The sides that are directed to the canal bed remain closed to avoid debris (sediment) ingress from the bed and for the optimum performance of air backwash. Air spray nozzles are arranged inside the polyhedron enabling a particularly effective screen backwash by pressurized air pulses. A compressor generates the air pressure pulses. The system is suitable for brackish or ocean environment because of its screen element types and polyhedron shape that have been optimized to respond to the fouling topology in surface water. The system is also considered superior over the traditional cylindrical wedge wire screens where fouling tends to develop over the screen drum surface and inside the drum. The number and size of the polyhedron are designed based on the required flow rate and available minimum water depth. The modular structure of the panel screen system would facilitate maintenance of the screens.

The polyhedron screen system conveys water to a wet well onshore, which is then pumped to the site. Flow to the wet well is controlled by the difference in hydraulic head between the well and the canal. Operating the air backwash system would be automated based on the pressure difference between the polyhedron and the wet well representing debris accumulation on the screen as well as on a timer, which is typically two to three times a day. Because the polyhedron is closed at the bottom, air backwash is more effective in removing debris from the screen surfaces compared to the traditional wedge wire screen where the air flush is outside the screen drum.

Although the panel-type intake system is a relatively new technology compared to the cylindrical wedge wire screens such as Johnson screens, its operation would be advantageous in reducing debris, biofouling, and ease of maintenance in a marine environment. In addition, passive screens are considered superior in minimizing impingement and entrainment, and would be environmentally preferable over traditional shoreline intake with active screens. Use of passive screens also eliminates the need for a fish return capability and the associated impacts on fish. The plan view and sectional view of the conceptual panel type intake system are shown in Figures 9.4-5 and 9.4-6.

9.4.2.1.4 Feasible Alternatives

The results of the initial environmental screening process indicate that alternate intake structures in the Boulder Zone and Card Sound Canal (conventional and passive intake structures) may be suitable for Units 6 & 7. In accordance with NUREG-1555, the feasible alternative intake structures are evaluated for comparison with the proposed intake structure system. The details of that evaluation are presented in Table 9.4-2.

9.4.2.1.5 Summary

A comparison of these alternative circulating water intake structures for Units 6 & 7 for construction-related, aquatic ecology, threatened or endangered species, and water use impacts is provided Table 9.4-2. Based on the analysis, the alternate intake structures (Boulder Zone and Card Sound Canal) are not environmentally preferable to the proposed intake structures. Therefore, no cost comparison has been provided. The proposed intakes would have minimal impact on ecological resources when compared to the alternate surface water intakes. The Boulder Zone intake alternative would be considered as environmentally equivalent as the proposed alternatives. However, it is unknown at this time if use of the Boulder Zone as a source of makeup water for Units 6 & 7 and as a discharge location for regional wastewater and Units 6 & 7 would impact water quality and affect long-term plant operations.

9.4.2.2 Discharge Systems

9.4.2.2.1 Screening of Alternative Discharge Systems

This subsection describes potential alternatives for discharge from the circulating water system and compares these alternatives to the proposed system. Alternatives for the discharge of blowdown from the circulating water system were identified. The potential blowdown receiving water bodies were selected from those within proximity of Units 6 & 7. The following discharge alternatives were considered. The initial screen is described in the following paragraphs.

9.4.2.2.1.1 Proposed Discharge System

The proposed circulating water system for Units 6 & 7 would discharge to the Boulder Zone of the Lower Floridan aquifer. Blowdown from the cooling tower would be injected into deep wells onsite. Subsection 2.3.1.2 provided details on subsurface injection in south Florida.

Class I injection wells would be developed in the proposed Units 6 & 7 power block area (Figure 3.1-3). Individual Class I injection wells would be designed and constructed to maintain an injection rate of approximately 6750 gpm. Injection wells would be located so that they would be separated from adjacent injection wells by at least 150 feet. However, the high Boulder Zone permeability allows significant flexibility in selecting the final well location placement in the event that suitable land availability is an issue.

Twelve wells would be installed for the proposed intake system for discharge to the Boulder Zone. Ten of the twelve wells would be used to accommodate 57,600 gpm of projected blowdown, and two wells would be used as backup. The injection zone, or interval, would be accessed via an open borehole spanning the entire vertical extent of the Boulder Zone. At the Units 6 & 7 site, this interval lies at an approximate elevation 2900 feet msl and is presumed to be approximately 200 feet thick. A 24-inch-diameter injection casing with an 18-inch diameter liner pipe would convey the blowdown to the top of the Boulder Zone. Class I injection wells would be constructed with telescoping steel casings cemented in place from top to bottom with sulfate, heat, and corrosion resistant cement. Figure 3.4-3 presents a schematic cross-sectional view of the conceptual design for a Class I injection well constructed in the Boulder Zone. Preliminary design showing operational characteristics and details of the Boulder Zone injection wells are provided in Subsection 2.3.2.

9.4.2.2.1.2 Alternate Discharge Systems

9.4.2.2.1.2.1 Biscayne Bay

Blowdown from the circulating water system would be discharged to Biscayne Bay using a shoreline or offshore diffuser. Construction of either type of diffuser would require alteration of, or construction on, the seabed. Rule 62-4.242, Florida Administrative Code prohibits activities, such as the dredging required to construct a shoreline or offshore diffuser that would degrade water quality of Outstanding Florida Waters. Therefore, this discharge system is eliminated from further consideration.

9.4.2.2.1.2.2 Card Sound

Blowdown from the circulating water system would be discharged to Card Sound using a shoreline or offshore diffuser. Construction of either type of diffuser would require alteration of, or construction on, the seabed and is therefore eliminated from further consideration.

9.4.2.2.1.2.3 Atlantic Ocean

Blowdown from the circulating water system would be discharged to the Atlantic Ocean via an offshore diffuser located outside the boundary of the Florida Keys National Marine Sanctuary, a distance of about 14.5 miles from the proposed plant site. Construction of the pipeline conveying blowdown from the circulating water system to the offshore diffuser would require dredging and burial of the pipe in the seafloor, or directional drilling or tunneling beneath the seabed to avoid disturbance of the seabed within park or sanctuary boundaries and is therefore eliminated from further consideration.

9.4.2.2.1.2.4 Card Sound Canal

Blowdown from the circulating water system would be discharged to Card Sound Canal using a shoreline discharge structure or a diffuser at the canal bed located at the north end of the canal. This blowdown discharge alternative could not be used in conjunction with the Card Sound Canal makeup water supply alternative due to the potential for recirculating the concentrated, dissolved constituents in the blowdown back to the makeup water intake.

9.4.2.2.1.2.5 Turning Basin

Blowdown from the circulating water system would be discharged to the turning basin using a shoreline discharge structure located at the southwest end of the basin. This blowdown water discharge alternative could not be used in conjunction with the turning basin makeup water supply alternative due to the potential for recirculating the concentrated, dissolved constituents in the blowdown back to the makeup water intake. Extensive construction and/or dredging within the canal would be required along with resulting thermal impacts; this alternative is therefore eliminated from further consideration.

9.4.2.2.1.2.6 Wastewater Treatment Plant

Blowdown water from the Units 6 & 7 cooling towers could be returned to the MDWASD for disposal via their existing effluent disposal wells as an alternate circulating water discharge. The same pipeline route for the conveyance of makeup water supply would be used to return the blowdown water discharge. The location the MDWASD is shown in Figure 9.4-7 along with the FPL right-of-way.

Water quality acceptance criteria and capacity restrictions on wastewater treatment plant discharges by deep well injection could restrict the use of this option for blowdown discharge if the makeup water for the circulating water system is supplied from a saltwater source such as radial collector wells, Boulder Zone, or the Card Sound Canal.

9.4.2.2.1.2.7 Cooling Canals

The onsite cooling canals are part of the closed-cycle circulating water system for Units 1 through 4. Because the temperature of the discharge water from the new Units 6 & 7 would be lower than the temperature of the existing (Units 1 through 4) circulating water discharges, the cooling canals could be used as an option for blowdown discharge.

The cooling canals are considered viable only when the makeup water supply is obtained from the MDWASD. Use of reclaimed water would allow higher cycles of concentration in the cooling tower resulting in a smaller blowdown discharge rate. Even at four cycles of concentration, the salinity of the blowdown (on the order of 4000 milligram/liter (mg/L) total dissolved solids) would be significantly less than the current salinity of the cooling canals (approximately 55,000 mg/L total dissolved solids). The blowdown water would be released to the discharge (hot) side of the existing cooling canals to initiate maximum mixing. The conceptual designs of the blowdown pipeline route and diffuser details are shown in Figures 9.4-8 and 9.4-9.

When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. The proposed backup water supply source provides saltwater, thus a backup discharge option (i.e. Boulder Zone discharge) would also be necessary.

9.4.2.2.1.2.8 Wetlands Rehydration

One of the alternatives of the Biscayne Bay Coastal Wetlands Restoration project requires a source of fresh water to rehydrate wetlands in the vicinity of Units 6 & 7. This blowdown discharge alternative entails conveying cooling tower blowdown via canals or pipelines to the wetlands north and west of Units 6 & 7 to rehydrate these wetlands. Because fresh water is required for rehydration purposes, any makeup water supply alternative using brackish or saltwater sources would be precluded for this blowdown discharge alternative. Also, the need to apply water to the wetlands exists only during the dry months of the year. During wet periods, water would need to be discharged to a different receiving water body. Additionally, the blowdown discharge may need to be treated to a level suitable for use in the restoration project. For these reasons, this alternative is eliminated from further consideration.

9.4.2.2.2 Feasible Alternatives

A screening analysis of the potential blowdown discharge alternatives was conducted to identify the feasible blowdown discharge alternatives. The objective of the screening analysis was to identify the feasible blowdown discharge alternatives to be considered for further environmental assessment. The results of the initial environmental screening process indicate that three were determined to be feasible. The three feasible alternative wastewater discharge systems were identified for Units 6 & 7 as follows:

- Cooling Canals
- Card Sound Canal
- Wastewater treatment plant

In accordance with NUREG-1555, the three feasible alternatives are evaluated for comparison with the proposed discharge system (Table 9.4-3). A comparison of these alternative circulating water discharge structures for Units 6 & 7 for construction-related, aquatic ecology, threatened or endangered species, and water use impacts is provided in Table 9.4-3. Based on the comparison, no discharge alternative was found to be environmentally equivalent or preferable to the proposed alternative; therefore no cost comparison has been provided. The proposed discharge structure would have minimal impact on ecological resources when compared to the alternative discharge structures.

9.4.2.2.3 Summary

Table 9.4-3 offers a summary comparison of the relative environmental impacts and regulatory considerations for the proposed discharge system and the alternative discharge systems for Units 6 & 7. The results of the evaluation indicate that the alternate discharge systems are not environmentally preferable to the proposed discharge system. Thus, a cost comparison has not been included.

9.4.2.3 Water Supply

9.4.2.3.1 Screening of Alternative Water Supply Systems

This subsection presents potential alternatives for water supply to the circulating water system and compares these alternatives to the proposed system. The proposed water supply for Units 6 & 7 will use reclaimed water from the MDWASD South District Wastewater Treatment Plant as makeup water for the circulating water system. Another fully operational water supply system will be saltwater supplied from radial collector wells. The circulating water system will be designed to accommodate 100 percent supply from reclaimed water, saltwater, or a combination of the two sources, based on operation of the units. The ratio of water supplied by the two makeup water sources will vary based on the availability of reclaimed water from the MDWASD South District Wastewater Treatment Plant.

Potential sources were identified and organized into five categories based on the original source of the makeup water supply. These identified potential alternative makeup water sources are those water bodies or water sources within proximity to the proposed plant site that are capable of supplying the makeup water needs of the units. The categories of the makeup water supply sources identified the following:

- Marine source
- Groundwater source
- Reclaimed water source
- Onsite surface water source
- Offsite surface water source

An initial environmental screening of the alternative designs was done to eliminate those systems that are unsuitable for use at the Units 6 & 7 site. The initial screen is described in the following paragraphs.

9.4.2.3.2 Proposed Water Supply System

Each of the two proposed water supplies to the circulating water system is described below:

Reclaimed Water — Proposed Raw Water System

Reclaimed water would be from the MDWASD South District Wastewater Treatment Plant, which is located approximately 9 miles north of the site.

Conceptually, the supply water would be conveyed from the MDWASD South District Wastewater Treatment Plant to the site by a pipeline that would be generally follow an existing FPL right-of-way. Locating the MDWASD South District Wastewater Treatment Plant and the right-of-way is shown in Figure 9.4-10.

There are no known current or future restrictions on use of this water for this application. However, to ensure uninterrupted water supply for plant operation, water supply from a backup source is highly desirable. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells.

Radial Collector Well — Proposed Raw Water System

As presented in Subsection 2.3.1, water derived from a radial collector well—a substratum collector of saltwater—from the geological formations underlying Biscayne Bay will supply the required backup cooling water for Units 6 & 7. The water bearing units of interest include the Pleistocene Miami Oolite and Fort Thompson formation. Water in these formations is saltwater at the proposed plant site, with salinity concentrations transitioning to freshwater levels several miles west of the site. The water bearing formations extend from approximately –5.0 feet to –115 feet below MSL NAVD 88. Transmissivities of these formations have been estimated to range from 4.8E04 square feet per day to greater than 2.0E06 square feet per day.

Saltwater cooling water sources in the Pleistocene Miami Oolite and Fort Thompson formation would be supplied by a series of radial collector wells (see Subsection 2.3.1 for details of the radial collector wells). A radial collector well consist of a central reinforced concrete caisson, approximately 25 feet inside diameter, extending below the ground to the target depth. Well screens project laterally outward into the surrounding earth materials in a radial pattern at the target depth. The well screen typically ranges from 12 to 30 inches in diameter and typically extends as far from the caisson as horizontal drilling conditions allow. In seawater applications, the caisson is constructed in an above grade watertight fashion and completed with a pump house.

There are no present or known future restrictions on use of water from the radial collector wells. Projected yield for the radial collector wells is provided in Subsection 2.3.1.

9.4.2.3.3 Marine Sources

Biscayne Bay

The Biscayne Bay is a shallow coastal lagoon that lies immediately east of the proposed Units 6 & 7 site. The bay is bounded on the west by the mainland and on the east by a series of barrier islands including Elliott Key that forms the northern limit of Florida Keys. In the vicinity of the plant site, the bay is about 6 miles in width and relatively shallow, having a maximum depth of about 9 feet.

The bay adjacent to the Units 6 & 7 site is within the boundary of Biscayne National Park. This portion of the bay also serves as part of the Intracoastal Waterway. Makeup water would be supplied from either a shoreline or offshore intake. Due to the shallowness of the bay, a shoreline intake would require dredging a channel in the seafloor to ensure sufficient capacity and is therefore eliminated from further consideration.

Card Sound

Card Sound is located south of Biscayne Bay and south-southeast of the proposed plant site for Units 6 & 7, and is part of the Biscayne Bay Aquatic Preserve. Card Sound is about 3.5 miles wide, bounded on the northwest by the mainland and on the southeast by Key Largo, and relatively shallow with a maximum depth of approximately 11 feet. A portion of the Intracoastal Waterway traverses the entire length of Card Sound. Makeup water for the circulating water system would be supplied from either a shoreline or offshore intake. Due to the shallowness of the bay, a shoreline intake would require dredging a channel in the seafloor to ensure sufficient capacity and is therefore eliminated from further consideration.

Atlantic Ocean

The portion of the Atlantic Ocean considered as a potential makeup water supply alternative for the circulating water system (CWS) lies approximately 14.5 miles east of the proposed plant site and outside the eastern boundary of the Florida Keys National Marine Sanctuary, which is defined by the 300-foot isobath. Makeup water would be supplied by an offshore intake.

The 14.5-mile-long pipeline conveying makeup water from the offshore intake to the plant site would traverse the 13-mile width of Biscayne National Park and a 1.5-mile-wide portion of the Florida Keys National Marine Sanctuary. Construction of the pipeline would require dredging and burial of the pipe in the seafloor, or directional drilling or tunneling beneath the seabed to avoid disturbance of the seabed within park or sanctuary boundaries and is therefore eliminated from further consideration.

Card Sound Canal

Card Sound Canal was originally intended to serve as the cooling water discharge canal for Turkey Point Units 1, 2, 3, and 4 as part of an open-cycle cooling system. This cooling system was subsequently abandoned, leaving an approximately 1-mile reach of remnant canal in hydraulic connection with Card Sound. The canal is located about 4 miles south of the site and lies within FPL property. The canal is 200 feet wide and 20 feet deep. Makeup water for the circulating water system would be supplied from an intake located in the northernmost end of the canal where it dead ends.

Since Card Sound Canal is in hydrological connection with Card Sound, Biscayne Bay, and ultimately the Atlantic Ocean, there is plentiful marine water supply for Units 6 & 7 makeup to the cooling towers and there are no present or future water restrictions on use of water from this source.

Turning Basin

The turning basin is about 0.5 miles northeast of the proposed Units 6 & 7 and in hydraulic connection with Biscayne Bay. The basin lies within FPL property and is about 0.3 mile in length. Makeup water for the CWS would be supplied from an intake located in the southwestern end of the basin. Construction and/or maintenance dredging within the basin could be required and is therefore eliminated from further consideration.

9.4.2.3.4 Groundwater Sources

Biscayne Aquifer

The Biscayne aquifer is a shallow, unconfined aquifer consisting of highly permeable limestone and less permeable sandstone and sand. The area of the aquifer is approximately 4000 square miles, and is the principal water source for Dade and Broward counties and the southeastern part of Palm Beach County.

The quality of water in Biscayne aquifer is classified as fresh, however, in the vicinity of the plant site and beneath Biscayne Bay, groundwater contained in the hydrogeologic units equivalent to the Biscayne aquifer increases in salinity approaching the bay. The salinity of the groundwater adjacent to and underlying the bay is roughly equal to that of seawater.

At the site, the water bearing zone extends from slightly below ground surface to about 115 feet below sea level. Being in direct hydraulic connection with the ocean, the quality of water produced from these units underlying the bay would be saltwater. The portion of the Biscayne aquifer that is designated as an EPA "sole source aquifer" is by definition the fresh (potable) portion of the aquifer. Circulating water system makeup water from the freshwater portion of the Biscayne aquifer would be derived from an inland well field of vertical water supply wells. Miami-Dade County Resolution Z-56-07, condition 4 requires that FPL shall not apply for any water withdrawals from the Biscayne Aquifer as a source of cooling water for the proposed facilities and is therefore eliminated from further consideration.

Upper Floridan Aquifer

The Upper Floridan aquifer underlies the Biscayne aquifer. It is comprised of a thick sequence of carbonate rocks (limestone and dolomite) generally 500 to 600 feet thick and consisting of several thin water-bearing zones of high permeability interlaid with thick zones of low permeability.

The most transmissive permeable zone is found at the top of the Upper Floridan aquifer and is associated with the unconformity at the top of the rocks of Eocene age. The quality of water produced from the Upper Floridan aquifer is classified as brackish. Makeup water for the circulating water system would be obtained from an onsite well field. Miami-Dade County Resolution Z-56-07, Condition 5 requires that any withdrawals from the Floridan aquifer will not interfere with current legal users of that source and meet the substantive requirements of Section 24-43.2 of the Code. An aquifer performance test would be required to demonstrate that no legal users of the aquifer would be affected and another water supply source would likely be required to supplement that supplied from the Floridan aquifer and therefore this water source is eliminated from further consideration

Lower Floridan Aquifer (Boulder Zone)

Deep groundwater from the Boulder Zone in the Lower Floridan aquifer is an alternative water supply for cooling water to Units 6 & 7. The Boulder Zone consists of a deeply buried zone of highly transmissive, cavernous limestone, and dolomites of the lower Eocene Oldsmar Formation. The Boulder Zone occurs under confined conditions. Transmissivities of greater than 3E06 square feet per day are typically reported. The Boulder Zone underlies a 13-county area in southern Florida and lies at a depth of approximately 2800 feet to 3450 feet at the Turkey Point site. Average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L total dissolved solids.

The conceptual design for a Boulder Zone cooling water supply consists of a groundwater production well field adjacent to the nuclear island (Figure 9.4-1). Details of the well field are described above with intake structures.

There are no permitted users, other than FPL of the Floridan aquifer within approximately 5 miles of Units 6 & 7. The cavernous nature of this formation suggests that this source could provide

100 percent of the cooling tower makeup water demand for Units 6 & 7. However, aquifer pumping tests would be required to characterize the hydrogeologic properties of the Boulder Zone and finalize the well and production well designs. This information is also needed to support groundwater modeling. Sampling and analysis of the Boulder Zone groundwater would be necessary to characterize the water quality, evaluate whether water pretreatment may be needed and to support any treatment system design, if needed. Initial evaluations indicate a strong possibility for recirculation of wastewater into the cooling water supply if the Boulder Zone were to be used for discharge of cooling tower blowdown. However, aquifer testing and groundwater modeling have not been conducted to determine exact aquifer yield since this water supply is not environmentally equivalent to using reclaimed water/radial collector well water.

9.4.2.3.5 Onsite Surface Water Sources

Cooling Canals

The hypersaline surface water currently in the cooling canals would be used as makeup for the circulating water system via direct withdrawal. This withdrawal would necessarily increase the volume of groundwater that infiltrates into the cooling canals from the surficial aquifer. The increased groundwater infiltration to the cooling canals would decrease the fresh water groundwater inflow to the Biscayne Bay. The impacts of the reduced inflow to Biscayne Bay may not be acceptable and is therefore eliminated from further consideration.

Deepened Cooling Canals

This alternative would entail deepening a portion of the cooling canals to increase the hydraulic connectivity between the surface water in the cooling canals and the groundwater in the surficial aquifer. The hypersaline surface water in the cooling canals would be used as makeup for the circulating water system via direct withdrawal, which would necessarily increase the volume of groundwater that infiltrates into the cooling canals. The increased groundwater infiltration to the cooling canals would decrease the fresh water groundwater inflow to the Biscayne Bay. The impacts of the reduced inflow to Biscayne Bay may not be acceptable and is therefore eliminated from further consideration.

9.4.2.3.6 Offsite Water Sources

Comprehensive Everglades Restoration Plan

The Biscayne Bay Coastal Wetlands preferred plan, Alternative O, includes plans to rehydrate wetlands in the vicinity of the proposed plant site. Fresh water would be obtained by building a new reservoir or expanding the Florida City Canal in an area northwest of the proposed plant site. In either case, the water would be used jointly by the South Florida Water Management District and Units 6 & 7, with makeup water being obtained from an intake at the shoreline of the reservoir and conveyed to the circulating water system. However, because South Florida Water Management District plans and Comprehensive Everglades Restoration Projects require use of fresh water for public water supply and environmental restoration projects, it is unlikely that the required makeup water supply would be permitted for industrial use and is therefore eliminated from further consideration.

Private Property Reservoir

Fresh water would be provided by expanding an existing surface water reservoir located about 7 miles west of the proposed plant site, or by constructing a new reservoir on private property in an undetermined location. Makeup water would be withdrawn from reservoir using an intake at the shoreline of the reservoir, and conveyed to the circulating water system by pipeline. However, because South Florida Water Management District plans and Comprehensive Everglades Restoration Projects require use of fresh water for public water supply and environmental restoration projects, it is unlikely that the required makeup water supply would be permitted for industrial use and is therefore eliminated from further consideration.

9.4.2.3.7 Feasible Water Supply Systems

A screening analysis of the potential water supply system alternatives was conducted to identify the feasible water supply alternatives. The objective of the screening analysis was to identify the feasible water supply alternatives to be considered for further environmental assessment. The results of the initial environmental screening process indicate that two alternatives were determined to be feasible. In addition to the proposed water supplies, the two feasible alternative water supply systems were identified for Units 6 & 7 as follows:

- Boulder Zone Groundwater Source (saltwater)
- Card Sound Canal Marine Source (saltwater)

9.4.2.3.8 Summary

Table 9.4-4 summarizes the details of the evaluation of the proposed and alternative water supplies. The results of the evaluation indicate that the alternative water supplies are not environmentally preferable to the proposed water supply. Thus, a cost comparison has not been included.

9.4.2.4 Water Treatment

Evaporating water from cooling towers leads to an increase in chemical and solids concentrations in the circulating water, which in turn increases the scaling tendencies of the water. The circulating water system for Units 6 & 7 would be operated so that the concentration of solids in the circulating water would be approximately four to one-and-a-half times the concentration of solids in the makeup (e.g., four to one-and-a-half cycles of concentration). The cooling tower would be operated at a maximum of four cycles of concentration when 100 percent of the makeup water is MDWASD South District Wastewater Treatment Plant reclaimed water and operated at a minimum of one-and-a-half cycles of concentration when 100 percent of the makeup water is from the radial collector wells. When makeup is a mixture of MDWASD South District Wastewater Treatment Plant reclaimed wastewater and radial collector wells, the cooling tower would operate at cycle of concentrations required for proper water chemistry determined by the makeup water quality of the mixture of the two sources of water.

As described in Subsection 3.3.2.1, reclaimed water from the MDWASD would be treated at the FPL reclaimed water treatment facility and used as circulating water system cooling tower makeup. The makeup water for the circulating water cooling towers will receive treatment to prevent biofouling in the intake structure and raw water supply piping to the circulating water cooling towers. The Miami-Dade potable water supply will provide water for the service water cooling towers, potable water system, fire protection system, demineralized water system, and other miscellaneous water users. The makeup water for the service water cooling towers will receive treatment to prevent biofouling in the intake structure and raw water supply piping to the service water cooling towers.

Additional treatment for biofouling, scaling, and suspended matter with biocides, antiscalants, and dispersants, respectively, will be performed at the water treatment facility as needed for the circulating water system. This treatment normally occurs through injecting chemicals into the system piping during circulation of the water withdrawn from the basins through the circulating water and service water systems. The cooling tower cycles of concentration would be adjusted to prevent scale formation or deposition from affecting tower performance.

Sodium hypochlorite would be used to control biological growth in the circulating water system for Units 6 & 7. Alternative biocides could include hydrogen peroxide or ozone. The final choice of water treatment chemicals or combination of chemicals is dictated by makeup water conditions, technical feasibility, economics, and discharge permit requirements. If alternative treatment chemicals are to be used to improve the conditions of the makeup water, they would have to be chosen from those that can be approved by the EPA or the state of Florida, and the volume and concentration of each chemical constituent discharged to the environment would meet the requirements established in the applicable permits. The anticipated aquatic impacts of alternative chemical use would be environmentally equivalent to those resulting from the use of the proposed chemicals described in Subsection 3.3.2. Since all blowdown from the circulating water system will be discharged to the Boulder Zone (proposed method of discharge), there would be minimal-to-no environmental impacts. Mechanical treatment and other non-chemical treatment such as ultraviolet are not viable options due to the large quantity of water requiring treatment, and, hence the large scale water treatment system necessary for the plant’s cooling system. No further alternatives are proposed since it is unlikely that any other water treatment alternatives would be preferable when compared against the proposed treatment system.

9.4.3 TRANSMISSION SYSTEMS

As specified in the guidelines in NUREG-1555, ESRP 9.4.3, this summary discussion identifies the feasible and legislatively compliant alternative transmission systems. Detailed descriptions of the transmission line system are described in Subsection 2.2.2 and Section 3.7, and associated environmental impacts are described in Chapters 4 and 5. Corridors are defined as transmission line routes of variable widths, which are sufficient to contain the eventual rights-of-way (NUREG-1555, Section 3.7.I, Note (a)). New transmission line corridors will be required to integrate Units 6 & 7 to the Florida electrical grid system, as described in Subsection 2.2.2 and Section 3.7.

Approval of transmission line corridors is under authority of the Florida Power Plant Siting Act, §403.501-518, F.S. A route study and corridor selection process was performed for the new lines under the requirements of this Act. The results of these analyses are presented in the following paragraphs.

9.4.3.1 Alternatives to the Proposed Transmission System Design

FPL has performed an interconnection and integration study that examined multiple alternatives for integrating Units 6 & 7 into the FPL transmission system. The study incorporated the latest data provided for the Units 6 & 7 project. Models used for the analysis were based on the latest available load forecasts, generation expansion plan, and system plans for 10 years into the future. As the load forecasts and system plans are updated (e.g., topological changes, generation retirements, or additions) in the coming years, the performance of the system will be reviewed as part of the normal transmission system assessment to ensure compliance with the North American Electric Reliability Corporation (NERC) and Florida Reliability Coordinating Council (FRCC) reliability standards and the effectiveness of the proposed transmission plan. To the extent necessary, adjustments to the results of this study may be warranted. In such circumstances, adjustments will be communicated to the relevant stakeholders, including the NERC and FRCC.

The evaluation process used to develop the transmission-related requirements for the Units 6 & 7 interconnection and integration plan considers factors associated with planning, construction, and operating the electric system. The process began with an evaluation team, including engineers from transmission and substation planning, operations, engineering, project management, permitting, and siting, who together performed the evaluation and developed a transmission interconnection and integration plan. The evaluation process considers many factors, as outlined below, in order to develop an effective transmission plan. The resultant plan is in compliance with NERC and FRCC reliability standards.

Generally, the process was to evaluate the proposed generating plant site location to determine its proximity to existing transmission facilities. To the extent there are existing transmission facilities nearby, those facilities are assessed to determine their capabilities for reliably interconnecting and integrating the proposed new generation into the transmission system as a firm FPL generation resource. Other factors, such as those listed below are considered (as applicable):

- Amount of generation (MW) being added at the new generation site, and the dispatch profile of the new generation resource relative to FPL's other generation resources in serving FPL's load
- Capabilities to upgrade existing facilities
- Capability of transmission lines needed, right-of-way requirements, existing right-of-way capabilities, siting of new right-of-way, permitting requirements, and expected time frame to acquire right-of-way and necessary permits
- Ability to transmit power efficiently
- Existing and new substation requirements, capabilities, and availability
- Impact on existing facilities
- Constructability
- Overall compatibility with the system (e.g., do the new facilities require new material stocking requirements or the need for new tools to maintain?)
- Compliance with NERC and FRCC reliability standards
- Operating considerations (e.g., what are the maintenance requirements of the proposed interconnection and integration facilities and how will they impact the ongoing operation of the system)
- Expected in-service testing and commercial operations dates for new generation (e.g., which transmission facilities necessary for interconnection and integration need to be in-service before the commercial operation in-service date for testing)
- Material adverse impact on third party transmission owner(s)
- Initial and recurring costs of facilities and operations

Taking into account these factors, a feasible interconnection and integration plan was developed and power flow studies for a proposed plan were performed. These power flow studies were used to evaluate the performance of the system and to converge on specific new system facilities and upgrades that would be needed to interconnect and integrate the new generation into the transmission system.

9.4.3.1.1 Assumptions

The project consisted of two nuclear generating units each with a total net summer continuous capability of 1100 MW, with June 2018 and June 2020 in-service dates. The proposed plan tested for interconnecting and integrating the Units 6 & 7 to the FPL network was connecting the units to a new 500/230 kV substation known as Clear Sky substation.

The latest available peak case model for the summer of 2017 from the 2007 FRCC databank with firm long-term contractual obligations was used to create a base case model for the power flow analysis. The model was modified to reflect the 2020 load forecasts for FPL. The model was also updated to include the most up-to-date information on the FPL system (e.g., planned new transmission facilities and upgrades, committed new generation, confirmed transmission service obligations, etc.). The resulting model is the reference base case.

The study case was derived from the aforementioned base case while also modeling Units 6 & 7, which were modeled as two generating units with a total net generating capacity of approximately 2200 MWe.

9.4.3.1.2 Acceptance Criteria

The study was performed by conducting a single contingency power flow analysis. Studied contingencies include each generating unit outage (including the largest generating unit), and each transmission line outage (including the most critical transmission line outage). The performance of the system must meet NERC reliability standards for normal and single contingency operation. Overloads greater than 100 percent of a facility rating (and not evident before Units 6 & 7) that were materially aggravated (more than 3 percent) when compared to the reference case, for the same contingency, were attributed to the new units. Similarly, low voltages that were materially lower (more than 1.5 percent) when compared to the reference case, for the same contingency, are attributed to Units 6 & 7.

9.4.3.1.3 Interconnection and Integration Study Results

The tested interconnection and integration plan for Units 6 & 7 would require constructing a new Clear Sky substation with two 500/230 kV autotransformers. Two new 500 kV lines, approximately 43 miles long, will be constructed to connect the Clear Sky substation to the Levee 500 kV substation. A new 230 kV line will be constructed between the Clear Sky substation and the Davis 230 kV substation, continuing on to the Miami substation. A second new 230 kV line will be constructed between the Clear Sky substation and Pennsuco 230 kV substation. A new line will also be constructed to the Turkey Point substation from Clear Sky. The results are summarized below:

Transmission Line (kV)	Termination Point	Length (miles)
Clear Sky-Levee # 1 (500 kV)	Levee 500 kV	43
Clear Sky-Levee # 2 (500 kV)	Levee 500 kV	43
Clear Sky-Davis (230 kV)	Davis 230 kV	19
Davis-Miami (230 kV)	Miami 230 kV	18
Clear Sky-Pennsuco (230 kV)	Pennsuco 230 kV	52
Clear Sky-Turkey Point (230 kV)	Turkey Point	0.4

9.4.3.2 Corridor Selection

Turkey Point Units 6 & 7 will require new transmission facilities to reliably interconnect and integrate the project into FPL's transmission system, as described in Subsection 9.4.3.1. The requirement to add transmission facilities is the result of the necessity to deliver approximately 2200 MWe net capacity of new generation from the site to FPL's load centers. It should be noted that the Clear Sky substation is on the Units 6 & 7 plant area and therefore is not further considered in the selection process.

The preferred corridors for the Turkey Point project were selected by a multidisciplinary transmission line siting team consisting of experts in land use, engineering, and the environment.

The objective of the corridor selection study was to select certifiable corridors that balance land use, socioeconomic, environmental, engineering, and cost considerations. Corridor selection methods were designed to be:

- Integrative of multidisciplinary siting criteria
- Rational and objective in decision making
- Sensitive to social and environmental conditions
- Responsive to regulatory requirements
- Reflective of community concerns and issues
- Capable of accurate documentation and verification

The corridor selection process consisted of four major tasks:

- Transmission study area definition
- Resource mapping and alternative route delineation
- Evaluating alternative routes and selecting the preferred corridors
- Community outreach

A summary describing each of these major tasks is presented in the following subsections. The transmission line siting team was assisted throughout this process by members of the public who participated in a public outreach program developed specifically for this transmission line routing study.

Transmission Study Area Definition

As presented in Subsection 9.4.3.1, FPL determined the best option to integrate this power to the FPL transmission system was to build a new onsite substation (Clear Sky) and new transmission lines to the existing Davis, Miami, Levee, and Pennsuco substations. The Clear Sky to Levee and Pennsuco substations corridor is known as the West Preferred Corridor. The Clear Sky to Davis and Miami substations corridor is known as the East Preferred Corridor. The following paragraphs discuss the transmission corridor selection.

West Preferred Corridor

The corridor selection process was based primarily on the geographic location of the starting and ending substations. A study area was first selected that incorporated the Clear Sky, Levee, and Pennsuco substations and FPL's existing transmission lines into those substations. Since much of the west study area is dominated by low-density residential development, agricultural and nursery operations, conservation lands, mining activities, and relatively few existing linear features (roads, other transmission lines) with which to collocate, there were immediately only a few obvious choices for routes. FPL has an existing 230 kV transmission line on a 330 ft-wide right-of-way leaving the Turkey Point site and intersecting with a 138 kV line which continues west and north for several miles. A portion of this available right-of-way, which was acquired by FPL in the 1960s and early 1970s, traverses what became the Everglades National Park (ENP) expansion area. From the Levee substation, there are also existing transmission lines and roads that provide potential routes to the Pennsuco substation.

East Preferred Corridor

The corridor selection process was based primarily on the geographic configuration of the starting and ending substations. A study area was first selected that incorporated the Clear Sky, Turkey Point, Davis, and Miami substations and FPL's existing transmission lines into those substations. Since much of the east study area is dominated by high-density residential development, there are several existing linear features (roads, railroads, other transmission lines) with which to collocate. FPL has existing 230 kV transmission lines on a 330 ft-wide right-of-way leaving the Turkey Point site all the way to the Davis substation. From there, FPL has available transmission line, roadway, railway, or other linear features to follow to the Miami substation.

Resource Mapping and Alternative Route Delineation

FPL first evaluated the study areas for all such opportunities and constraints in a regional screening mapping exercise. Resource mapping information was obtained from available information sources, including local, state, and federal agency data files, particularly Miami-Dade County's geographic information system (GIS); the Florida Geographic Data Library (FGDL); the Florida Natural Areas Inventory (FNAI); SFWMD; and other commercial non-agency databases. FPL used a technique of overlay mapping through the use of computer mapping software programs such as AutoCAD® and ArcView®. Use of computer mapping allowed flexibility in adding new information as it became available and modifying coverage to analyze certain constraints or opportunities. Table 9.4-5 provides a listing of the types of resources mapped. Once those resources were mapped, the team developed alternative routes that attempted to best avoid or minimize certain constraints and take advantage of certain opportunities. Figures 9.4-11 and 9.4-12 depict the west and east alternative routes studied, respectively.

Then using predetermined route selection guidelines summarized in Table 9.4-6, FPL developed several alternative route segments that when combined could connect the substations.

Based on the results of the alternative route identification, 34 route segments were identified, comprising 99 potential alternative route alignments between the Clear Sky substation and the existing Levee and Pennsuco substations.

Thirty five route segments were identified, comprising 134 potential alternative route alignments between the Clear Sky substation site and the existing Davis and Miami substations.

Finally, using predetermined route selection guidelines contained in Table 9.4-6, FPL developed several alternative route segments that when combined could connect these substations.

Alternative Route Evaluation and Preferred Corridor Selection

The objective of this task was to evaluate, in detail, the routes identified and ultimately select a West and East Preferred Corridor.

The first step of the alternative route evaluation process was to perform a systematic, quantitative evaluation of each route alternative using environmental, land use, cost, and engineering criteria.

Table 9.4-7 presents the criteria used in this evaluation. These criteria are based on application of accepted transmission line siting factors used on projects across Florida.

Data used to apply these criteria came from the regional screening map data, recent digital aerial photography for the study area, input from agencies and local governments, ground surveys of routes, and input from the community outreach program. Each segment was then analyzed for each of the criteria listed in Table 9.4-7, and the value for each criterion was recorded by segment.

The relative weight (importance) of each criterion to be used in the alternative route evaluation was then established by the multidisciplinary transmission line siting team. These criteria and weights were validated through input from the community obtained as part of the community outreach program, discussed in Subsection 9.4.3.4.

The routes were ranked according to their weighted composite score on all criteria. This score represented a route's potential for impacting a combination of all the relevant resources (Table 9.4-7), with the lowest score being the most favorable.

Recognizing that the quantitative evaluation alone does not provide a true indication of the potential suitability of the routes, the transmission line siting team then began evaluation of the alternatives with a qualitative assessment of more site-specific conditions. This evaluation included analyses of site-specific siting issues and opportunities, additional ground and aerial surveys, and feedback and comments received at agency meetings, the nine community open houses, and individual meetings with area residents and property owners. Table 9.4-8 depicts a list of the types of criteria evaluated at this stage.

After evaluation of all the identified route alignments and significant public input throughout the route selection process, the West Preferred, West Secondary and East Preferred routes were selected (see Figures 9.4-13 and 9.4-14).

Finally, corridor boundaries were delineated along the West and East routes. The West/East Preferred Corridors are of variable width, being wider in certain areas to give FPL an appropriate amount of flexibility in accommodating site-specific conditions or taking advantage of certain opportunities, and narrower in other areas to avoid existing siting constraints or to utilize existing FPL rights-of-way.

9.4.3.3 Preferred Corridors

Based on the results of the first three tasks discussed above, East and West Preferred Corridors were selected. The corridors are depicted on Figures 9.4-13 and 9.4-14. The following paragraphs discuss the preferred corridors selected.

West Preferred Corridor Description

The proposed corridor width varies from a minimum of 170 ft to a maximum of 3700 ft along the length of the West Preferred Corridor. This allows FPL the ability to maximize use of existing FPL rights-of-way, avoid constraints in some areas, and provide FPL the necessary flexibility to locate a right-of-way consistent with local conditions and landowner and agency input. Once a corridor is certified, FPL expects to use a combination of existing and relocated right-of-way of approximately 330 ft in width from Clear Sky to Levee and then use an existing right-of-way of approximately 170-ft minimum width between the Levee and Pennsuco substations. The total length of the West Preferred Corridor is approximately 52 miles; between Clear Sky and Levee is about 44 miles, and between Levee and Pennsuco is about 8 miles.

West Preferred Corridor from Clear Sky Substation to Levee Substation

The West Preferred Corridor begins within the Turkey Point plant property at the boundary of the Units 6 & 7 plant area. The proposed location of the West Preferred Corridor is on FPL's Turkey Point plant property for a distance of approximately 3.2 miles. For the first mile, the corridor is 3700 ft wide. The remainder of the corridor on the Turkey Point plant property is approximately 500 ft wide.

FPL has an existing approximately 330- to 370-ft-wide right-of-way running west from the Turkey Point plant property for several miles. There is currently one single-pole, 230-kV line in that right-of-way that runs for a distance of approximately 4.5 miles. The West Preferred Corridor is collocated with this existing transmission right-of-way. The two 500-kV lines and the 230-kV line can be constructed within this available right-of-way alongside the existing 230-kV line. Therefore, the corridor is limited to FPL's existing right-of-way boundaries in this location, and no additional property will be necessary.

The West Preferred Corridor continues to run due west for another approximately 4.25 miles following FPL's existing right-of-way containing a 138-kV line. Just west of SW 202nd Avenue, the West Preferred Corridor and existing 138-kV line turn to the north and then run due north for approximately 14.5 miles to SW 136th Street where the 138-kV line turns due east and departs the West Preferred Corridor. The West Preferred Corridor then continues for approximately 1 mile to SW 120th Street.

The width of the West Preferred Corridor in this area remains 330 to 370 ft, collocated with FPL's existing right-of-way. Adjacent to the Miami-Dade County Natural Forest Community (NFC) north of SW 304th Street, the corridor is expanded by 50 ft to the west to allow flexibility in accessing the transmission line within the NFC.

Although FPL currently owns sufficient right-of-way in fee or by easement for this project through the ENP and the Water Conservation Area 3B (WCA-3B), FPL has been working cooperatively with multiple federal and state agencies to relocate this portion of the right-of-way to outside the ENP. To that end, these agencies have entered into agreements with FPL to implement the relocation. This land exchange has been authorized by the federal Omnibus Public Land Management Act of 2009. As a result of relocating the 7.4-mile portion of the right-of-way now within the ENP Expansion Area to outside the ENP, contiguous portions of the existing right-of-way to the north and south must also be relocated to provide a continuous right-of-way. FPL is agreeable to the proposed right-of-way exchange in this area if this can be accomplished in a timely manner and is therefore proposing the relocated right-of-way as its West Preferred Corridor.

At SW 120th Street, the West Preferred Corridor turns due east and continues to the SFWMD L-31N Canal right-of-way and is approximately 900 to 1000 ft wide. This alignment will allow FPL to locate the proposed transmission lines at the periphery of the ENP and provide the opportunity to use the existing SFWMD L-31N levee as an access road.

The West Preferred Corridor continues to follow the L-31N Canal right-of-way for several miles, crossing U.S. Highway 41/Tamiami Trail, and then runs parallel to the L-30 Canal right-of-way. In this area, the West Preferred Corridor is approximately 900 to 1000 ft wide and provides the opportunity to use the existing SFWMD L-30N levee as an access road.

Approximately 3 miles north of U.S. Highway 41/Tamiami Trail, the West Preferred Corridor turns due east along an existing FPL right-of-way (at approximately NW 41st Street) and proceeds to the Levee substation. In this area, the West Preferred Corridor is limited to the existing FPL 330- to 1100-ft-wide right-of-way. At the Levee substation, the two 500-kV lines terminate, but the corridor expands around the substation to approximately 1750 ft (to accommodate the proposed Clear Sky-Pennsuco 230-kV line bypassing the substation) and lies entirely within FPL property.

From Clear Sky to Levee, the West Preferred Corridor crosses the jurisdictions of Miami-Dade County and Florida City.

West Preferred Corridor from Levee to Pennsuco

Beginning at the existing Levee substation area, the West Preferred Corridor exits the substation property heading east approximately 4.4 miles within an existing FPL right-of-way along NW 41st Street between NW 147th Avenue and NW 137th Avenue and NW 50th Street between NW 137th Avenue and NW 107th Avenue. The right-of-way within this portion of the West Preferred Corridor, which ranges from approximately 170 to 1750 ft (exiting the Levee substation) wide, currently accommodates multiple transmission lines and has room to accommodate the new 230-kV line.

At NW 107th Avenue, the corridor turns due north and follows the existing FPL right-of-way paralleling NW 107th Avenue approximately 4 miles to the existing Pennsuco substation. The

West Preferred Corridor paralleling NW 107th Avenue averages 170 ft wide and is wholly located within FPL's existing right-of-way.

From the Levee substation to Pennsuco substation, the West Preferred Corridor crosses the jurisdictions of Miami-Dade County, Doral, and Medley.

West Secondary Corridor

FPL is proposing one alternate corridor to its West Preferred Corridor, which is referred to as the "West Secondary Corridor."

The West Secondary Corridor is an alternate for the West Preferred Corridor in the ENP and WCA-3B areas. The West Secondary Corridor deviates from the West Preferred Corridor at SW 120th Street in the 8.5 SMA and continues to follow FPL's existing right-of-way directly northward through the ENP Expansion Area for approximately 7.4 miles to U.S. Highway 41/Tamiami Trail. There, the West Secondary Corridor crosses U.S. Highway 41/Tamiami Trail and then turns northeastward along FPL's existing right-of-way to its intersection with the West Preferred Corridor along Krome Avenue. The West Secondary Corridor is approximately 330 to 370 ft wide and is wholly located within existing FPL right-of-way. The total length of FPL's West Secondary Corridor is approximately 51 miles; the length where it differs from the West Preferred Corridor is 12 miles.

The West Secondary Corridor is being proposed as an alternative option in the event the previously described proposed right-of-way exchange is not completed on a timely basis.

East Preferred Corridor

The proposed corridor width varies from approximately 150 to a maximum of 2200 ft along the length of the East Preferred Corridor. This allows FPL the ability to maximize use of existing FPL rights-of-way, avoid constraints in some areas, and provide the necessary flexibility to locate a right-of-way consistent with local conditions and landowner and agency input. Once a corridor is certified, FPL expects to use an existing FPL 330-ft-wide right-of-way from the Turkey Point plant property to the Davis substation. From the Davis substation FPL proposes to use an existing FPL right-of-way of variable width north and east to U.S. Highway 1. After reaching U.S. Highway 1, FPL generally plans to locate within an existing transportation right-of-way of variable width northeast to the vicinity where Interstate 95 (I-95) and Metrorail diverge. The corridor is expanded, however, around the Metrorail stations (Dadeland South, Dadeland North, Douglas Road, Coconut Grove, Vizcaya, and Brickell). This is to provide flexibility in locating the right-of-way at these congested areas, while also maintaining the ability to accommodate potential future development associated with these mass transit stations. In the vicinity where I-95 and Metrorail diverge, the corridor expands to provide flexibility in locating the right-of-way as it approaches the

Miami substation. The total length of the East Preferred Corridor is approximately 36.7 miles; between Clear Sky and Davis is about 19 miles, and between Davis and Miami is about 18 miles.

East Preferred Corridor from Clear Sky to Davis

The East Preferred Corridor begins within the Turkey Point plant property at the boundary of the Units 6 & 7 plant area. The first 1.8 miles of the East Preferred Corridor is entirely within the Turkey Point plant property and will accommodate both the Clear Sky-Turkey Point 230-kV and Clear Sky-Davis 230-kV transmission lines. In this area, the corridor varies from 330 to 800 ft in width. FPL has a multi-circuit transmission line right-of-way running north from the Turkey Point substation for approximately 17 miles to the Davis substation. North of the Turkey Point plant property, the East Preferred Corridor is limited to that existing transmission line right-of-way, which is approximately 330 ft in width, and will accommodate the Clear Sky-Davis 230-kV transmission line.

After exiting the Turkey Point plant property, the corridor continues due north for several miles and then turns west along SW 261st Street until the corridor crosses Florida's Turnpike (Homestead Extension) and turns northwestward to U.S. Highway 1. After crossing U.S. Highway 1, the corridor again proceeds due north to approximately SW 212th Street, where it turns northwest to SW 208th Street and then north again. It continues due north to approximately SW 164th Street, where it turns northeast to the Davis substation. At this point, the corridor includes the entire FPL property surrounding Davis substation. The corridor from Clear Sky to Davis is within the jurisdiction of Miami-Dade County.

East Preferred Corridor from Davis to Miami

North of the Davis substation along SW 131st Street, the corridor turns eastward along an existing FPL multi-circuit transmission line easement of varying widths for about 4.4 miles to U.S. Highway 1. At this point, FPL's existing easement and two transmission lines cross U.S. Highway 1 and continue east, while FPL's East Preferred Corridor heads northeastward along U.S. Highway 1.

Along U.S. Highway 1, the corridor encompasses the U.S. Highway 1/Busway right-of-way and is generally widened to include an additional 30 ft on either side of this transportation corridor. It is FPL's intent to locate its right-of-way along the Busway right-of-way immediately west of the U.S. Highway 1 right-of-way. However, since the authority to place the new line within the Busway right-of-way has not yet been secured, and to provide flexibility in a relatively congested siting area, the East Preferred Corridor is approximately 260 ft wide in this portion of the route. Along the east side of U.S. Highway 1, the corridor includes a narrow strip of the jurisdictions of Palmetto Bay and Pinecrest.

When the corridor reaches the Palmetto Expressway/Dadeland area, it is widened to approximately 2200 ft. The east corridor boundary in this area remains generally 30 ft east of the U.S. Highway 1 right-of-way. The west corridor boundary expands to approximately 30 ft west of the SW 77th Avenue right-of-way. After crossing Kendall Drive, the boundary turns east approximately 30 ft north of the Kendall Drive right-of-way and then turns north approximately 30 ft west of the Palmetto Expressway right-of-way. When the west corridor boundary reaches the middle of the Snapper Creek Canal, it turns back to the east following the centerline of the Snapper Creek Canal (parallel to Dadeland Mall Road) to the Florida East Coast (FEC) right-of-way located along SW 70th Avenue. The corridor boundary then proceeds north approximately 30 ft west of the FEC right-of-way to the centerline of SW 80th Street and then proceeds east back to 30 ft west of the U.S. Highway 1/Metrorail right-of-way. The widening of the corridor in this area will provide flexibility in siting the transmission line in a heavily congested area.

Proceeding northeastward along U.S. Highway 1 from the Dadeland area, the corridor generally includes the area from 30 ft east of the east right-of-way boundary of U.S. Highway 1 to 30 ft west of the west boundary of the Metrorail right-of-way. The corridor crosses the jurisdiction of South Miami at this point. The corridor varies in width depending on the widths of those transportation rights-of-way. FPL also expands the corridor to include the centerline of Ponce de Leon Boulevard beginning at SW 57th Avenue/Red Road northeast to Ruiz Avenue. This expansion of the corridor will provide the opportunity to collocate the new transmission line with the existing 138-kV transmission line on the east side of Ponce de Leon Boulevard. This area crosses the jurisdiction of Coral Gables.

The corridor is further expanded to accommodate siting constraints around the Douglas Road Metrorail station and provide the opportunity to incorporate other transmission improvements planned independent of the Units 6 & 7 project, thereby avoiding another transmission line segment in this area. The west corridor boundary in this area expands to include approximately 30 ft north of Ruiz Avenue, approximately 30 ft west of SW 38th Avenue, and approximately 100 ft north of Bird Road/SW 40th Street until it reaches a point approximately 30 ft west of the Metrorail/U.S. Highway 1 right-of-way. From this location to the Miami substation, the East Preferred Corridor lies within the jurisdiction of the City of Miami.

Further north, the corridor is again expanded at the Coconut Grove Metrorail station both to the north and south of the U.S. Highway 1/Metrorail transportation corridor to provide flexibility in a relatively congested area. In this area, the west corridor boundary proceeds approximately 30 ft west of the SW 29th Avenue right-of-way, approximately 30 ft north of the SW 27th Terrace right-of-way and then approximately 250 ft east of the SW 27th Avenue right-of-way until the boundary reaches 30 ft north of the Metrorail/U.S. Highway 1 transportation corridor, at which point it again proceeds approximately 30 ft west of the Metrorail right-of-way boundary. South of U.S. Highway 1 in this location, the corridor boundary proceeds approximately 30 ft south of the SW 28th Terrace right-of-way, approximately 30 ft east of the SW 27th Avenue right-of-way, approximately

30 ft south of the SW 28th Street right-of-way, and then approximately 30 ft east of the SW 26th Avenue right-of-way until the boundary reaches 30 ft south of the U.S. Highway 1 right-of-way.

Proceeding northeastward, the corridor is again expanded in the vicinity of the Vizcaya Metrorail station to provide flexibility around the station. The corridor is expanded to include a short stretch of SW 1st Avenue and the Metrorail parking lot on the north (west) side of U.S. Highway 1.

Just north of the Vizcaya Metrorail station, I-95 intersects the East Preferred Corridor. Here the west (north) corridor boundary widens to proceed approximately 30 ft north (west) of the SW 1st Avenue right-of-way and to a point approximately 30 ft west of the intersection with the I-95 right-of-way. The east (south) corridor boundary in this area proceeds approximately 30 ft south of the U.S. Highway 1 right-of-way, and then turns east approximately 30 ft east of the South Miami Avenue right-of-way. Approximately 30 ft north (east) of the SW 26th Road right-of-way, the east corridor boundary proceeds west to approximately 30 ft east of the I-95 right-of-way. The east corridor boundary then proceeds north (east) approximately 30 ft east of the I-95 right-of-way boundary. In the area of SW 19th Road, I-95 and the east corridor boundary turn to the west. The east corridor boundary then proceeds north (east) approximately 30 ft south of the Metrorail right-of-way.

Where I-95 crosses over to the west side of Metrorail, the East Preferred Corridor is again widened to allow flexibility in the approach to the Miami substation. The west edge of the corridor crosses I-95 from west to east and borders the east right-of-way boundary of I-95 north to SW 5th Street. From there, the west edge of the corridor turns northeast across the Miami River into the Miami substation property.

Along the east side of the corridor in this area, the corridor boundary extends approximately 30 ft east of the Metrorail right-of-way past Simpson Park and then east approximately 30 ft south of the SW 15th Road right-of-way to 30 ft east of the SW 1st Avenue right-of-way, where it turns north to SW 7th Street. The corridor boundary then turns northeast for a short distance along the east road right-of-way of South Miami Avenue, then turns north to the west of South Miami Place, and then turns northwest to cross the river. This alignment continues due north along the east boundary of the Metrorail property north of the Miami River and then to the Miami substation.

The East Preferred Corridor in this area of Miami allows flexibility in siting an overhead route to the Miami River, the crossing of which is at present proposed to be subaqueous.

The total length of the East Preferred Corridor is approximately 37 miles.

9.4.3.4 Community Outreach Program

FPL extended considerable effort to inform and involve the public during the route selection process that produced the preferred corridors. FPL used direct mail, a community e-survey, nine open houses, a newspaper advertisement, a project Web page, two agency workshops, meetings with local governments and regional and state agencies, a project e-mail address, and a toll free telephone number to share information and provide an opportunity for interested persons to learn more about the project and express their views.

Initially, using the Miami-Dade County Property Appraisers' and FPL customer databases, more than 260,000 letters were sent to FPL customers and property owners within 0.5 mile from the potential routes that were under consideration. This letter was sent in English and Spanish, introduced the transmission line improvement project, and invited people to attend upcoming open houses. Enclosed with the letter was a map of Miami-Dade County showing the potential routes being studied and a list of the locations, dates, and times for the nine open houses.

Prior to the open houses, the team was able to identify from the FPL database those customers within a half mile of the routes who have provided their e-mail addresses and allow unsolicited e-mail. These 64,000 customer accounts were sent an e-survey that asked people which of the selection criteria the respondents thought were more important. These surveys generated results that validated the route selection criteria used.

Nine open houses were held in November and December 2008 with the intent of spreading them out to different geographical sites along the potential routes. More than 350 people attended these open houses. During the open houses, visitors were able to talk directly, informally, and one-on-one with FPL project team members. They could learn about the project and the routes being considered, view maps and aerial photographs of the routes being evaluated, and specifically identify on Google Earth® their home or property in relation to the alternative routes under consideration. Engineers, biologists, land use planners and other FPL representatives in attendance were there to answer questions and review information provided about the project and FPL on display boards and in brochures. Attendees could express their views and provide feedback to FPL for consideration in the route selection process.

Two agency workshops were held with local, regional, and state government staff at the initiation of the route selection process and after the open houses as the team began to narrow their focus. The staff personnel provided valuable input regarding special features and community values of their jurisdiction, future plans for development, and ways to communicate with their constituents.

Additional one-on-one meetings and contacts with local, regional, and state governments were held throughout the selection process, not only to collect relevant data and maps, but to also seek input on route selection issues. Agencies and local governments provided important information about the routes FPL was studying, as well as individuals and groups who might have specific interest in the project. Some of the agencies and local government representatives proposed alternate routes that were considered and studied by FPL.

FPL representatives were also available to meet with community groups, homeowner associations, and property owners upon request to discuss the project route selection and route selection process, as well as the Florida Electrical Power Plant Siting Act (PPSA) process.

The FPL project team incorporated what they learned through the community outreach program into the preferred corridor selection decision. Members of the public and governmental agencies who participated through the various components of the program were able to suggest the following to the team:

- Places to consider or avoid in routing.
- Other linear facilities to consider for collocation with the proposed line.
- Which evaluation criteria should be considered as more important.
- Specific routes to evaluate.
- Unique or important study area features or characteristics that should be given consideration in route selection.
- Areas under consideration for future development that could potentially affect a route.
- Existing operational considerations for land uses on or near the rights-of-way.
- Preferences on structure design for the 500 kV lines.
- Ways to effectively communicate with the public regarding the project.

Section 9.4 References

AEC 1973. Sizing of Spray Pond from AEC (1973), *Final Environmental Statement Related to Operating the Virgil C. Summer Nuclear Station Unit 1*, Page XI-7.

MDC 2007. Miami-Dade County Resolution Z-56-07, dated December 24, 2007.

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WEC 2003. Westinghouse 2003. AP1000 Siting Guide: *Site Information for an Early Site Permit*, APP-0000-X1-001, Revision 3, April 24, 2003.

U.S. EPA 2001a. U.S. Environmental Protection Agency, *Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities*, EPA-821-R-01-036, November, 2001.

U.S. EPA 2001b., *National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities*, Federal Register: December 18, 2001 (Volume 66, Number 243).

Table 9.4-1 (Sheet 1 of 2)
Analysis of Heat Dissipation System Alternatives

Factors Affecting System Selection	Round Mechanical Draft Cooling Towers — Proposed	Fan-Assisted Natural Draft Towers — Alternate
Land Use		
Onsite land requirements	The round mechanical draft would require approximately 30 acres to support 2 AP1000 units.	The fan-assisted natural draft would require approximately 30 acres to support 2 AP1000 units.
Terrain considerations	Terrain features of the Units 6 & 7 site are suitable for the round mechanical draft.	Terrain features of the Units 6 & 7 site are suitable for a fan-assisted natural draft system.
Floodplain Alterations	The round mechanical draft cooling tower would not result in modifications of the floodplain (site will be raised to elevation above floodplain).	The fan-assisted natural draft cooling tower would not result in modifications of the floodplain (site will be raised to elevation above floodplain).
Wetlands or Critical Habitat Issues	The Units 6 & 7 site is a critical non-nesting habitat for the American crocodile so constructing the round mechanical draft would disturb approximately 30 acres of critical habitat land during construction and slightly less during operation.	The Units 6 & 7 site is a critical non-nesting habitat for the American crocodile so constructing the fan-assisted natural draft would disturb approximately 30 acres of critical habitat land during construction and slightly less during operation.
Terrestrial Biota	Impacts to terrestrial biota are presented in Subsection 4.3.1.	Impacts to terrestrial biota are described in Subsection 4.3.1. Impacts from constructing and operating the fan-assisted natural draft would be similar to impacts from constructing and operating the round mechanical draft.
Water Use	Intake requirements for round mechanical draft would be for makeup water and would consist of pumps, piping, and valves. There are no foreseen impacts to aquatic biota associated with constructing or operating the saltwater wells (radial collector wells) or the reclaimed water source. Circulating water makeup quantity (to replace water lost by evaporation and drift) for the proposed system is provided in Table 3.3-1. The discharge water quality is provided in Section 3.6 and the quantity is provided in Table 3.3-1.	Intake requirements for the fan-assisted natural draft would be for makeup water and would consist of pumps, piping and valves. There are no foreseen impacts to aquatic biota associated with constructing or operating the saltwater wells (radial collector wells) or the reclaimed water source. Circulating water makeup and discharge quantity for the fan-assisted natural drafts expected to be approximately the same or less than the proposed round mechanical draft system. The discharge water quality for the fan-assisted natural draft is expected to be the same as for the proposed round mechanical draft.

Table 9.4-1 (Sheet 2 of 2)
Analysis of Heat Dissipation System Alternatives

Factors Affecting System Selection	Round Mechanical Draft Cooling Towers — Proposed	Fan-Assisted Natural Draft Towers — Alternate
Atmospheric Effects	The round mechanical draft system would emit water droplets (drift) and intermittently produce a visible vapor plume. As provided in Section 5.3.3, the drift droplets would be a minor source of particulate matter and salt deposits. The water vapor plume would result in minimal additional fogging but no icing conditions on local road systems.	Similar to the round mechanical draft system, fan-assisted natural draft would emit water droplets (drift) and intermittently produce a visible vapor plume. It is expected that, similar to the round mechanical draft, the drift droplets would be a minor source of particulate matter and salt deposits. The water vapor plume would result in minimal additional fogging but no icing conditions on local road systems.
Thermal and Physical Effects	The discharge to the Boulder Zone of the Lower Floridan aquifer would meet the requirement of Florida's Department of Environment Deep Well Injection Control, Chapter 62-528.	The discharge to the Boulder Zone of the Lower Floridan aquifer would meet the requirement of Florida's Department of Environment Deep Well Injection Control, Chapter 62-528.
Noise Levels	Sound pressure level is estimated at 85 decibels adjusted (dBA) at 3 feet from the tower.	Sound pressure level is estimated at 97 dBA at 3 feet from the tower.
Aesthetic and Recreational Benefits	Aesthetic impacts from the visible plume would be small. There are no recreational benefits to the round mechanical draft cooling tower.	Aesthetic impacts from the visible plume would be small. There are no recreational benefits to the fan-assisted natural draft cooling tower.
Operating and Maintenance Experience	Established technology in the U.S. with highly reliable experience with operation and maintenance and plentiful installations throughout the U.S.	Considered an emerging technology in the U.S.; however, there is successful operation and maintenance experience outside the U.S.
Generating Efficiency (per AP1000 unit)	Total Fan Auxiliary Power Requirement (MW): 6.7 Total Pump Auxiliary Power Requirement (MW): 16.5.	Total Fan Auxiliary Power Requirement (MW): 8.0 Total Pump Auxiliary Power Requirement (MW): 24.7.
Legislative Restrictions	The proposed raw water makeup sources (reclaimed and radial collector well) do not require an intake system as defined by 40 CFR 125.83 so there would be no construction-related, aquatic ecology, threatened or endangered species, or water use impacts and Section 316(b) of the Clean Water Act does not apply. Cooling tower blowdown would discharge to the Boulder Zone of the Lower Floridan aquifer and, therefore not impact aquatic biota. The regulatory restrictions would not negatively impact applying this heat dissipation system.	The proposed raw water makeup sources (reclaimed and radial collector wells) do not require an intake system as defined by 40 CFR 125.83 so there would be no construction-related, aquatic ecology, threatened or endangered species, or water use impacts and Section 316(b) of the Clean Water Act does not apply. Cooling tower blowdown, which may be less than the preferred alternative, would discharge to the Boulder Zone of the Lower Floridan aquifer and therefore, not impact aquatic biota. The regulatory restrictions would not negatively impact applying this heat dissipation system.
Is this a suitable alternative for the Units 6 & 7 site?	Yes.	Yes.

Table 9.4-2
Comparison of Proposed Water Intake Alternatives

Impact	MDWASD Reclaimed Water — Proposed Raw Water System	Biscayne Aquifer (Radial Collector Well) — Proposed Raw Water System	Lower Floridan Aquifer (Boulder Zone) — Alternate System	Card Sound Canal Conventional Intake — Alternate System	Card Sound Canal Passive Screen Intake — Alternate System
Construction Impacts	No intake system is required. There would be no construction impacts related to intake structures. However, construction impacts would include land disturbance along the pipeline route.	A cooling water intake structure as defined by 40 CFR 125.83 does not exist for this alternative; however, construction impacts include land disturbance and associated ecological impacts in the vicinity of the caissons and along pipeline route to plant site. Construction impacts would be low.	No intake system is required. There would be no construction impacts related to intake structures. However, construction impacts of this system would be limited to localized land disturbance.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route. Construction impacts would be low.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route to plant site (about 4 miles), and canal bed disturbance in area of passive screens. Construction impacts would be low.
Aquatic Impacts	No intake system is required. There would be no aquatic impacts.	Operation would induce flow from Biscayne Bay into the seabed. Induced flow would be distributed over a very large area. Aquatic impacts are not foreseen.	No intake system is required. There would be no aquatic impacts.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.
Water-Use Impacts	No intake system is required. There would be no water-use impacts.	There are no other consumptive water uses and operation would not interfere with non-consumptive uses. There would be no water-use impacts.	No intake system is required. There could be water use impacts from Boulder zone discharge option if used simultaneously with this option from recirculation effects.	There are no other consumptive or nonconsumption water uses of Card Sound Canal. There would be no water use impacts.	There are no other consumptive or nonconsumption water uses of Card Sound Canal. There would be no water use impacts.
Compliance with Regulations	Not applicable.	Not applicable.	Not applicable.	The intake would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.	The intake would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.

Table 9.4-3
Comparison of Water Discharge Alternatives

Impact	Lower Floridan Aquifer (Boulder Zone) — Proposed System	MDWASD Wastewater Treatment Plant — Alternate System	Cooling Canals — Alternate System	Card Sound Canal — Alternate System
Construction Impacts	Construction impacts limited to localized land disturbance in the vicinity of the injection wells and along the discharge pipeline route. Construction impacts would be low.	Construction impacts include land and traffic disturbance along the pipeline route (Approx. 9 miles of public right-of-way in urbanized areas or FPL transmission corridors). Construction impacts would be moderate.	Construction impacts limited to the short pipeline route between the plant site and the discharge side of the existing cooling canals. Construction impacts would be low.	Construction impacts include land disturbance on canal bank at discharge location and along pipeline route to plant site (about 4 miles). Construction impacts would be low.
Aquatic Impacts	The Boulder Zone is a deep saltwater aquifer that has no interaction with aquatic systems. There would be no aquatic impacts.	There would be no site-related aquatic impacts.	Temperature and salinity of blowdown would be less than the ambient levels in cooling canals. Assuming that blowdown discharge would be treated for nutrient limits, aquatic impacts would be low, although pollutants unique to reclaimed water may require consideration.	Water temperatures would be elevated as a result of discharging blowdown, but within thermal compliance limits at the point of discharge to Card Sound. Water quality of the blowdown is less saline than ambient levels. Aquatic impacts would be low.
Water-Use Impacts	Other than potentially Units 6 & 7, there are no other water users in the region. There would be no water use impacts.	Currently, the wastewater treatment plants do not have the capacity to accept blowdown from Units 6 & 7. However, if reclaimed water is used for water supply, the blowdown could be returned to the wastewater treatment plant for disposal. Water quality acceptance criteria and capacity restrictions on wastewater plant discharges could restrict the use of this option. Also, returning water to the MDWASD would deprive other potential users of the beneficial use of this water (e.g., for wetlands rehydration).	Turkey Point Units 1 through 4 are the sole users of the cooling canals. The additional flow would supplement their supply. There would be no water use impacts.	There are no other consumptive or non-consumptive water uses of the Card Sound Canal. There would be no water-use impacts.
Compliance with Regulations	Discharge must comply with Class I injection well concentration limits. Compliance monitoring required.	Water returned to the MDWASD for disposal would need to meet the requirements of their pretreatment.	The current industrial wastewater permit would require modification to accept blowdown from Units 6 & 7.	The discharge of blowdown from a recirculated cooling water system would need to comply with Rule 62-4.242, F.A.C.

Table 9.4-4
Comparison of Water Supply Alternatives

Impacts	Reclaimed Water — Proposed Supply	Radial Collector Wells — Proposed Supply	Boulder Zone — Alternate Supply	Card Sound Canal — Alternate Supply
Construction Impacts	Construction impacts include land and traffic disturbance along the pipeline route (Approx. 9 miles of public right-of-way in urbanized areas or FPL transmission corridors) and land disturbance at the MDWASD where new treatment facilities would be constructed. Given that the pipeline would follow a majority of an existing corridor, clearing of new corridors and /or expansion of existing corridors would include use of best management practices to reduce impacts to sensitive habitats. Therefore, impacts would be low.	Construction impacts include land disturbance in the vicinity of the caissons and along pipeline route to plant site. Construction impacts would be low.	Construction impacts limited to localized land disturbance in the vicinity of the supply wells and along pipeline route to plant site. Construction impacts would be low.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route to plant site (about 4 miles), and canal bed disturbance in area of passive screens. Construction impacts would be low.
Aquatic Impacts	There would be no adverse aquatic impacts associated with the use of reclaimed water. Using reclaimed water would eliminate the volume of treated effluent discharged by ocean outfall and positively impact those receiving water bodies.	Operation would induce flow from Biscayne Bay or Card Sound into the seabed. Induced flow would be distributed over a very large area. Aquatic impacts would be low.	The Boulder Zone is a deep saltwater aquifer that has no interaction with aquatic systems. There would be no aquatic impacts.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.
Water-Use Impacts	Reclaimed water use would allow MDWASD to meet a portion of its water reuse requirements while supplying the plant site with makeup water. There would be no consumptive water-use impacts.	There are no other consumptive water users and operation would not interfere with nonconsumptive uses. There would be no water use impacts.	The Boulder Zone is a saltwater aquifer that is not used for water supply. There would be no consumptive or nonconsumptive water use impacts. There could be re-circulation impacts if Boulder Zone discharge option used simultaneously.	There are no other consumptive or nonconsumptive water uses of Card Sound Canal. There would be no water use impacts.
Compliance with Regulations	The use of reclaimed water used in open cooling towers would need to comply with Rule 62-610.668, F.A.C.	The water supply system would not need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.	Not Applicable	The cooling water intake system would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.

Table 9.4-5
Area Resources Mapped

Category	Resource
Base map information	• Highways, roads, streets • County boundaries • City boundaries • Railroads, airports, heliports • Existing and proposed FPL substations • Existing FPL transmission lines • Existing FPL properties, rights-of-way, and easements • Water bodies, rivers, streams, canals
Land use information	• Existing and proposed development for which local approvals are pending • Planned unit developments and developments of regional impact • Property boundaries • Existing school properties • National parks, wildlife refuges, estuarine sanctuaries, landmarks, or historical sites • State parks, preserves, proposed and existing Florida Forever lands, • Areas of Critical State Concern, Conservation and Recreation Lands, Save Our Rivers lands, aquatic preserves • SFMWD-owned lands • Miami-Dade County lands, parks, recreation areas, and mitigation lands • Native American lands • Private designated wetland mitigation areas • Privately owned environmental preserves/sanctuaries • Military properties
Environmental information	• Listed federal and state species and unique habitats, U.S. Fish and Wildlife Service (USFWS)-designated critical habitats • Wetlands as delineated on USFWS national wetlands inventory maps

Table 9.4-6
Alternative Route Identification

- Maximize collocation with certain linear features (existing FPL transmission lines, easements, or rights-of-way, roads, canals, etc.)
- Follow parcel or section lines where practicable and when other collocation opportunities do not exist
- Minimize crossing of constraints identified as a result of regional screening (e.g., environmentally sensitive lands, existing development, and proposed development for which local approvals are pending)
- Avoid known airports and private airstrips consistent with Federal Aviation Administration and other applicable regulations
- Follow disturbed alignments (ditches, roads) through wetlands, where practicable
- Minimize crossing of existing transmission lines

Table 9.4-7
Alternate Route Evaluation Criteria — West/East Routes

- Number of buildings in proximity
- Number of school properties in proximity
- Number of non-FPL parcels/lots crossed
- Length of route not following FPL-owned right-of-way or other transmission line easements
- Length of route not following other linear features (roads, railroads, canals, etc.)
- Length of route through existing parks/recreation areas/designated conservation lands
- Length of forested wetlands crossed
- Length of non-forested wetlands crossed
- Number of eagle nests/wading bird colonies in proximity
- Engineering costs

Table 9.4-8 (Sheet 1 of 2)
Qualitative Criteria Used to Evaluate — West/East Alternate Routes

West Alternate Routes
• Available space within existing FPL rights-of-way, easements, or fee-owned property • Available right-of-way along roads, transmission lines, and railroads • Road plans (new roads, extensions, widening) • Proposed development plans • Proximity of existing development to collocation rights-of-way • Types of development in proximity • Proximity and orientation of public airports and private airstrips • Ingress to substations • Bridge crossings • Constructability • Acquisition status of existing and proposed conservation lands and/or greenways • Availability of multi-agency land exchange • Ability to avoid or minimize wetland impacts • Ability to avoid or minimize impacts to parks, recreation, and conservation lands • Proximity to historical districts, roads, and/or structures • Review of potential underground scenarios where overhead is not feasible • Potential listed species presence • Crossing of Native American lands • Potential use of local access roads/trails • Proximity to known archaeological sites • Vegetative landscapes along streets (tall trees)

Table 9.4-8 (Sheet 2 of 2)
Qualitative Criteria Used to Evaluate — West/East Alternate Routes

East Alternate Routes
• Available space within existing FPL rights-of-way, easements, or fee-owned property
• Available right-of-way along roads, transmission lines, and railroads
• Road plans (new roads, extensions, widening)
• Proposed development plans
• Proximity of existing development to collocation rights-of-way
• Types of development in proximity
• Proximity and orientation of public airports and private airstrips
• Ingress to Miami substation and crossing the Miami River
• Bridge crossings
• Constructability
• Acquisition status of existing and proposed conservation lands and/or greenways
• Ability to avoid or minimize wetland impacts
• Ability to avoid or minimize impacts to parks, recreation, and conservation lands
• Proximity to historical districts, roads, and/or structures
• Review of potential underground scenarios where overhead is not feasible
• Potential listed species presence
• Crossing of Native American lands
• Potential use of local access roads/trails
• Proximity to known archaeological sites
• Miami-Dade Metrorail and/or Busway right-of-way availability and use
• Vegetative landscapes along streets (tall trees)

Figure 9.4-1 Boulder Zone Production Well Field Location

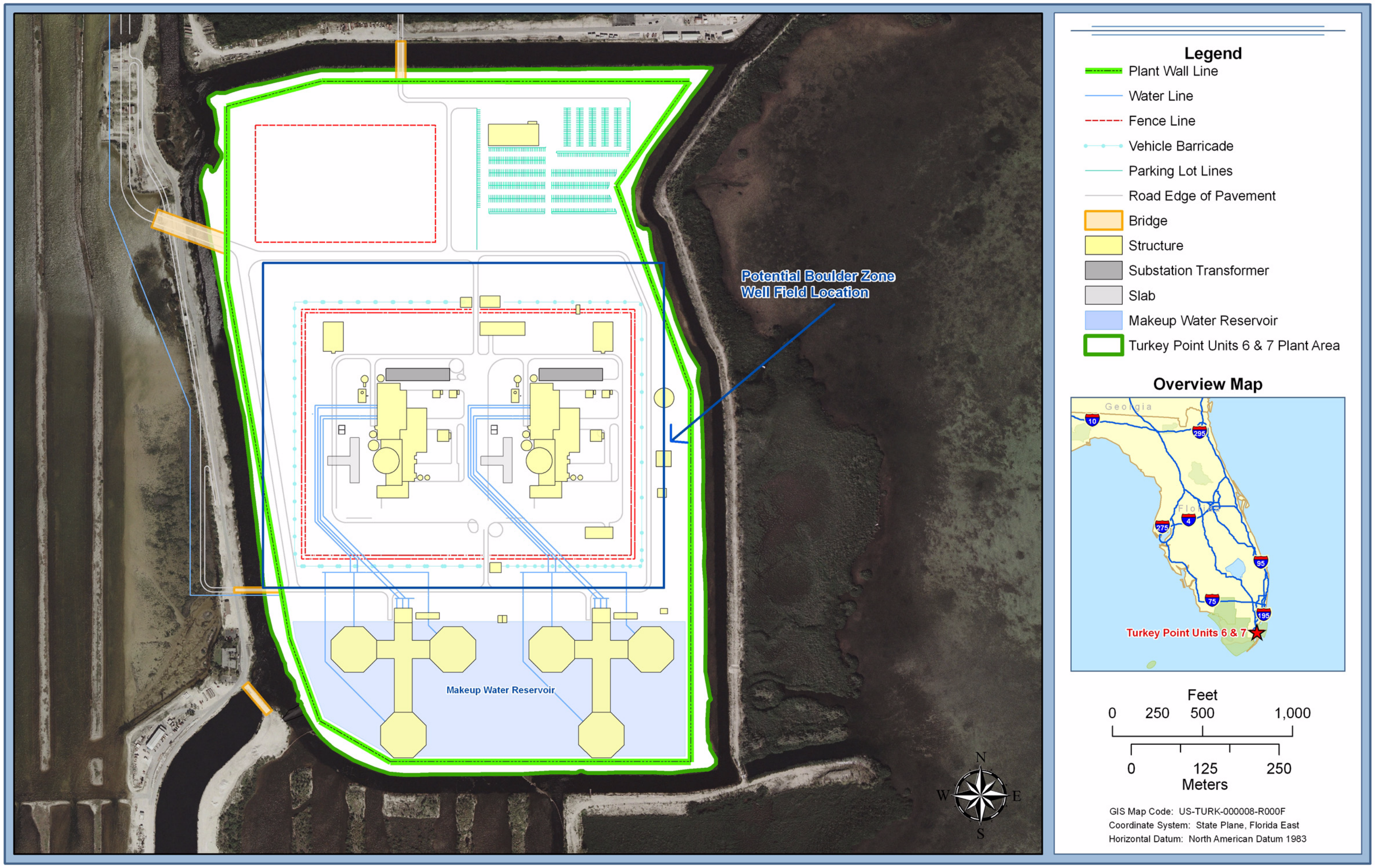

Figure 9.4-2 Water Supply for Turkey Point Power Plant Card Sound Canal Intake

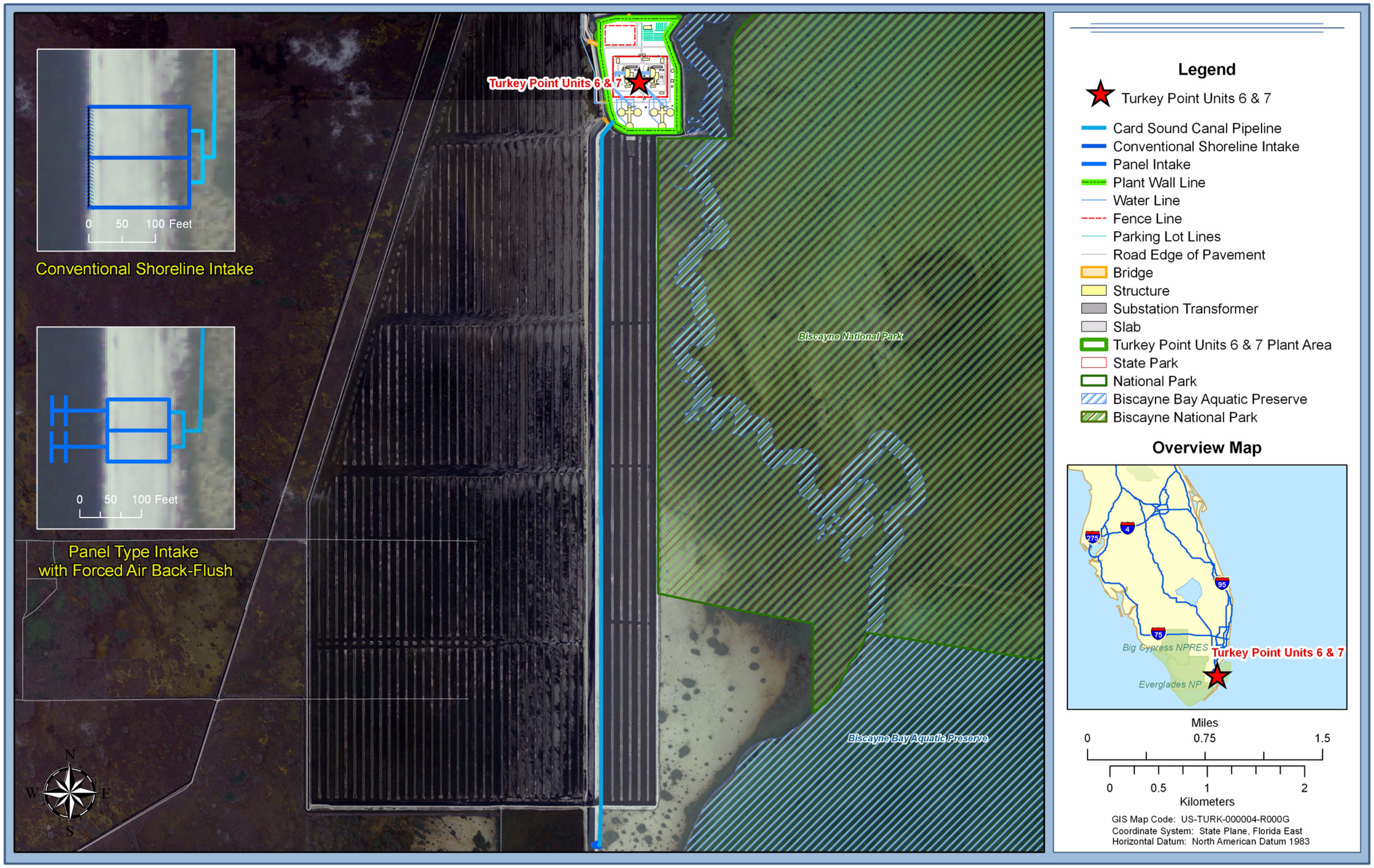

Figure 9.4-3 Conventional Shoreline Pump Intake on Card Sound Canal — Conceptual Plan View

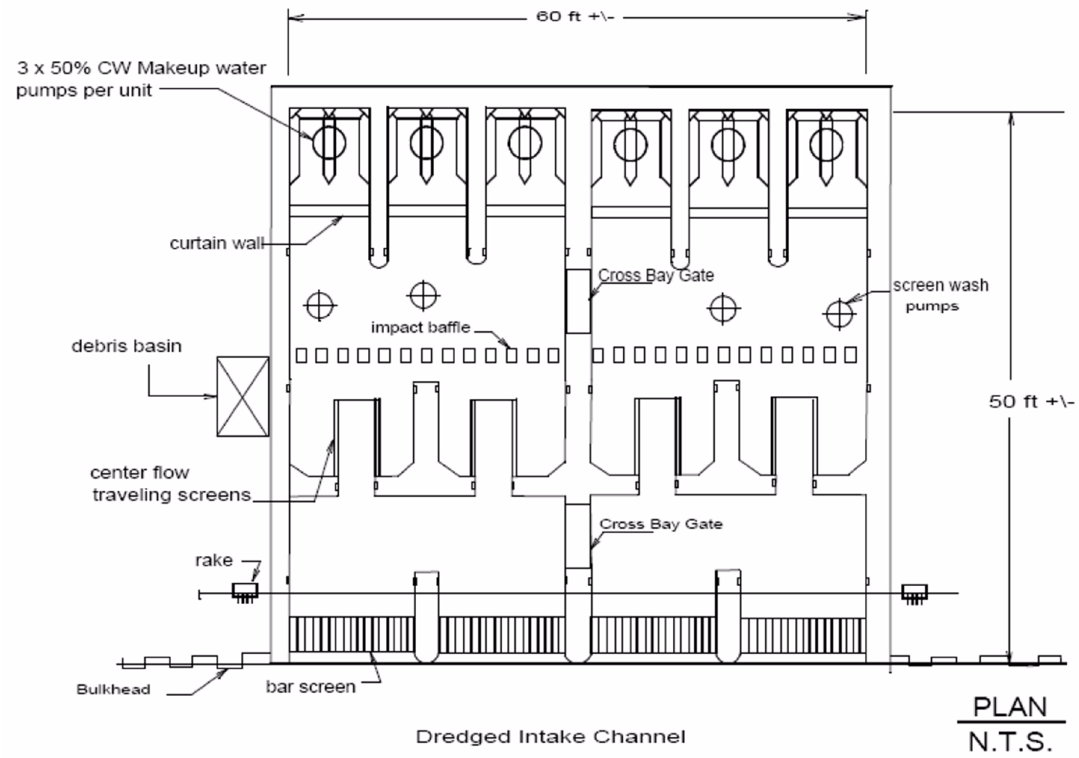

Figure 9.4-4 Conventional Shoreline Pump Intake on Card Sound Canal — Conceptual Sectional View

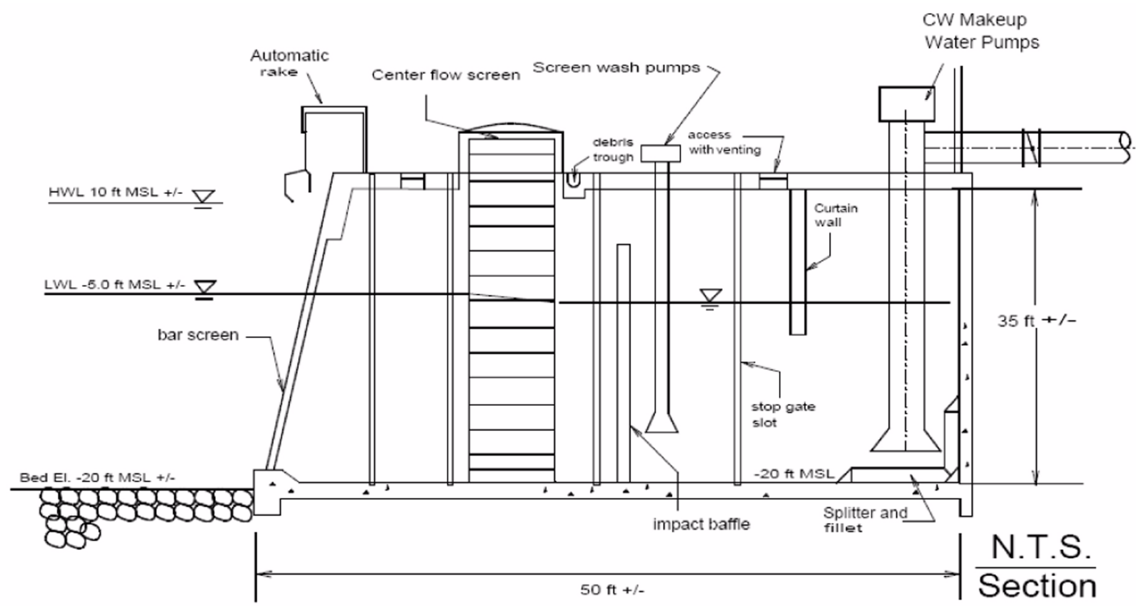

Figure 9.4-5 Panel-Type Shoreline Pump Intake on Card Sound Canal — Conceptual Plan View

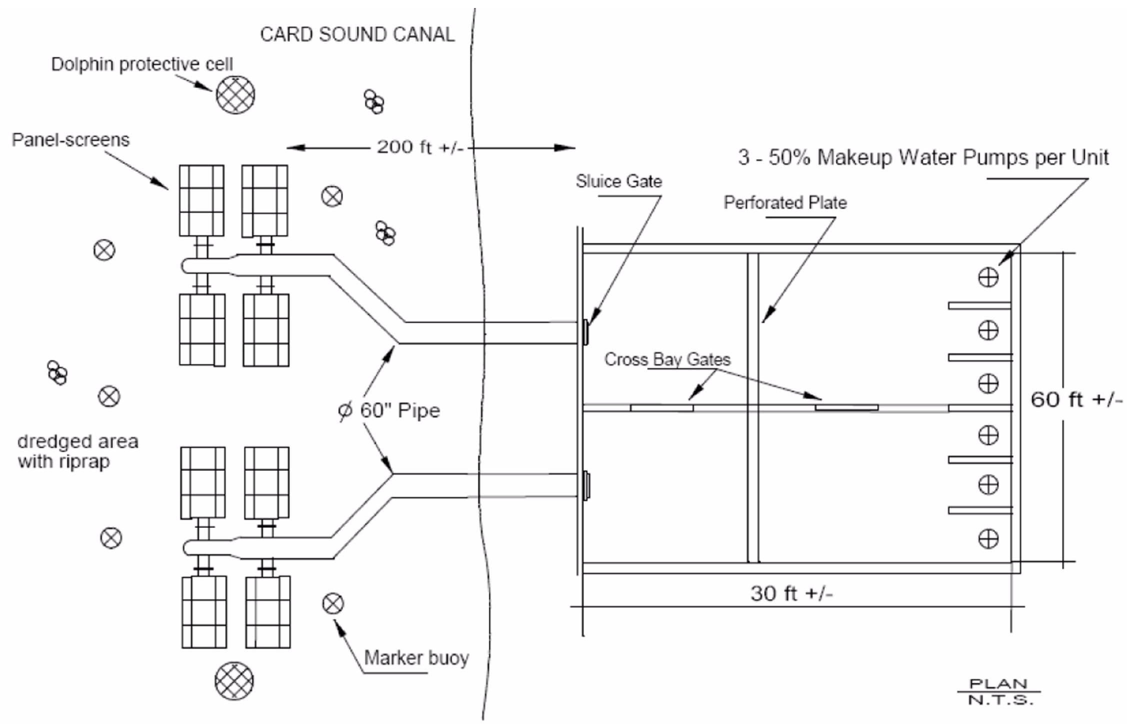

Figure 9.4-6 Panel-Type Shoreline Pump Intake on Card Sound Canal — Conceptual Sectional View

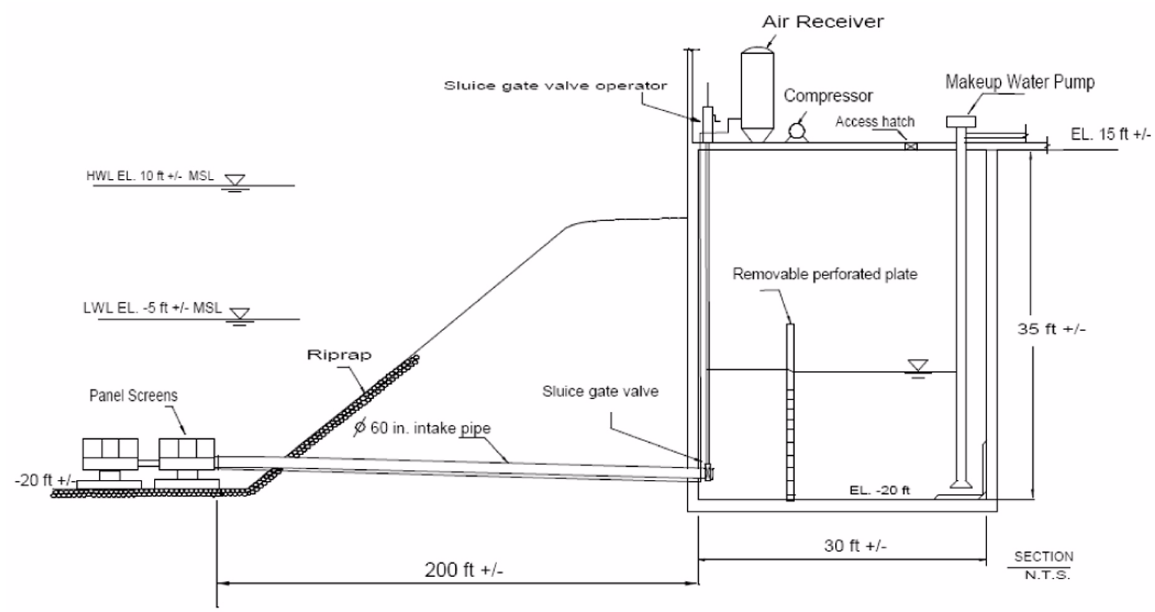

Figure 9.4-7 Blowdown Discharge to Miami-Dade Water and Sewer District (MDWASD)

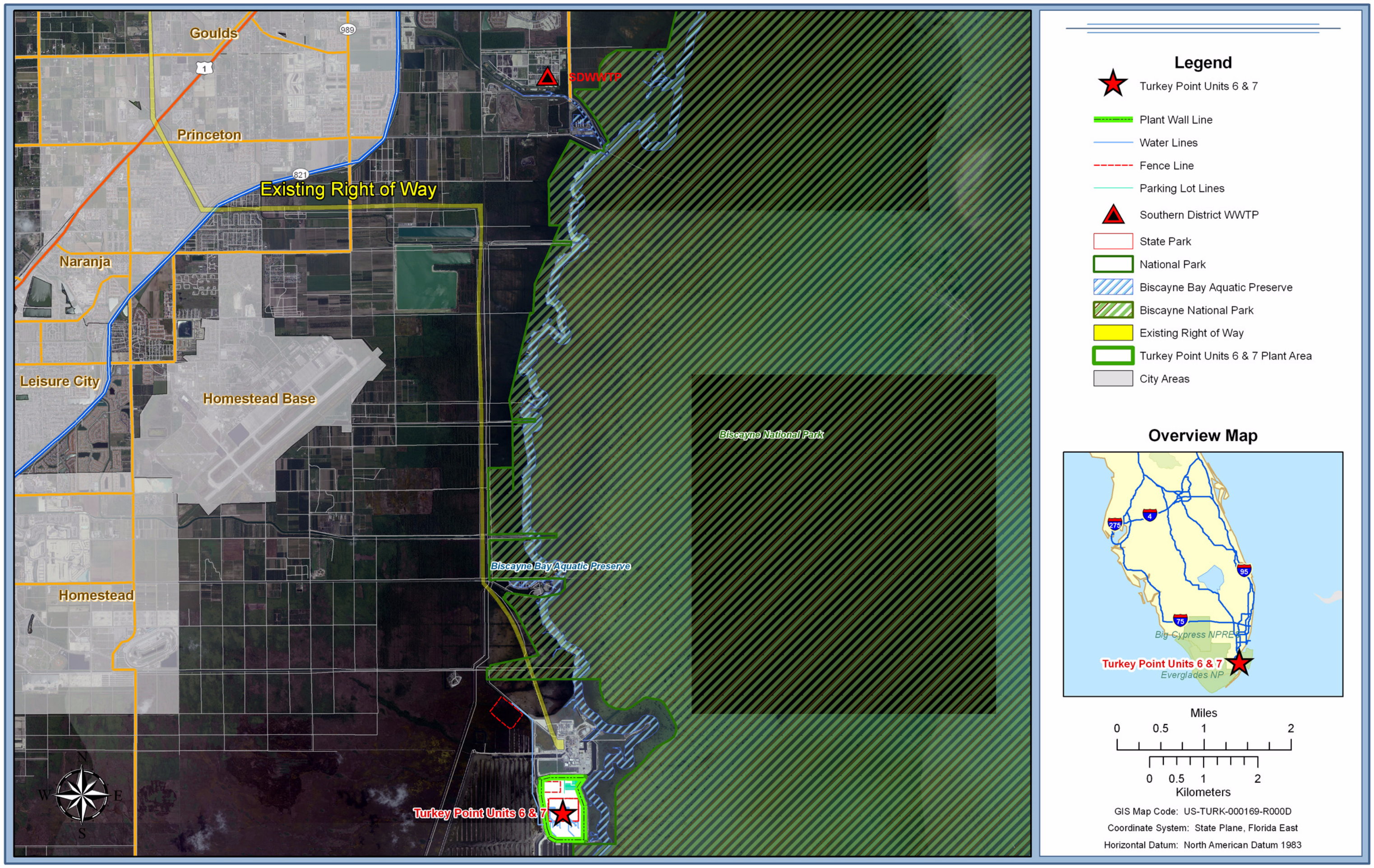

Figure 9.4-8 Water Discharge for Turkey Point Power Plant Cooling Canals

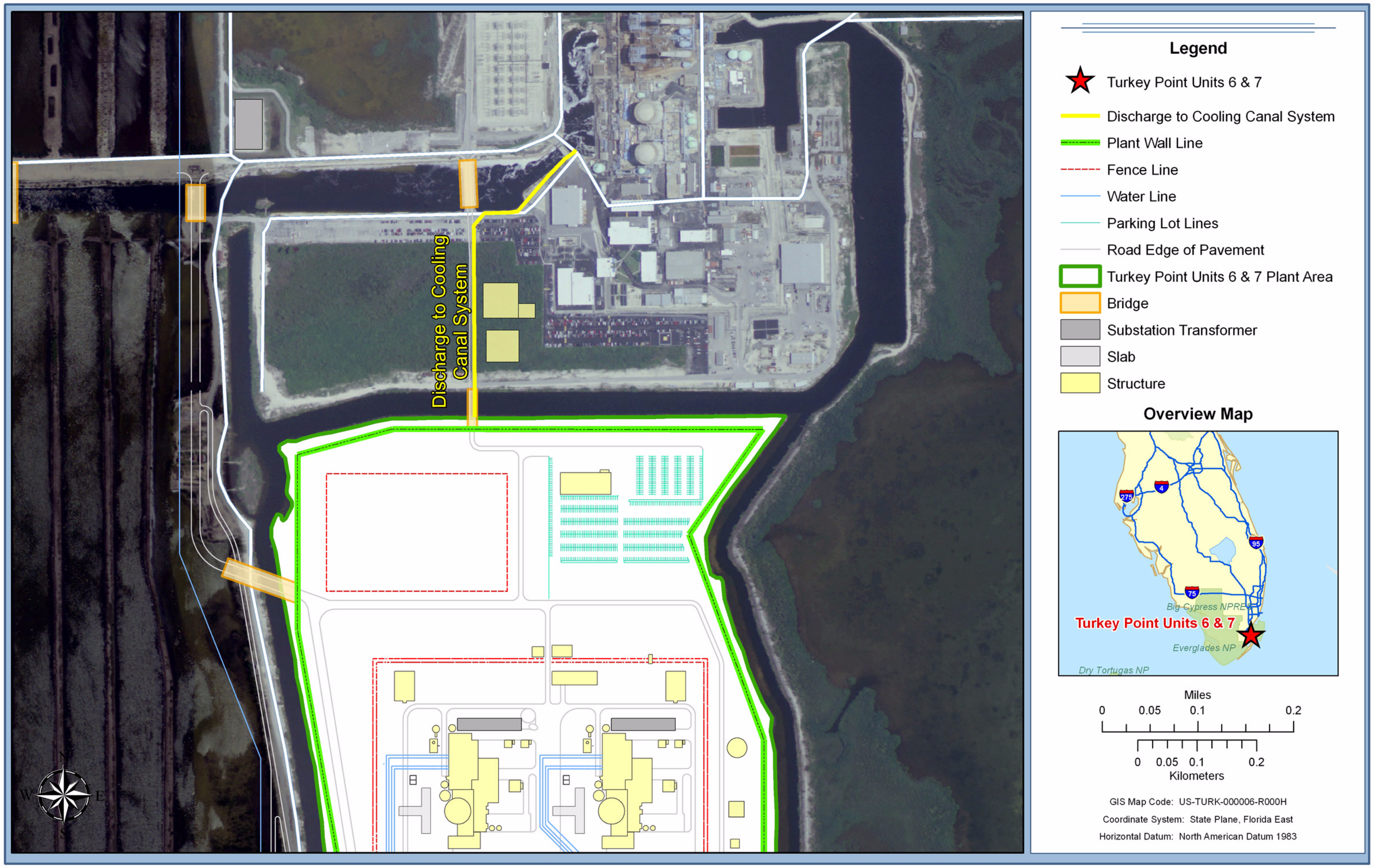

Figure 9.4-9 Blowdown Discharge to the Cooling Canals — Outlet Detail

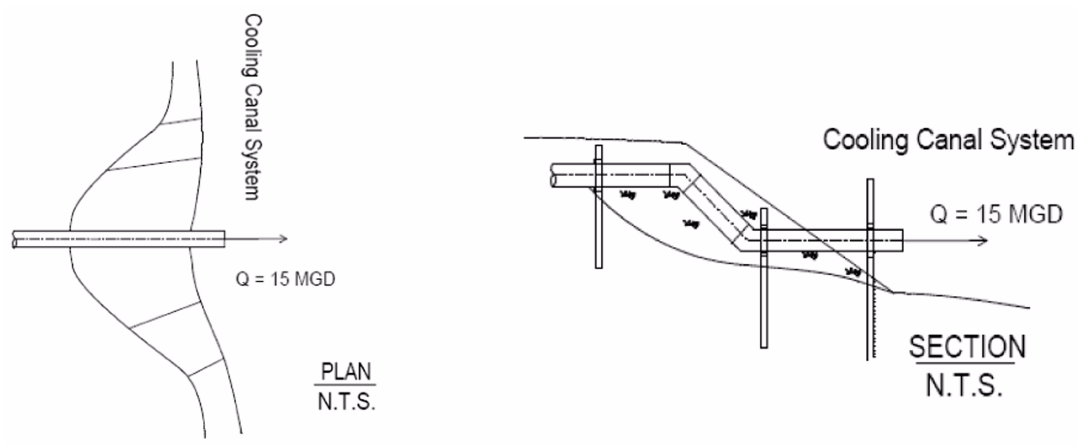

Figure 9.4-10 Water Discharge for Turkey Point Power Plant — Southern District WWTP

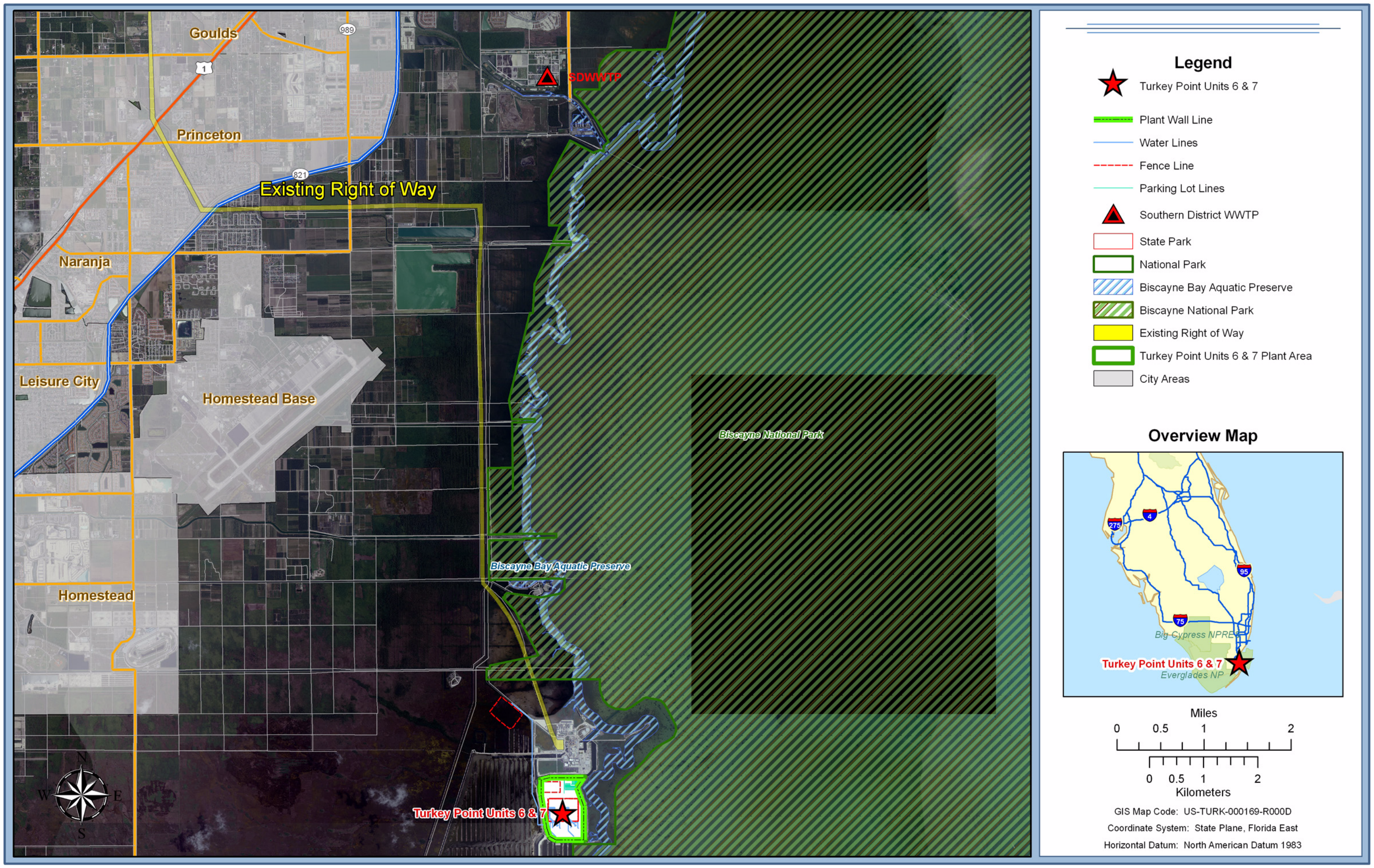

Figure 9.4-11 West Regional Alternative Routes

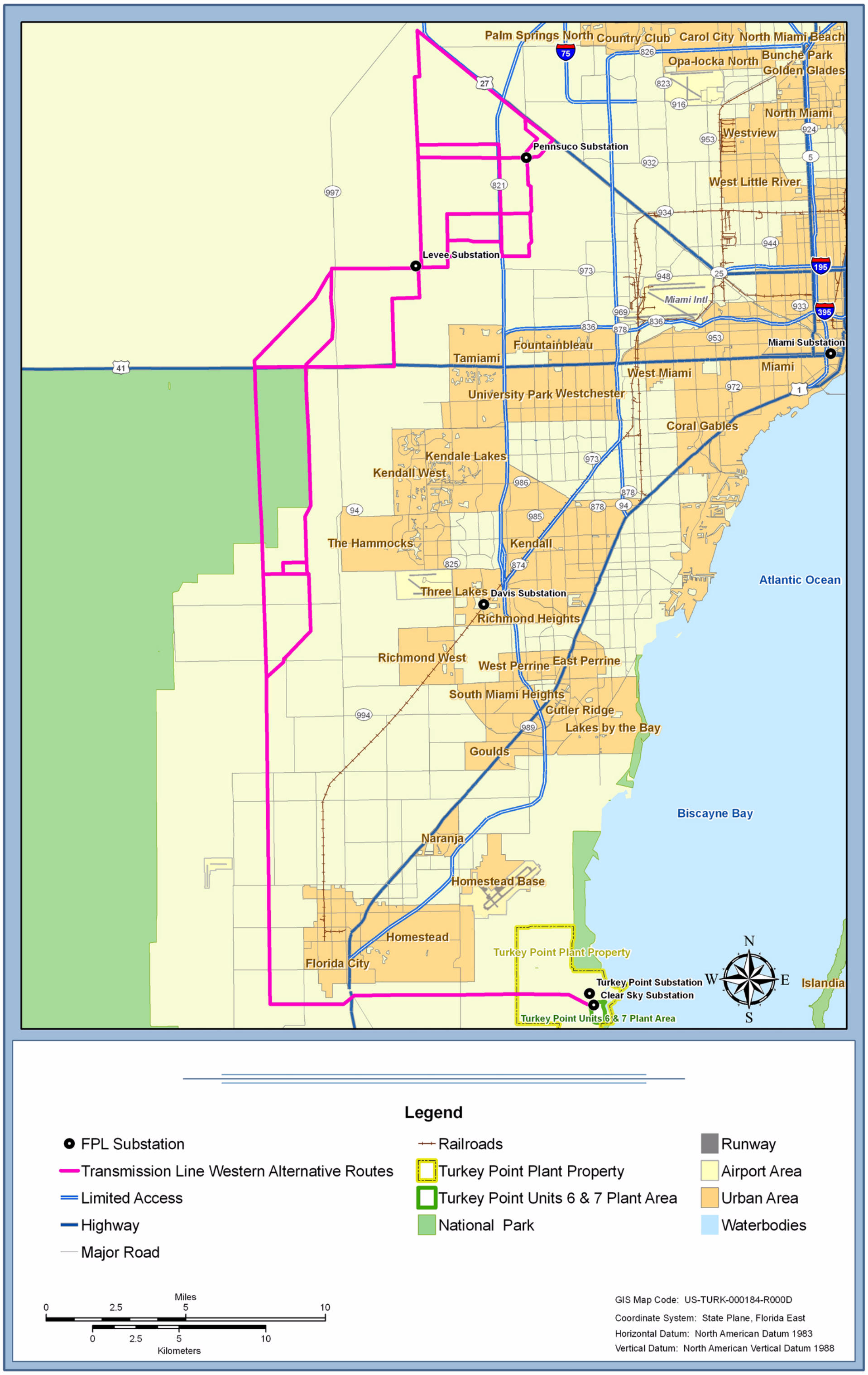

Figure 9.4-12 East Regional Alternative Routes

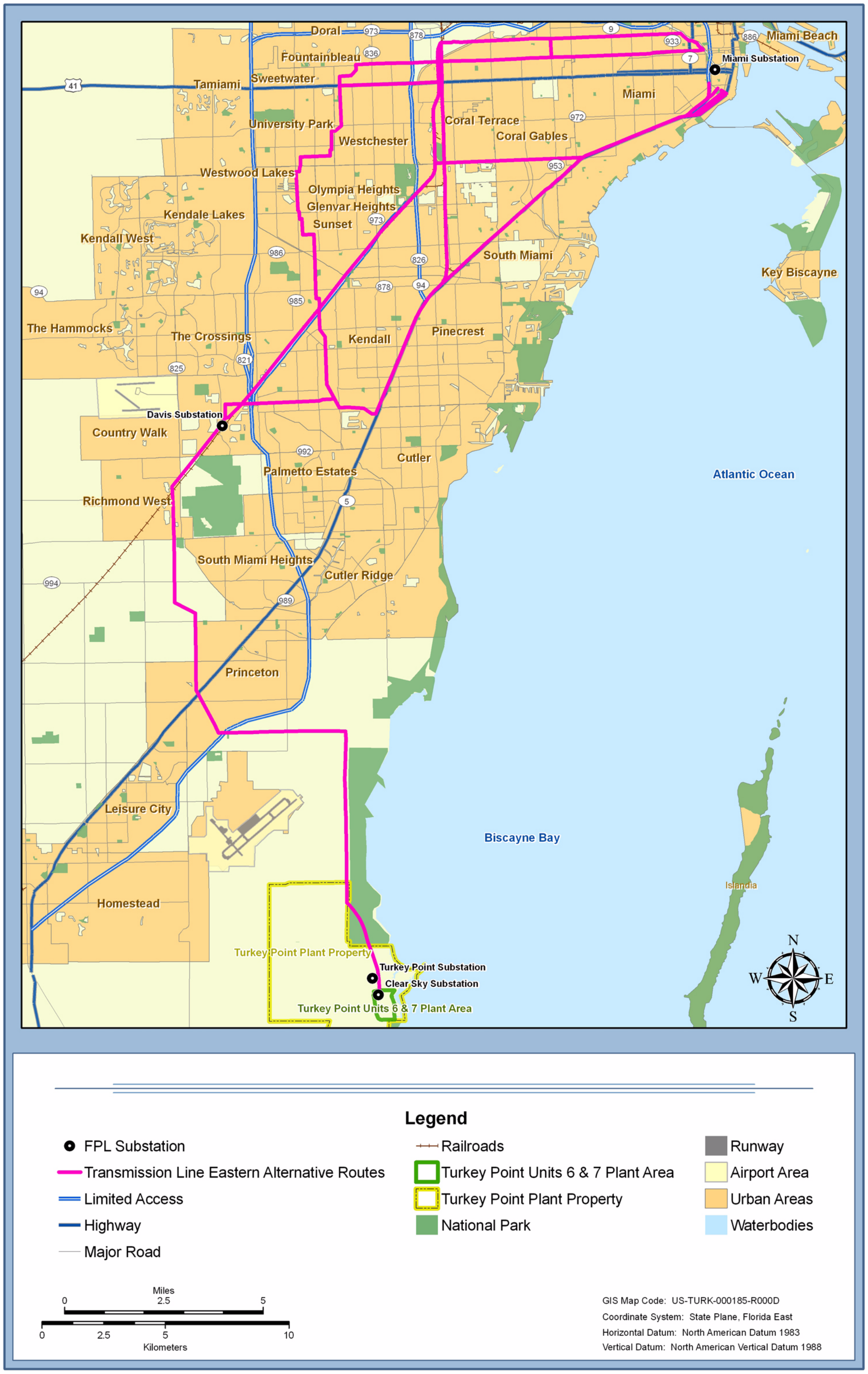

Figure 9.4-13 West Preferred and West Secondary Corridors

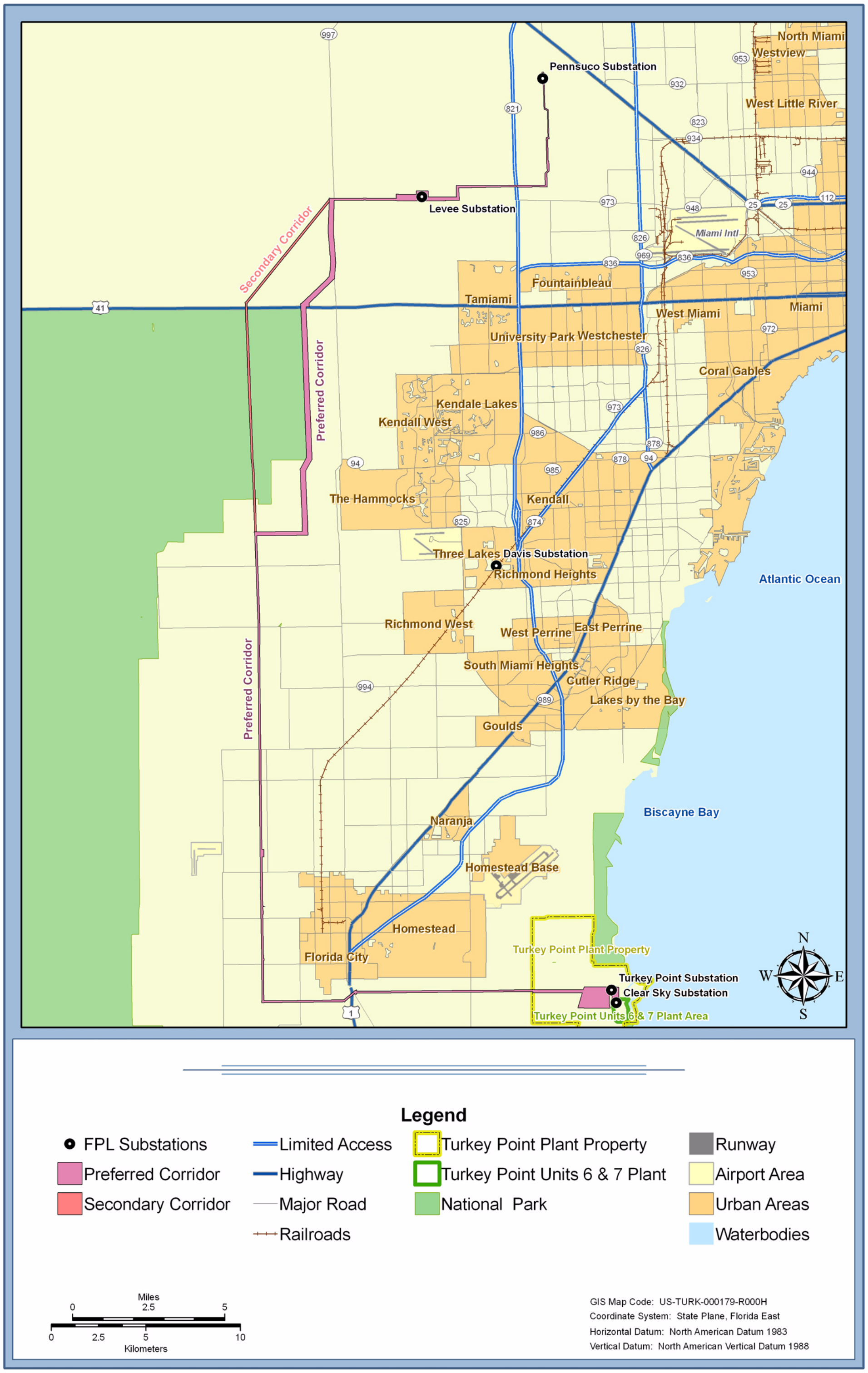

Figure 9.4-14 East Preferred Corridor