United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-2176, Vol. 1

Environmental Impact Statement for Combined Licenses (COLs) for Turkey Point Nuclear Plant Units 6 and 7

Draft Report for Comment

Volume 1

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

U.S. Army Corps of Engineers
Jacksonville District
Jacksonville, Florida 32232-0019

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Abstract

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by Florida Power and Light Company (FPL) for two combined construction permits and operating licenses (combined licenses or COLs). The proposed actions related to the FPL application are (1) NRC issuance of COLs for two new power reactor units (Units 6 & 7) at the Turkey Point Nuclear Power Plant site in Miami-Dade County, Florida, and (2) U.S. Army Corps of Engineers (USACE) decision to issue, deny, or issue with modifications a Department of the Army (DA) permit to perform certain dredge and fill activities in waters of the United States and to construct structures in navigable waters of the United States related to the project. The NRC, its contractors, and USACE make up the review team. The National Park Service (NPS) is also a cooperating agency on this EIS but does not now have a request to take any specific regulatory action before it. Due to this unique set of circumstances, impact determinations made in this EIS should only be attributed to the review team. This EIS documents the review team's analysis, which considers and weighs the environmental impacts of constructing and operating two new nuclear units at the Turkey Point site and at alternative sites, including measures potentially available for reducing or avoiding adverse impacts.

The EIS includes an evaluation of the impacts of construction and operation of Turkey Point Units 6 & 7 on waters of the United States pursuant to Section 404 of the Clean Water Act and on navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899. The USACE will base its evaluation of FPL's DA permit application, on the requirements of USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process.

After considering the environmental aspects of the proposed action before the NRC, the NRC staff's preliminary recommendation to the Commission is that the COLs be issued as proposed. This recommendation is based on (1) the application, including the Environmental Report (ER), submitted by FPL; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS.

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Executive Summary

This environmental impact statement (EIS) presents the results of a U.S. Nuclear Regulatory Commission (NRC) environmental review of an application for a combined construction permit and operating license (combined license or COL) for two new nuclear reactor units at a proposed Turkey Point site in Miami-Dade County, Florida. The U.S. Army Corps of Engineers (USACE) participated in the preparation of the EIS as a cooperating agency and as a member of the review team, which consisted of the NRC staff, its contractor staff, and the USACE staff. The National Park Service (NPS) participated in the environmental review as a cooperating agency by providing special expertise for the areas in and around the adjacent national parks (Biscayne and Everglades National Parks). The NPS does not now have a request to take any specific regulatory actions related to the proposed COLs before it. Due to this unique set of circumstances, all impact determinations made in this EIS should not be attributed to NPS, but only to the NRC and USACE (also referred to as the review team). The NPS's participation in connection with this EIS does not imply NPS concurrence.

Background

On June 30, 2009, the Florida Power and Light Company (FPL) submitted an application to the NRC for a combined construction permit and operating license (combined license or COL) for Turkey Point Units 6 and 7.

Upon acceptance of FPL's application, the NRC review team began the environmental review process by publishing a Notice of Intent to prepare an EIS and conduct scoping in the *Federal Register* on June 15, 2010. As part of this environmental review, the review team did the following:

- conducted public scoping meetings on July 15, 2010 in Homestead, Florida
- conducted a site visit of the proposed Units 6 and 7 plant area on the Turkey Point site in June 2010
- conducted visits to alternative sites in July 2010
- reviewed FPL's Environmental Report (ER)
- consulted with Tribal Nations and other agencies such as the U.S. Fish and Wildlife Service (FWS), Advisory Council on Historic Preservation, Florida Fish and Wildlife Conservation Commission, National Marine Fisheries Service, Miami-Dade Office of Historic and Archaeological Resources, and Florida Division of Historical Resources
- conducted the review following guidance set forth in NUREG-1555:
  - "Standard Review Plans for Environmental Reviews for Nuclear Power Plants
  - Supplement 1: Operating License Renewal"
- considered public comments received during the 60-day scoping process from June 15, 2010 to August 16, 2010.

Proposed Action

FPL initiated the proposed Federal action by submitting an application for Turkey Point Units 6 and 7 to the NRC. The NRC's Federal action is issuance of COLs for two Westinghouse AP1000 reactors at the Turkey Point site near Homestead, Florida.

The USACE is a cooperating agency in preparation of this EIS. The USACE's Federal action is its decision of whether to issue, deny, or issue with modifications a Department of Army (DA) permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899 to authorize certain construction activities potentially affecting waters of the United States.[(1)]

Purpose and Need for Action

The purpose of the proposed NRC action, issuance of the COL, is to provide for additional baseload electric generating capacity for use in the FPL service territory.

The USACE determines both a basic and an overall project purpose pursuant to the Clean Water Act Section 404(b)(1) Guidelines, 33 CFR Section 230.10. The basic purpose is to meet the public's need for electric energy. The overall purpose is to meet the public's need for reliable increased electrical baseload generating capacity in FPL's service territory.

Affected Environment

The Turkey Point site is located in southeast Miami-Dade County, Florida, near Homestead (Figure ES-1). Turkey Point Units 6 and 7 would be located on the same site as the existing Turkey Point site, which has five other power plants, including two nuclear power reactors. Turkey Point would be located 25 mi south of Miami and 4.5 and 8 mi east of Homestead and Florida City, respectively. Cooling water would be provided by reclaimed wastewater. The ultimate heat sink for Turkey Point Units 6 and 7 is the atmosphere, using three mechanical draft cooling towers per reactor.

(1) Waters of the United States" is used to include both "waters of the United States" as defined by 33 C.F.R. Part 328 defining the extent of USACE geographic jurisdiction pursuant to Section 404 of the Clean Water Act and "navigable waters of the United States" as defined by 33 CFR. Part 329 defining the extent of USACE geographic jurisdiction pursuant to Section 10 of the Rivers and Harbors Act of 1899.

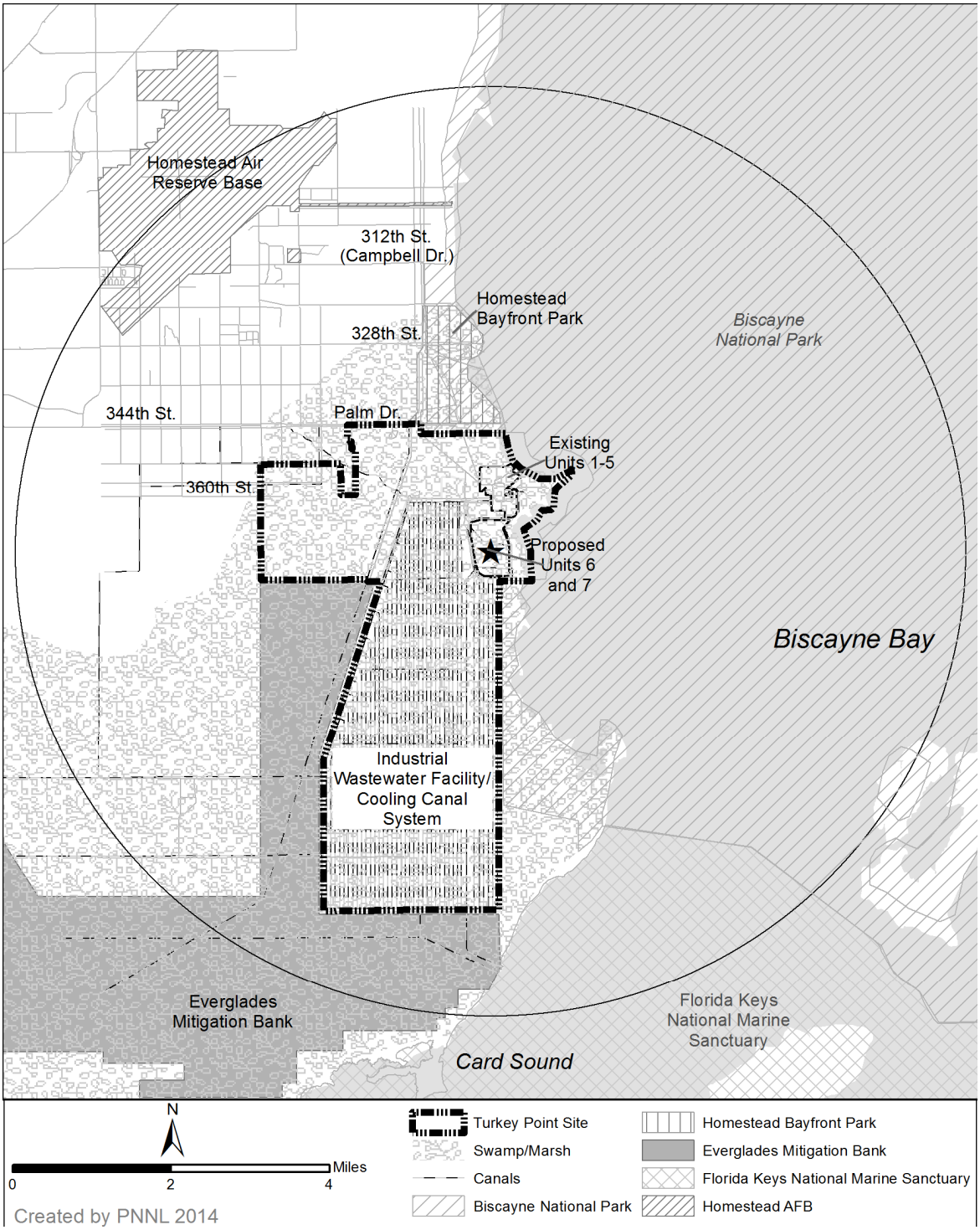


Figure ES-1. The Turkey Point Site and Affected Environment.

Evaluation of Environmental Impacts

This EIS evaluates the potential environmental impacts of the construction and operation of the two new nuclear plants proposed for the Turkey Point site related to the following resource areas:

- land use
- air quality
- aquatic ecology
- terrestrial ecology
- surface and groundwater
- waste (radiological and nonradiological)
- human health (radiological and nonradiological)
- socioeconomics
- environmental justice
- cultural resources
- fuel cycle, decommissioning, and transportation

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.

The impacts are designated as SMALL, MODERATE, or LARGE. The incremental impacts related to the construction and operations activities requiring NRC authorization are described and characterized, as are the cumulative impacts resulting from the proposed action when the effects are added to, or interact with, other past, present, and reasonably foreseeable future effects on the same resources. A summary of the construction and operation impacts are outlined in Tables ES-1. Table E-2 summarizes the review team's assessment of cumulative impacts. The review team's detailed analysis which supports the impact assessment of the proposed new units can be found in Chapters 4, 5, and 7, respectively.

Table ES-1. Environmental Impact Levels of the Proposed Turkey Point Units 6 and 7

Resource Category	Preconstruction and Construction	Operation
Land Use	MODERATE (NRC authorized construction impact level is SMALL)	MODERATE (NRC authorized construction impact level is SMALL)
Water-Related		
Water Use – Surface Water	SMALL	SMALL
Water Use – Groundwater Use	SMALL	SMALL
Water Quality – Surface Water	SMALL	SMALL
Water Quality – Groundwater	SMALL	SMALL
Ecology		
Terrestrial Ecosystems	MODERATE (NRC authorized construction impact level is SMALL)	MODERATE
Aquatic Ecosystems	SMALL to MODERATE	SMALL
Socioeconomic		
Physical Impacts	SMALL	SMALL
Demography	SMALL	SMALL
Economic Impacts on the Community	SMALL	SMALL
Infrastructure and Community Services	SMALL to MODERATE	SMALL to MODERATE
Environmental Justice	NONE[(a)]	NONE[(a)]
Historic and Cultural Resources	MODERATE (NRC authorized construction impact level is SMALL)	SMALL
Air Quality	SMALL	SMALL
Nonradiological Health	SMALL	SMALL
Nonradiological Waste	SMALL	SMALL
Radiological Health	SMALL	SMALL
Postulated Accidents	n/a	SMALL
Fuel Cycle, Transportation, and Decommissioning	n/a	SMALL

(a) A determination of "NONE" for Environmental Justice analyses does not mean there are no adverse impacts to minority or low-income populations from the proposed project. Instead, an indication of "NONE" means that while there are adverse impacts, those impacts do not affect minority or low-income populations in any disproportionate manner, relative to the general population.

Table ES-2. Cumulative Impacts on Environmental Resources, Including the Impacts of Proposed Turkey Point Units 6 and 7

Resource Category	Impact Level
Land Use	MODERATE
Water-Related	
Water Use – Surface Water	SMALL
Water Use – Groundwater Use	SMALL
Water Quality – Surface Water	SMALL
Water Quality – Groundwater	SMALL
Ecology	
Terrestrial Ecosystems	MODERATE to LARGE
Aquatic Ecosystems	MODERATE
Socioeconomic	
Physical Impacts	SMALL to MODERATE
Demography	SMALL
Economic Impacts on the Community	SMALL
Infrastructure and Community Services	SMALL to MODERATE
Environmental Justice	NONE[(a)]
Historic and Cultural Resources	MODERATE
Air Quality	SMALL to MODERATE for criteria pollutants and MODERATE for GHGs
Nonradiological Health	SMALL
Nonradiological Waste	SMALL
Radiological Health	SMALL
Postulated Accidents	SMALL
Fuel Cycle, Transportation, and Decommissioning	SMALL

(a) A determination of "NONE" for Environmental Justice analyses does not mean there are no adverse impacts to minority or low-income populations from the proposed project. Instead, an indication of "NONE" means that while there are adverse impacts, those impacts do not affect minority or low-income populations in any disproportionate manner, relative to the general population.

Alternatives

The review team considered the environmental impacts associated with alternatives to issuing a COL for the two new nuclear units proposed by FPL for the Turkey Point site. These alternatives included a no-action alternative (i.e., not issuing the COL) and alternative energy sources, siting locations, and system designs.

The no-action alternative would result in the COL not being granted or the USACE not issuing its permit. Upon such a denial, construction and operation of new units at the Turkey Point site would not occur and the predicted environmental impacts would not take place. If no other facility would be built or strategy implemented to take its place, the benefits of the additional electrical capacity and electricity generation to be provided would also not occur and the need for baseload power would not be met.

Based on the NRC staff's review of energy alternatives, the NRC staff concluded that, from an environmental perspective, none of the viable alternatives is environmentally preferable to building a new baseload nuclear power generation plant at the Turkey Point site. The NRC staff eliminated several energy sources (e.g., wind, solar, geothermal, and biomass) from full

consideration because they are not currently capable of meeting the need of this project. None of the viable baseload alternatives (natural gas, coal, or a combination of alternatives) was environmentally preferable to the proposed Turkey Point units.

After comparing the cumulative effects of a new nuclear power plant at the proposed site against those at the alternative sites, the NRC staff concluded that none of the alternative sites would be environmentally preferable to the proposed site for building and operating a new nuclear power plant (Table ES-3). The four alternatives sites selected were as follows (Figure ES-2):

- Glades
- Martin
- Okeechobee 2
- St. Lucie.

Table ES-3. Comparison of Cumulative Impacts at the Turkey Point and Alternative Sites

Resource Category	Turkey Point Site[a]	Glades[b]	Martin[b]	Okeechobee 2[b]	St. Lucie[b]
Land Use	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Water-Related					
Surface-water use	SMALL	MODERATE	MODERATE	MODERATE	SMALL
Groundwater use	SMALL	SMALL	SMALL	SMALL	SMALL
Surface-water quality	SMALL	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecology					
Terrestrial and wetland ecosystems	MODERATE to LARGE	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic ecosystems	MODERATE	MODERATE	MODERATE	MODERATE	SMALL to MODERATE
Socioeconomics					
Physical impacts	SMALL adverse except for MODERATE beneficial impacts on roads	SMALL except for MODERATE impacts on roads and aesthetics	SMALL except for MODERATE impacts on roads and aesthetics	SMALL except for MODERATE impacts on roads and aesthetics	SMALL except for LARGE impacts on buildings and roads
Demography	SMALL	SMALL	SMALL	SMALL	SMALL, except for LARGE residential displacement impacts
Economic impacts on the community	SMALL and beneficial	SMALL and beneficial, except for LARGE and beneficial property tax revenues for Glades County and School District	SMALL and beneficial, except for LARGE and beneficial property tax revenues for Martin County and School District	SMALL and beneficial, except for LARGE and beneficial property tax revenues for Okeechobee County and School District	SMALL and beneficial

Table ES-3. (contd)

Resource Category	Turkey Point Site[a]	Glades[b]	Martin[b]	Okeechobee 2[b]	St. Lucie[b]
Infrastructure and community services	SMALL except for MODERATE adverse impacts on traffic	SMALL except for MODERATE adverse impacts on traffic	SMALL except for MODERATE adverse impacts on traffic	SMALL except for MODERATE adverse impacts on traffic	SMALL except for MODERATE adverse impacts on traffic
Environmental Justice	None[c]	None[c]	None[c]	None[c]	None[c]
Historic and Cultural Resources	MODERATE	MODERATE	SMALL	MODERATE	SMALL
Air Quality					
Criteria pollutants	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Greenhouse gas emissions	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Nonradiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL	SMALL

(a) Cumulative impact determinations taken from EIS Table 7-3.
(b) Cumulative impact determinations taken from EIS Table 9-28.
(c) A determination of "NONE" for Environmental Justice analyses does not mean there are no adverse impacts to minority or low-income populations from the proposed project. Instead, an indication of "NONE" means that while there are adverse impacts, those impacts do not affect minority or low-income populations in any disproportionate manner, relative to the general population.

Table ES-3 provides a summary of the cumulative impacts for the proposed and alternative sites. The NRC staff concluded that all of the sites were generally comparable, and it would be difficult to state that one site is preferable to another from an environmental perspective. In such a case, the proposed site prevails because none of the alternatives is environmentally preferable to the proposed site.

Table ES-4 provides a summary of the EIS-derived impacts for a new nuclear power plant in comparison with the energy alternatives. The NRC staff concluded that none of the viable energy alternatives is preferable to construction of a new baseload nuclear power-generating plant located within FPL's region of interest.

The NRC staff considered various alternative systems designs, including seven alternative heat-dissipation systems and multiple alternative intake, discharge, and water-supply systems. The review team identified no alternatives that were environmentally preferable to the proposed Turkey Point Units 6 and 7 systems design.

Figure ES-2. Location of Sites Considered as Alternatives to the Turkey Point Site

Table ES-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural-Gas-Fired Generating Units and a Combination of Alternatives

Impact Category	Nuclear	Coal[(a)]	Natural Gas[(a)]	Combination of Alternatives[(a)]
Land Use	MODERATE	MODERATE	MODERATE	MODERATE
Air Quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Ecology	MODERATE	MODERATE	MODERATE	MODERATE
Waste Management	SMALL	MODERATE	SMALL	SMALL
Socioeconomics	SMALL Beneficial to MODERATE Adverse	SMALL Beneficial to MODERATE Adverse	SMALL Beneficial to SMALL Adverse	SMALL Beneficial to MODERATE Adverse
Human Health	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	MODERATE	MODERATE	MODERATE	MODERATE
Environmental Justice	NONE[(b)]	NONE[(b)]	NONE[(b)]	NONE[(b)]

(a) Impacts taken from EIS Table 9-4. These conclusions for energy alternatives should be compared to NRC-authorized activities reflected in Chapters 4, 5, and Sections 6.1, and 6.2.

(b) A determination of "NONE" for Environmental Justice analyses does not mean there are no adverse impacts to minority or low-income populations from the proposed project. Instead, an indication of "NONE" means that while there are adverse impacts, those impacts do not affect minority or low-income populations in any disproportionate manner, relative to the general population.

Benefits and Costs

The NRC staff compiled and compared the pertinent analytical conclusions reached in the EIS. It gathered all of the expected impacts from building and operating proposed Turkey Point Units 6 and 7 and aggregated them into two final categories: (1) expected environmental costs and (2) expected benefits to be derived from approval of the proposed action. Although the analysis in Section 10.6 is conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the purpose of the section is to identify potential societal benefits of the proposed activities and compare them to the potential internal (i.e., private) and external (i.e., societal) costs of the proposed activities. In general, the purpose is to inform the COL process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed activities outweigh the aggregate costs.

On the basis of the assessments in this EIS, the building and operation of proposed Turkey Point Units 6 and 7, with mitigation measures identified by the review team, would accrue benefits that most likely would outweigh the economic, environmental, and social costs. For the NRC-proposed action (i.e., NRC-authorized construction and operation), the accrued benefits would also outweigh the costs of preconstruction, construction, and operation of proposed Turkey Point Units 6 and 7.

Public Involvement

A 60-day scoping period was held from June 15, 2010, to August 16, 2010. On July 15, 2010, the NRC held two public scoping meetings in Homestead, Florida. The review team received many oral comments during the public meetings and 32 e-mails and 10 letters throughout the rest of the scoping period on numerous topics including energy alternatives, terrestrial ecology, ground and surface water, and socioeconomics. The review team's response to the in-scope public comments can be found in Appendix D. The Scoping Summary Report (Agencywide Document Access and Management System (ADAMS) Accession No. ML103130609) contains all of the comments, even those considered out-of-scope (e.g., security, safety issues).

Once the draft EIS is published, the U.S. Environmental Protection Agency will issue a Notice of Availability in the *Federal Register*, which will begin a 75-day comment period for the public to submit comments on the results of the staff's environmental review. There are several ways to submit comments, which will be outlined in the *Federal Register* Notice. During the comment period, the NRC will hold public meetings near the Turkey Point site to describe the results, respond to questions, and accept public comments.

Recommendation

The NRC's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COL should be issued.

This recommendation is based on the following:

- the application, including the ER, submitted by FPL
- consultation with Federal, State, Tribes, and local agencies
- site audit and alternative sites audit
- consideration of public comments received during scoping
- the review team's independent review and assessment summarized in this EIS.

The NRC's determination is independent of the USACE's determination of whether to issue, deny, or issue with modifications the DA permit application for the Turkey Point Units 6 and 7. The USACE will conclude its Clean Water Act Section 404(b)(1) Guidelines and public interest analyses in its Record of Decision.

Abbreviations/Acronyms

AADT	annual average daily traffic
ac	acre(s)
ACC	averted cleanup and decontamination costs
ac-ft	acre (foot) feet
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AD	Anno Domini
ADAMS	Agencywide Documents Access and Management System
ALARA	as low as reasonably achievable
a.m.	ante meridian
AP1000	Advanced Passive 1000 pressurized water reactor
AP-42	EPA's Compilation of Air Pollutant Emission Factors document
APE	Area of Potential Effect
APPZ	Avon Park Permeable (or Producing) Zone
AQCR	Air Quality Control Region
ARRA	American Recovery and Reinvestment Act of 2009
ASR	aquifer storage and recovery (system)
ATC	Atlantic Coastal Ridge
BA	Biological Assessment
BACT	Best Available Control Technologies
BBCW	Biscayne Bay Coastal Wetlands
BC	Before Christ
BEBR	University of Florida's Bureau of Economic and Business Research
BEA	U.S. Bureau of Economic Analysis
BEIR VII	Biological Effects of Ionizing Radiation VII
bgs	below ground surface
BISC	Biscayne Bay
BLS	U.S. Bureau of Labor Statistics
BMP	Best Management Practice
Btu	British thermal unit
°C	degree(s) Celsius
μCi	microcurie(s)
μCi/mL	microcuries per milliliter
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CCR	coal combustion residuals
CCS	cooling-canal system

CDF	core damage frequency
CDMP	Comprehensive Development Master Plan
CEC	chemical/contaminant of emerging concern
CEQ	Council on Environmental Quality
CERP	Comprehensive Everglades Restoration Program (also Project, Plan)
CFR	*Code of Federal Regulations*
cfs	cubic foot/feet per second
cm	centimeter(s)
cm^2	square centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COL	combined construction permit and operating license
CPUE	catch per unit effort
CSAPR	Cross-State Air Pollution Rule
CTEMISS	cooling-tower emissions processor
CWA	Clean Water Act (aka Federal Water Pollution Control Act)
CWS	circulating-water system
CZMP	Coastal Zone Management Plan
d	day(s)
D	Directional Distribution Factor
DA	Department of the Army
dB	decibel(s)
dBA	decibel(s) on the A-weighted scale
DBA	design basis accident
DCD	Design Control Document
DEIS	draft environmental impact statement
DERM	Miami-Dade County Department of Environmental Resources Management
DNL	day-night average sound level
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPS	distinct population segment
DSM	demand-side management
DZMW	dual-zone monitoring well
EAB	exclusion area boundary
EAI	Ecological Associates, Inc.
EC10	effective concentration required to induce a 10% effect
EC50	effective concentration required to induce a 50% effect

EDR	Florida Legislature's Office of Economic and Demographic Research
EEL	Environmentally Endangered Lands (Program)
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	environmental impact statement
EJ	environmental justice
ELF	extremely low frequency
ELF-EMF	extremely low frequency-electromagnetic field
EMB	Everglades Mitigation Bank
EMF	electromagnetic field
ENP	Everglades National Park
EPA	U.S. Environmental Protection Agency
EPOC	emerging pollutant of concern
EPRI	Electric Power Research Institute
ER	Environmental Report
ESA	Endangered Species Act of 1973, as amended
ESOC	emerging substance of concern
ESRP	Environmental Standard Review Plan (NUREG-1555, Supplement 1, Operating License Renewal)
EW	exploratory well
°F	degree(s) Fahrenheit
FAA	Federal Aviation Administration
FAC	Florida Administrative Code or Fla. Admin. Code
FDEP	Florida Department of Environmental Protection
FDHR	Florida Division of Historic Resources
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEC	Florida East Coast (Railway)
FEFP	Florida Education Finance Program
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFWCC	Florida Fish and Wildlife Conservation Commission
FKNMS	Florida Keys National Marine Sanctuary
FLUCFCS	Florida Land Use, Cover, and Forms Classification System
FLUM	Future Land Use Map
FMNH	Florida Museum of Natural History
FMP	fishery management plan
FMSF	Florida Master Site File (form)
FNAI	Florida Natural Areas Inventory
FPL	Florida Power and Light Company

fps	foot(feet) per second
FPSC	Florida Public Service Commission
FR	*Federal Register*
FRCC	Florida Reliability Coordinating Council
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
ft	foot/feet
ft^2	square foot/feet
ft/d	foot(feet) per day
ft^2/d	square foot(feet) per day
ft^3	cubic foot(feet)
ft^3/d	cubic foot (feet) per day
ft^3/yr	cubic foot (feet) per year
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act of 1977)
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
µg	microgram(s)
µg/L	microgram(s) per liter
µGy	microgray(s)
g	gram(s) or gravity of Earth (g-force)
gal	gallon(s)
gal/yr	gallon(s) per year
GC	gas centrifuge
g/cm^3	gram(s) per cubic centimeter
GCRP	U.S. Global Change Research Program
GEIS	Generic Environmental Impact Statement (for License Renewal of Nuclear Plants, NUREG-1437)
GHG	greenhouse gas
GIS	geographic information system
gpd	gallon per day
gpm	gallon per minute
gpm/ft	gallon(s) per minute per foot
g/s	gram(s) per second
GU	Interim District (zone)
GW	gigawatt(s)
GWh	gigawatt hour(s)
ha	hectare(s)
HAP	hazardous air pollutant

HAPC	habitat area of particular concern
HBB	health-based benchmark
HDR	HDR Engineering, Inc.
HEC-RAS	Hydrologic Engineering Centers River Analysis System
hr	hour
HUD	U.S. Department of Housing and Urban Development
Hz	hertz
I	Interstate
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ID	identification
IGCC	integrated gasification combined-cycle
in.	inch(es)
IRWST	in-containment refueling water storage tank
ISFSI	independent spent-fuel storage installation
IUCN	World Conservation Union
IWF	industrial wastewater facility
K	Standard Peak Hour Factor
kg	kilogram(s)
kg/d	kilogram(s) per day
kg/L	kilogram(s) per liter
kg/yr	kilogram(s) per year
kg/ha/mo	kilogram(s)/hectare/month
kHz	kilohertz
km	kilometer(s)
km^2	square kilometer(s)
km/hr	kilometer(s) per hour
kt	knot(s)
kV	kilovolt(s)
kV/m	kilovolt(s) per meter
kW	kilowatt(s)
kWh	kilowatt-hour(s)
L	liter(s)
lb	pound(s)
lb/yr	pound(s) per year
L_{dn}	day-night average sound level
LEDPA	least environmentally damaging practicable alternative
L_{eq}	noise level equivalent

LLC	Limited Liability Company
LLW	low-level waste
LOEC	lowest-observed effect concentration
LOS	level of service
LPZ	low-population zone
LST	local standard time
LWA	Limited Work Authorization
LWR	light water reactor
µmhos/cm	micromhos per centimeter
m	meter(s)
m/s	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
m^3/d	cubic meters per day
m^3/s	cubic meter(s) per second
mA	milliampere(s)
MACCS	MELCOR Accident Consequence Code System
mcu	Middle Confining Unit
MDC	Miami-Dade County
M-DCPS	Miami-Dade County Public School District
MDWASD	Miami-Dade Water and Sewer Department
MEI	maximally exposed individual
mg	milligram(s)
mG	milliGauss
Mgd	million gallon(s) per day
Mgd/yr	million gallon(s) per day per year
Mgm	million gallons per month
Mg/L	milligram(s) per liter
Mg/m^3	milligram(s) per cubic meter
mg N/L	milligrams of nitrate per liter
mg P/L	milligrams of phosphate per liter
mGy	milligray(s)
mGy/d	milligray(s) per dayMFCMA Magnuson–Stevens Fishery Conservation and Management Act **(or** Magnuson–Stevens Act**)**
MHz	megahertz
mi	mile(s)
mi^2	square mile(s)
min	minute(s)
MIT	Massachusetts Institute of Technology
mL	milliliter(s)

MMBtu	one million British thermal units
MMBtu/hr	one million British thermal units per hour
MMBtu/yr	one million British thermal units per year
MOU	Memorandum of Understanding
mph	mile(s) per hour
mrad	millirad
mrem	millirem
msl or MSL	mean sea level
mSv	millisievert(s)
MSW	municipal solid waste
MT	metric ton(nes)
MTU	metric ton uranium
MW	megawatt(s)
MWd/MTU	megawatt-days per metric ton of uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
MWh/yr	megawatt hour(s) per year
N	north or nitrogen
NA	not applicable
NAAQS	National Ambient Air Quality Standard
NAD83	North American Datum of 1983
NASCAR	National Association for Stock Car Auto Racing
NAVD88	North American Vertical Datum of 1988
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act of 1969, as amended
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NFC	Natural Forest Community
NGCC	natural-gas combined-cycle
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_3+NO_2	nitrate+nitrite
NO_x	nitrogen oxides
NOAA	National Oceanographic and Atmospheric Administration
NOEC	no-observed effect concentration

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSR	new source review
NUREG	U.S. Nuclear Regulatory Commission technical document
NWS	National Weather Service
O_2	oxygen
O_3	ozone
ODCM	Offsite Dose Calculation Manual
OFW	Outstanding Florida Water
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
P	phosphorus
PAH	polycyclic aromatic hydrocarbon
PC	personal computer
PCB	polychlorinated biphenyl
pCi/L	picocurie(s) per Liter
pH	measure of acidity or basicity in solution
P/L	phosphorus per liter
PIR	Public Interest Review or Project Implementation Report
PIRF	Public Interest Review Factor
PK-12	preschool through 12th grade
p.m.	post meridian
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PPSA	Power Plant Siting Act
ppm	part(s) per million
ppt	parts per thousand
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment
PSD	Prevention of Significant Deterioration (Permit)
psu	practical salinity unit
PWR	pressurized water reactor
rad	radiation absorbed dose
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RCW	radial collector well

rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RfC	reference concentration
RFI	Request for Information
RHA	Rivers and Harbors Act of 1899
RIMS II	Regional Input-Output Modeling System
RMS	root mean square
Rn-222	radon-222
ROD	Record of Decision
ROI	region of interest
RRY	reference reactor year
RSICC	(Oak Ridge) Radiation Safety Information Computational Center
RV	recreational vehicle
RWTF	reclaimed water treatment facility
Ryr	reactor year
s or sec	second(s)
SAFMC	South Atlantic Fisheries Management Council
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SAV	submerged aquatic vegetation
SCA	Site Certification Application
scf	standard cubic feet
SCR	selective catalytic reduction
SDWWTP	South District Wastewater Treatment Plant
SER	Safety Evaluation Report
SFRPC	South Florida Regional Planning Council
SFWMD	South Florida Water Management District
SGWEA	Southern Glades Wildlife Environmental Area
SHA	seismic hazard analysis
SHPO	State Historic Preservation Office (or Officer)
s/m^3	seconds per cubic meter
SO_2	sulfur dioxide
SO_x	oxides of sulfur
SOR	Save Our Rivers (Program)
SPCC	Spill Prevention, Control, and Countermeasure (Plan)
SR	State Route
SRP	Standard Review Plan
SSC	Species of Concern
SU	Standard Unit(s)
Sv	sievert(s)

SWPPP	stormwater pollution prevention plan
SWS	service-water system
T	ton(s) or tonne(s)
T/B	Tug/Barge
TB_q	terrabequerel
TCP	traditional cultural property
T&E	threatened and endangered
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Officer
TKN	total Kjeldahl nitrogen
TLD	thermoluminescent dosimeter
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TRC	total reportable cases
TVA	Tennessee Valley Authority
UDB	urban development boundary
UF_6	uranium hexafluoride
UIC	Underground Injection Control
UMAM	Uniform Mitigation Assessment Method
UMTRI	University of Michigan Transportation Research Institute
UNESCO	United National Educational, Scientific and Cultural Organization
UO_2	uranium dioxide
US	U.S. (State Highway)
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDW	underground source of drinking water
USGS	U.S. Geological Survey
VOC	volatile organic compound
W	west
W.A.T.E.R.	Wetland Assessment Technique for Environmental Review
WCA	water conservation area
Westinghouse	Westinghouse Electric Company, LLC

WHO	World Health Organization
wk	week(s)
WOTUS	waters of the United States
WRDA	Water Resources Development Act
WTP	water treatment plant
χ/Q	atmospheric dispersion factor(s); annual average normalized air concentration value(s)
yd^3	cubic yards
yr	year(s)

1.0 Introduction

By letter dated June 30, 2009 (FPL 2009-TN1229), as supplemented by a letter dated August 7, 2009 (FPL 2009-TN1230), the Florida Power and Light Company (FPL) applied to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for two combined construction permits and operating licenses (combined licenses or COLs) for the proposed Turkey Point Units 6 and 7 (COL application). The NRC review team's evaluation of the environmental impacts of the proposed action is based on the October 29, 2014 revision of the COL application (FPL 2014-TN4102), including the Environmental Report (ER) (FPL 2014-TN4058), responses to requests for additional information, and supplemental information. Documents supporting the review team's evaluation are listed as references where appropriate.

The site proposed by FPL for the two new nuclear units is the Turkey Point site in southeastern Miami-Dade County, Florida. The Turkey Point site is an approximately 9,640 ac site that includes five existing power plants. Units 1 and 2 have been operated as natural-gas/oil steam-generating units. Unit 2 was recently converted to operate in synchronous condenser mode. Unit 1 will be converted to operate in synchronous condenser mode in 2016 (FPL 2014-TN3360). In the synchronous condenser mode, the generators help stabilize and optimize grid performance but do not generate power. Units 3 and 4 are nuclear pressurized water reactors (PWRs), and Unit 5 is a natural-gas combined-cycle steam-generating unit. The proposed plant area is south of Turkey Point Units 3 and 4 on approximately 218 ac of the Turkey Point site property (FPL 2014-TN4058). The proposed Turkey Point Units 6 and 7 would be owned by FPL (2014-TN4058). With the exception of the transmission systems needed to route power from the proposed units, and the pipelines needed to bring reclaimed water to the Turkey Point site, all of the construction and operation related to proposed Turkey Point Units 6 and 7 would be completely within the confines of the Turkey Point site (FPL 2014-TN4058).

On June 30, 2009, the U.S. Army Corps of Engineers (USACE or Corps) received a Department of the Army (DA) permit application from FPL in connection with the proposed Turkey Point Units 6 and 7, and associated structures, including a reclaimed water facility, access roads, radial collector wells, pipelines, transmission lines, and other related infrastructure. The proposed work would result in the alteration of waters of the United States,[1] including wetlands. The USACE is participating as a cooperating agency with the NRC in preparing this environmental impact statement (EIS). The USACE expects to publish a public notice of FPL's DA permit application within 30 days of the publication of this draft EIS.

On June 30, 2009, FPL submitted a Site Certification Application (SCA) to the State of Florida Department of Environmental Protection for the proposed Turkey Point Units 6 and 7 and ancillary facilities (FPL 2010-TN1231). The SCA process provides a Certification that encompasses all licenses and permits needed for affected Florida State, regional, and local agencies. It also includes any regulatory activity that would be applicable under these agencies'

(1) "Waters of the United States" is used to include both "waters of the United States" as defined by 33 C.F.R. Part 328 defining the extent of USACE geographic jurisdiction pursuant to Section 404 of the Clean Water Act and "navigable waters of the United States" as defined by 33 C.F.R. Part 329 defining the extent of USACE geographic jurisdiction pursuant to Section 10 of the Rivers and Harbors Act of 1899.

regulations for proposed Turkey Point Units 6 and 7 (FDEP 2013-TN2629). On May 19, 2014, the State of Florida issued final Conditions of Certification to FPL authorizing construction, operation, and maintenance of proposed Turkey Point Units 6 and 7 and associated facilities (State of Florida 2014-TN3637). The final Conditions of Certification issued are binding and subject to the requirements listed in State of Florida 2014(TN3637).

FPL's applications for proposed Turkey Point Units 6 and 7 seek (1) NRC issuance of COLs for constructing and operating two new nuclear units at the Turkey Point site, and (2) DA authorization pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act), as amended (33 USC Section 1344) (TN662), Section 10 of the Rivers and Harbors Act of 1899 (33 USC Section 403) (TN660), and Section 14 of the Rivers and Harbors Act of 1899 (33 USC Section 408) (Section 408) (TN660). The DA permit application requests authorization to discharge fill into approximately 1,000 ac of jurisdictional wetlands, to construct structures under navigable waters of the United States such as radial collector wells, and to expand the existing barge unloading area in navigable waters of the United States.

1.1 Background

The granting of a COL is Commission approval of the construction and operation of a nuclear power facility. NRC regulations related to COLs are found primarily in Title 10 of the *Code of Federal Regulations* (CFR) Part 52, Subpart C.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.) (TN661), requires the preparation of an EIS for a major Federal action that significantly affects the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51 (TN250). Further, in 10 CFR 51.20 (TN250), the NRC has determined that the issuance of a COL under 10 CFR Part 52 (TN251) is an action that requires an EIS.

According to 10 CFR 52.80(b) (TN251), a COL application must contain an ER. The ER provides the applicant's input to the NRC's EIS. NRC regulations related to ERs and EISs are found in 10 CFR Part 51 (TN250). FPL's ER, which was included as Part 3 of the application, provides a description of the proposed actions related to the application and FPL's analysis of the potential environmental impacts of construction and operation of proposed Units 6 and 7.

1.1.1 Application and Review

The purpose of the FPL COL application is to obtain COLs to construct and operate two baseload nuclear power reactors. In addition to the COLs, FPL must obtain and maintain permits from other Federal, State, and local agencies and permitting authorities. The purpose of FPL's DA application is to meet the public's need for reliable increased electrical baseload generating capacity in FPL's service territory. Pursuant to the Clean Water Act (33 USC 1251 et seq.) (TN662), the Corps has jurisdiction over navigable waters, which are defined as waters of the United States (WOTUS) and the territorial seas. Pursuant to the Rivers and Harbors Act of 1899 (33 USC Section 40 et seq.) (TN660), the Corps has jurisdiction over navigable WOTUS. Throughout the rest of the document, WOTUS will be used to refer to both navigable waters, including certain wetlands, as defined by the Clean Water Act (33 USC 1251 et seq.)

(TN662) and navigable WOTUS as defined by the Rivers and Harbors Act of 1899 (33 USC Section 401 et seq.) (TN660).

Collectively, the NRC staff (including its contractor staff at Pacific Northwest National Laboratory and Information Systems Laboratory) and the USACE staff who reviewed the environmental aspects of the applications and supporting documentation and decided on impact levels are referred to as the "review team" throughout this EIS. The National Park Service participated in the environmental review as a cooperating agency by providing special expertise for the areas in and around the national parks (Biscayne and Everglades National Parks). Individual contributors to this EIS are listed in Appendix A.

1.1.1.1 NRC COL Application Review

FPL's ER focuses on the environmental effects of construction and operation of two Westinghouse Advanced Passive 1000 (AP1000) pressurized water reactors (FPL 2014-TN4058) at the proposed site. The NRC regulations setting standards for review of a COL application are listed in 10 CFR 52.81 (TN251). Detailed procedures for conducting the environmental portion of the review are listed in NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan* (NRC 2000-TN614) and recent updates. Additional guidance on conducting environmental reviews is provided in NRC Interim Staff Guidance COL/ESP-ISG-026 *Environmental Issues Associated with New Reactors* (NRC 2014-TN3767).

The FPL COL application references Revision 19 of the Westinghouse AP1000 reactor certified design (Westinghouse 2011-TN261), which is incorporated by reference into 10 CFR Part 52, Appendix D. Subpart B of 10 CFR Part 52 (TN251) states NRC regulations related to standard design certification. Revision 19 of the AP1000 design was published on December 30, 2011 (76 FR 82079) (TN248). The NRC staff reviews severe accident mitigation design alternatives in its review of an application for certification of a standard reactor design. Where appropriate, this EIS incorporates results of the review of Revision 19. (Additional information about design certification is discussed in Section 3.2.1).

In this EIS, the review team evaluates the environmental effects of the construction and operation of two Westinghouse AP1000 PWRs at the Turkey Point site, each with thermal power ratings of 3,415 MW(t). In addition to considering the environmental effects of the proposed action, this EIS addresses alternatives to the proposed action, including the no-action alternative and the building and operation of new reactors at alternative sites. The benefits of the proposed action (e.g., meeting an identified need for power) and measures and controls to limit adverse impacts are also evaluated. FPL's proposed action to construct and operate two new nuclear units includes requests for departures (FPL 2013-TN3083) from the AP1000 design certification under 10 CFR 52.93 (TN251). The environmental impacts of the requested departures are addressed in this EIS. The technical analysis for each design certification departure will be included in the NRC's Final Safety Evaluation Report, including a recommendation for approval or denial of each departure.

By letter dated September 4, 2009 (NRC 2009-TN1667), the NRC notified FPL that its application was accepted for docketing. Docket numbers 52-040 and 52-041 were established

for proposed Units 6 and 7, respectively. After acceptance of FPL's application, the NRC began the environmental review process by publishing in the *Federal Register* on June 15, 2010 a Notice of Intent to prepare an EIS and conduct scoping (75 FR 33851) (TN511). On July 15, 2010, the NRC held two public scoping meetings in Homestead, Florida, to obtain public input on the scope of the environmental review. The NRC staff also contacted Federal, State, Tribal, regional, and local agencies to solicit comments. A list of the agencies and organizations contacted is provided in Appendix B. Correspondence between NRC and the Federal, State, Tribal, regional, and local agencies is included in Appendix C. The NRC staff reviewed the comments received during scoping and responses were written for each comment. Comments within the scope of the NRC environmental review and their associated responses are included in Appendix D. A complete list of the scoping comments and responses is documented in the *Turkey Point Nuclear Plant Combined License Scoping Summary Report* (NRC 2010-TN515).

To gather information and to become familiar with the Turkey Point site, the entire review team visited the site in June 2010. During the June 2010 visit, the review team also conducted a site audit and met with FPL staff, Federal, Tribal, State and local officials, and members of the public. Members of the review team visited the Martin, Glades, Okeechobee 2, and St. Lucie alternative sites in July 2010. Documents related to the Turkey Point site and alternative sites were reviewed and are listed as references where appropriate.

To guide its assessment of the environmental impacts of the proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27) (TN428). Table B-1 of 10 CFR Part 51 (TN250), Subpart A, Appendix B, provides the following definitions of the three significance levels established by the NRC—SMALL, MODERATE, and LARGE:

> 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.

This EIS presents the review team's analysis, which considers and weighs the environmental impacts of the proposed action at the Turkey Point site, including the environmental impacts associated with constructing and operating proposed Units 6 and 7 at the site, the impacts of constructing and operating reactors at alternative sites, the environmental impacts of alternatives to granting the COLs, and the mitigation measures available for reducing or avoiding adverse environmental effects. This EIS also provides the NRC staff's preliminary recommendation to the Commission regarding the issuance of the COLs for proposed Units 6 and 7 at the Turkey Point site.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency (EPA) Notice of Availability of the draft EIS to allow members of the public to comment on the results of the environmental review. A public meeting will be held near the site

during the EIS comment period. This meeting will also provide an opportunity for the public to provide comments that may be considered in evaluating a proposed DA permit. During this public meeting, members of the review team will describe the results of the environmental review, provide members of the public with information to assist them in formulating comments about the EIS, and accept comments about the EIS. After the comment period, the review team will consider all comments and address them in the final EIS.

1.1.1.2 USACE Permit Application Review

The USACE is a cooperating agency with the NRC, which is serving as the lead agency in the development of this EIS. The USACE has participated as a member of the review team. In carrying out its regulatory responsibilities, the USACE will complete an independent evaluation of the applicant's DA permit application to determine whether to issue, deny, or issue with modifications a DA permit for this project. This decision will be documented in the USACE's Record of Decision (ROD). The decision whether to issue a DA permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended effect on the public interest. Evaluation of the probable impacts that the proposed activity may have on the public interest requires a careful weighing of all of the factors relevant in each particular case. A decision by the USACE to authorize this proposal, and if so, the conditions under which it will be allowed to occur, are therefore determined by the outcome of this general balancing process.

By acting as a cooperating agency on the development of the EIS, USACE plans to adopt the EIS in its ROD. USACE will also include any additional information and analyses required to support its decision to issue the DA permit, deny the DA permit, or issue the DA permit with modifications. The USACE's role as a cooperating agency in the preparation of this EIS is to ensure to the maximum extent practicable that the information presented is adequate to fulfill the requirements of USACE regulations. The Clean Water Act, Section 404(b)(1) "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (40 CFR Part 230) (TN427); hereafter 404(b)(1) Guidelines, contains the substantive environmental criteria used by the USACE in evaluating discharges of dredged or fill material into WOTUS. The USACE's Public Interest Review (PIR) (33 CFR Section 320.4) (TN424) directs the USACE to consider a number of factors as part of a balanced evaluation process in order to determine whether the proposed project is contrary to the public interest. The USACE's PIR will be part of its ROD and will not be addressed in this EIS. The following general criteria are considered in the evaluation of every application:

- the relative extent of the public and private need for the proposed structure or work;
- where there are unresolved conflicts about resource use, the practicability of using practicable and reasonable alternative locations and methods to accomplish the objective of the proposed structure or work; and
- the extent and permanence of the beneficial and/or detrimental effects that the proposed structure or work is likely to have on the public and private uses to which the area is suited.

As part of the USACE public comment process, USACE will publish a public notice within 30 days of the publication of the draft EIS, to solicit comments from the public regarding FPL's DA permit application for proposed work at the Turkey Point site.

1.1.2 Preconstruction Activities

In a final rule dated October 9, 2007, "Limited Work Authorizations (LWAs) for Nuclear Power Plants" (72 FR 57416) (TN260), the Commission limited the definition of "construction" to those activities within its regulatory purview in 10 CFR 51.4 (TN250). Many of the activities required to construct a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, erecting support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the review of a COL application, or after a COL is granted, or in some cases, concurrently with NRC-regulated construction. Although preconstruction activities are outside the NRC's regulatory authority, many of them are within the regulatory authority of local, State, or other Federal agencies.

Because the preconstruction activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. In addition, certain preconstruction activities that require permits from the USACE are considered to have direct effects related to its Federal permitting decision. Chapter 4 describes the relative magnitude of impacts related to construction and preconstruction activities.

1.1.3 Cooperating Agencies

NEPA lays the groundwork for coordination between the lead agency preparing an EIS and other Federal agencies that may provide special expertise regarding an environmental issue or jurisdiction by law. These other agencies, referred to as "cooperating agencies," are responsible for assisting the lead agency through early participation in the NEPA process, including scoping, by providing technical input to the environmental analysis and by making staff support available as needed by the lead agency. In addition to a license from the NRC, most proposed nuclear power plants require a permit from the USACE when impacts on WOTUS are proposed. Therefore, the NRC and the USACE concluded that the most effective and efficient use of Federal resources in the review of nuclear power projects would be achieved by a cooperative agreement. On September 12, 2008, the NRC and the USACE signed a Memorandum of Understanding (MOU) regarding the review of nuclear power plant license applications (USACE and NRC 2008-TN637). On November 25, 2009 the NRC formally requested that the USACE become a cooperating agency during the review of the combined license application at Turkey Point to construct proposed Units 6 and 7. Via letter correspondence dated December 10, 2009, the Corps agreed. Therefore, the Jacksonville District of the USACE is a cooperating agency as defined in 10 CFR 51.14 (TN250).

As described in the MOU, the NRC is the lead Federal agency, and the USACE is a cooperating agency in the development of the EIS for proposed Turkey Point Units 6 and 7. Under Federal

law, each agency has jurisdiction related to portions of the proposed project as major Federal actions that could significantly affect the quality of the human environment. The goal of this cooperative agreement is to develop one EIS that serves the needs of the NRC environmental review process and the USACE permit decision process. While both agencies must meet the requirements of NEPA, the NRC and the USACE have additional mission requirements that must be met. The NRC makes license decisions under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) (TN663), and the USACE makes permit decisions under Section 404 of the Clean Water Act (33 USC Section 1344) (TN427), and Sections 10 and 14 of the Rivers and Harbors Act of 1899 (33 USC Sections 403 and 408) (TN660). The USACE is cooperating with the NRC to ensure that the information presented in the NEPA documentation is adequate to fulfill the requirements of USACE regulations (33 CFR Parts 320–332) (TN4127), the PIR process (33 CFR Section 320.4) (TN424), and the 404(b)(1) Guidelines (40 CFR Part 230) (TN427), which contain the substantive environmental criteria used by the USACE in evaluating discharges of dredged or fill material into WOTUS.

As a cooperating agency, the USACE is part of the NRC review team and is involved in all aspects of the environmental review, including scoping, public meetings, public comment resolution, and EIS preparation. Environmental issues are evaluated using the three-level standard of significance—SMALL, MODERATE, or LARGE—developed by the NRC using guidelines from the Council on Environmental Quality (CEQ) (40 CFR 1508.27) (TN428). However, for permit decisions under Section 404 of the Clean Water Act (33 USCE Section 1344) (TN427), the USACE can only permit the least environmentally damaging practicable alternative and a project that is not contrary to the public interest. This EIS is intended to provide information to support the USACE permitting decision, as will be documented in the USACE's ROD. However, it is possible that the USACE will need additional information from the applicant to complete the permit review; for example, information that the applicant could not make available by the time the final EIS is issued. Also, any conditions required by USACE, such as implementation of additional mitigative measures, would be required by a DA permit if issued by the USACE.

On July 1, 2013 the National Park Service (NPS) signed the Memorandum of Agreement and became a cooperating agency for the proposed Turkey Point Units 6 and 7 COL application environmental review (NRC 2013-TN2518). According to the Memorandum of Agreement, the NPS has "special expertise regarding the environment in and around its national parks." Specifically, the NPS has special expertise regarding impacts to park resources and the experience of park visitors at Biscayne National Park, which is located adjacent to the Turkey Point facility. In addition, the NPS has special expertise regarding impacts to park resources and the experience of park visitors from cumulative impacts associated with FPL's proposed western power line corridor near, or potentially through, Everglades National Park. The NPS is preparing a separate EIS to evaluate options and potential impacts for acquiring lands owned by FPL within the East Everglades Expansion Area of Everglades National Park.

The NPS has firm and clear mandates from Congress regarding its mission. The NPS Organic Act of 1916 requires the NPS "…to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." Congress reaffirmed the NPS's conservation mandate by amending the Organic Act in 1978. That

amendment, known as the "Redwood Amendment," states that the "authorization of activities…shall not be exercised in derogation of the values and purposes for which these various areas have been established."

On March 11, 2011, the NRC formally requested the NPS become a cooperating agency for the proposed Turkey Point Units 6 and 7 COL application environmental review. Via letter correspondence dated April 22, 2011, the NPS agreed. Therefore, the NPS's Southeastern Regional Office, which includes Biscayne National Park and Everglades National Park, is a cooperating agency as defined in 10 CFR 51.14 (TN250). The NPS does not have any specific regulatory actions pending before it in regard to the proposed Units 6 and 7 at this time. However as a cooperating agency, the NPS did provide input into the NRC impact analysis based on the special expertise described previously. Due to this unique set of circumstances, impact determinations made in this EIS should not be attributed to NPS, but only to the NRC and USACE (also referred to as the review team). The NPS's participation in preparing this EIS does not imply NPS concurrence and was primarily centered on data gathering and information sharing regarding the environment in and around the applicable national parks. The NPS role in regard to this EIS is described in a Memorandum of Agreement between the NRC, USACE, and NPS (NRC 2013-TN2518).

1.1.4 Concurrent NRC Reviews

In a review that is separate but parallel to the EIS process, the NRC staff analyzes the safety aspects of the COL application, including, among other things, the characteristics of the proposed site and emergency planning information. These analyses are documented in a Safety Evaluation Report (SER) issued by NRC. The SER presents the conclusions reached by NRC regarding (1) whether the COL application for Turkey Point meets the applicable requirements in NRC regulations, including among others 10 CFR Part 50 (TN249), 10 CFR Part 52 (TN251), 10 CFR Part 73 (TN423), and 10 CFR Part 100 (TN282); and (2) whether there is reasonable assurance that two AP1000 reactors can be constructed and operated at the Turkey Point site without undue risk to the health and safety of the public. The final SER for the Turkey Point COL application is expected to be published in October 2016 (NRC 2014-TN4161).

The reactor design referenced in FPL's COL application for Turkey Point Units 6 and 7 is Revision 19 of the AP1000 certified design (Westinghouse 2011-TN261), which is incorporated by reference into 10 CFR Part 52, Appendix D. Subpart B of 10 CFR Part 52 (TN251) states NRC regulations related to standard design certification. The final rulemaking certifying the AP1000 standard design, as described in Revision 19 of the AP1000 FSAR was published on December 30, 2011 (76 FR 82079) (TN248). The NRC staff reviewed AP1000 severe accident mitigation design alternatives (SAMDAs) in its review of the application for certification of the AP1000 standard reactor design, and published an Environmental Assessment (EA) on those SAMDAs in connection with the final rulemaking certifying the design (76 FR 82079, 71 FR 4464) (TN248); Where appropriate, this EIS incorporates results of the review of Revision 19.

This EIS provides the NRC and USACE analyses of the environmental impacts that could result from building and operating the two proposed units at the Turkey Point site or at one of the four alternative sites. These impacts are analyzed by the review team to determine whether the

proposed site is suitable for the two units and whether any of the alternative sites are considered to be obviously superior to the proposed site.

1.2 The Proposed Federal Actions

The proposed NRC Federal action is issuance, under the provisions of 10 CFR Part 52 (TN251), of COLs that would authorize the construction and operation of two new Westinghouse AP1000 reactors at the Turkey Point site. This EIS provides the NRC staff's analyses of the environmental impacts that could result from building and operating the two proposed units at the Turkey Point site or at one of the four alternative sites. These impacts are analyzed by the NRC to determine whether the proposed site is suitable for the two units and whether any of the alternative sites are considered to be obviously superior to the proposed site. The proposed USACE Federal action is the decision whether to issue, issue with modifications, or deny a DA permit pursuant to the requirements in Section 404 of the Clean Water Act (33 USC Section 1344) (TN427) and Sections 10 of the Rivers and Harbors Act of 1899 (33 USC Sections 403and 408) (TN660) to authorize certain activities potentially affecting WOTUS based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activities on the public interest. If issued, the USACE permit would authorize the impact on WOTUS, including wetlands, for the construction of the Turkey Point electrical generation facility, and various associated, integral project components, including electrical transmission lines and substations, access roads, expansion of an existing barge slip, a pretreatment facility, and reclaimed wastewater and potable water pipelines. The barge slip, radial collector well makeup-water−intake structures, and some portions of the pipelines or transmission lines would be located in, over, or under navigable WOTUS.

1.3 The Purpose and Need for the Proposed Actions

The continued growth of residential and commercial development in Florida has created an increased demand for electrical power. The purpose and need of the NRC proposed action—NRC authorization of the construction and operation of two AP1000 units at the Turkey Point site—is to provide additional baseload electrical generation capacity for use in the FPL service territory. The need for additional baseload power is discussed in Chapter 8 of this EIS.

The Atomic Energy Act of 1954, as amended (Act), prohibits construction and operation of proposed Units 6 and 7 without licenses from the NRC, which, in this case would be two COLs. Preconstruction and certain long lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, however, may begin before the COLs are granted. FPL must obtain and maintain permits or authorizations from other Federal, State, and local agencies and permitting authorities prior to undertaking some of these activities. The ultimate decision whether or not to build the new units and the schedule for building are not within the purview of the NRC or the USACE and would be determined by the license holder if the authorizations are granted.

Pursuant to the 404(b)(1) Guidelines (40 CFR Part 230) (TN427), the USACE determines both a basic and an overall project purpose. Defining the basic project purpose enables the USACE to determine whether the activity is water-dependent (40 CFR Section 230.10(a)(3)) (TN427). The

overall project purpose is used to identify and evaluate practicable alternatives (40 CFR Section 230.10(a)(2)) (TN427).

For this project, the USACE has determined the following purpose and need statements:

- Basic Purpose – To meet the public's need for electric energy.
- Overall Purpose – To meet the public's need for reliable increased electrical baseload generating capacity in FPL's service territory.

For the USACE's NEPA review, the overall project purpose is consistent with that stated above in this section for the purpose and need for the proposed NRC action.

1.4 Alternatives to the Proposed Actions

Section 102(2)(C)(iii) of NEPA (42 USC 4321 et seq.) (TN661) states that EISs are to include a detailed statement analyzing alternatives to the proposed action. The NRC regulations for implementing Section 102(2) of NEPA provide for including in an EIS a chapter that discusses the environmental impacts of the proposed action and the alternatives (10 CFR Part 51) (TN250), Subpart A, Appendix A). Chapter 9 of this EIS addresses the following five categories of alternatives to the proposed action: (1) the no-action alternative, (2) energy source alternatives, (3) alternative sites, (4) system design alternatives, and (5) onsite alternatives to reduce impacts on natural and cultural resources.

In the no-action alternative, the proposed action would not proceed. The NRC could deny FPL's request for the COLs. If the request was denied, construction and operation of two new units at the Turkey Point site would not occur and any benefits intended by the approved COLs would not be realized. Energy source alternatives focus on alternatives that could generate baseload power. The alternative site selection process to determine alternate site locations for comparison with the Turkey Point site is addressed below. System design alternatives include heat-dissipation and circulating-water systems, intake and discharge structures, and water-use and water-treatment systems.

In its ER (FPL 2014-TN4058), FPL defines a region of interest for use in identifying and evaluating potential sites for power generation. Using this process, FPL reviewed multiple sites and identified 23 candidate sites for this project from which the alternative sites were selected. The review team evaluated the region of interest, the process by which alternative sites were selected, and the environmental impacts of construction and operation of new power reactors at those sites using reconnaissance-level information in accordance with ESRP 9.3 (NRC 2000-TN614). Reconnaissance-level information is data that are readily available from agencies and other public sources and also can include information obtained through visits to the site area. The alternative sites include two owned by FPL and two others. The FPL-owned sites are the Martin site, on which five fossil-fired power plants currently exist and which is located in Martin County, Florida, and the St. Lucie site, on which a nuclear power-generating station currently exists and which is located on Hutchinson Island in St. Lucie County, Florida. The other sites include the Glades site, an agricultural site in the southwestern region of Glades County, Florida, and the Okeechobee 2 site, an undeveloped site in Okeechobee County, Florida

(FPL 2014-TN4058). The objective of the comparison of environmental impacts is to determine whether any alternative site is obviously superior to the preferred the Turkey Point site.

In evaluating permit applications pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 USC Section 403) (TN660) and Section 404 of the Clean Water Act (33 USC Section 1344) (TN427), the USACE is required to consider alternatives in the context of the applicant's purpose and need for the project, as well as the purpose and need from a public interest perspective. The USACE is required by regulation to apply the criteria set forth in the 404(b)(1) Guidelines (40 CFR Part 230) (TN427). These guidelines establish criteria that must be met for the proposed activities to be permitted pursuant to Section 404. These guidelines state, in part, that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem provided the alternative does not have other significant adverse consequences (40 CFR Section 230.10(a)) (TN427).

In evaluating permit applications under Section 10 of the Rivers and Harbors Act of 1899 (33 USC Section 403) (TN660), the USACE is primarily concerned with obstructions to navigation in navigable WOTUS. USACE must also determine whether the proposed project is contrary to the public interest (33 CFR Section 320.4).

The USACE must also determine whether to grant approval pursuant to Section 14 of the Rivers and Harbors Act (33 USC Section 408) (Section 408) (TN660). Any proposed action that modifies, alters, or is built upon or adjacent to a Federal project may require authorization pursuant to Section 408, including any proposed action that modifies, alters, or is constructed within a Federal project right-of-way; any proposed structures within 62.5 of a Federal navigation project; any proposed degradation, relocation, penetration, or work under a Corps levee, dike, dam, or water retaining structure; and any proposed work within 15 ft of the toe of a Corps levee, 15 ft of a Federal canal top of bank, or within 50 ft of a Corps dam requires coordination under Section 408. The portions of the proposed project that may fall under this coordination process include potential impacts to the L-31N and L-31E levees, and transmission lines crossing under the Miami River and/or canals in Miami-Dade County.

1.5 Compliance and Consultations

Before building and operating new units, FPL is required to obtain certain Federal, State, and local environmental permits, as well as meet applicable statutory and regulatory requirements. In its ER (FPL 2014-TN4058), FPL provided a list of environmental approvals and consultations associated with proposed Turkey Point Units 6 and 7. Potential authorizations, permits, and certifications relevant to the proposed COLs are included in Appendix H. In the development of this EIS, the NRC contacted the appropriate Federal, State, Tribal, and local agencies to identify any consultation, compliance, permit, or significant environmental issues of concern to the reviewing agencies that may affect the acceptability of the Turkey Point site for building and operating the two proposed AP1000 units. A chronology of the correspondence is provided in Appendix C. A list of the key consultation correspondence is provided in Appendix F, which also contains biological assessments and an essential fish habitat assessment.

1.6 Report Contents

Subsequent chapters of this EIS are organized as follows: Chapter 2 describes the proposed site and discusses the environment that would be affected by building and operating the proposed nuclear reactor units. Chapter 3 describes the power plant layout, structures, and activities related to building and operation that are used as the basis for evaluating the environmental impacts. Chapters 4 and 5 separately examine the respective environmental impacts of building and operating the proposed nuclear reactor units. Chapter 6 analyzes the environmental impacts of the uranium fuel cycle, transportation of radioactive materials, and decommissioning. Chapter 7 examines the cumulative impacts of the proposed action as defined in 40 CFR Part 1508 (TN428). Chapter 8 addresses the need for power. Chapter 9 discusses alternatives to the proposed action; analyzes alternative energy sources, sites and system designs; and compares the proposed action with these alternatives. Chapter 10 summarizes the findings of the preceding chapters and provides a benefit-cost evaluation; it also presents the NRC staff's preliminary recommendation with respect to the Commission's decision regarding the proposed site for COLs based on the evaluation of environmental impacts.

The appendices to the EIS provide the following additional information:

- Appendix A – Contributors to the Environmental Impact Statement
- Appendix B – Organizations Contacted
- Appendix C – NRC and USACE Environmental Review Correspondence
- Appendix D – Scoping Comments and Responses
- Appendix E – Draft Environmental Impact Statement Comments and Responses (Reserved)
- Appendix F – Key Consultation Correspondence
- Appendix G – Supporting Documentation
- Appendix H – Authorizations, Permits, and Certifications
- Appendix I – The Effect of Climate Change on the Evaluation of Environmental Impacts
- Appendix J – Carbon Dioxide Footprint Estimates for a 1,000 MW(e) Reference Reactor

References for sources cited in the narrative are located at the end of each volume of this EIS. Appendix references are found in the final sections of the applicable appendices.

2.0 Affected Environment

The site proposed by Florida Power and Light Company (FPL) for two combined construction permits and operating licenses (combined licenses or COLs) and a Department of the Army permit is located in southeast Miami-Dade County, Florida. The proposed Turkey Point Nuclear Power Plant (Turkey Point) site is owned by FPL, and currently includes five other power plants on the site. Units 1 and 2 have been operated as natural-gas/oil steam-generating units. Unit 2 was recently converted to operate in synchronous condenser mode. Unit 1 will be converted to operate in synchronous condenser mode in 2016 (FPL 2013-TN2630). In the synchronous condenser mode, the generators help stabilize and optimize grid performance but do not generate power. Units 3 and 4 are nuclear pressurized water reactors, and Unit 5 is a natural-gas combined-cycle steam-generating unit (FPL 2014-TN4058). The location of proposed Turkey Point Units 6 and 7 is described in Section 2.1 followed by descriptions of the land, water, ecology, socioeconomics, environmental justice, historic and cultural resources, geology, meteorology and air quality, nonradiological health, and the radiological environment of the site presented in Sections 2.2 through 2.11, respectively. Section 2.12 examines related Federal projects and consultations.

2.1 Site Location

The geographic position of proposed Turkey Point Units 6 and 7 in relationship to the counties, cities, and towns within a 50 mi radius is shown in Figure 2-1. Figure 2-2 shows additional details within a 6 mi radius of the proposed units. The power blocks and most support facilities for proposed Units 6 and 7 would be built on a 218 ac plant area surrounded by man-made cooling canals (referred to from here on as the plant area) situated within the approximately 9,640 ac Turkey Point site (FPL 2014-TN4058). Other project-related facilities would be built on the Turkey Point site. The total area of these facilities, with the exception of the portions of the transmission lines located on the Turkey Point site, is referred to as the project area. The location of proposed Units 6 and 7 within the Turkey Point site and in relation to the existing units is shown in Figure 2-2.

The Turkey Point site is located on the southeastern coast of Florida in unincorporated southeast Miami-Dade County. The site borders Biscayne Bay and Card Sound and is approximately 25 mi south of Miami (as measured from the center point between the proposed Unit 6 and 7 power blocks). Homestead and Florida City are the closest incorporated communities. Florida City is 8 mi west of the site and the municipal limits of Homestead are 4.5 mi west of the site. Homestead is also the location of the Homestead Bayfront Park and the Homestead Air Reserve Base.

The location for the proposed Units 6 and 7 is within portions of Sections 33 and 34 of Township 58S Range 40E (FPL 2014-TN4058). The coordinates for the proposed Units 6 and 7 containment buildings are listed in Table 2-1.

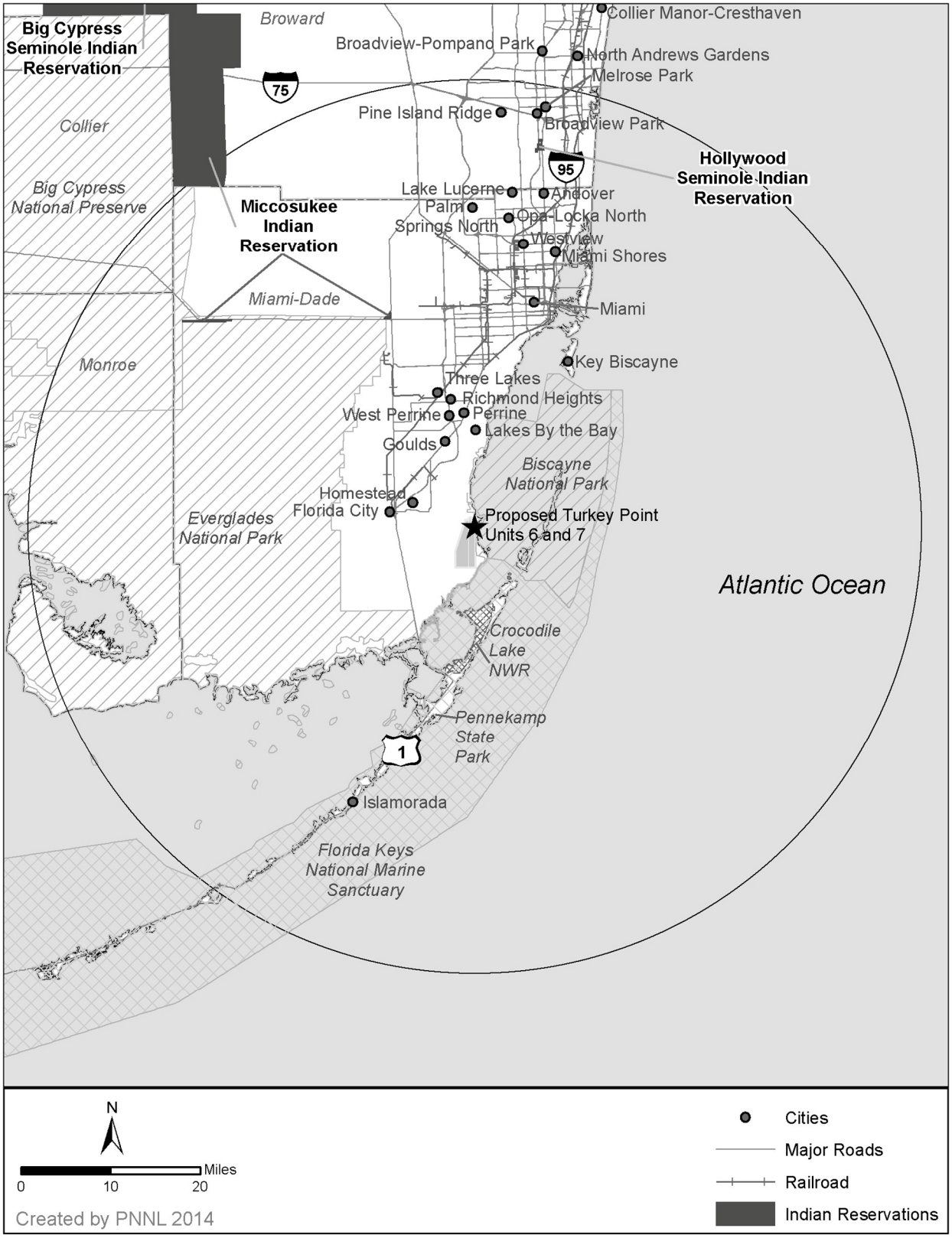


Figure 2-1. Proposed Units 6 and 7 Plant Area and 50-Mile Region

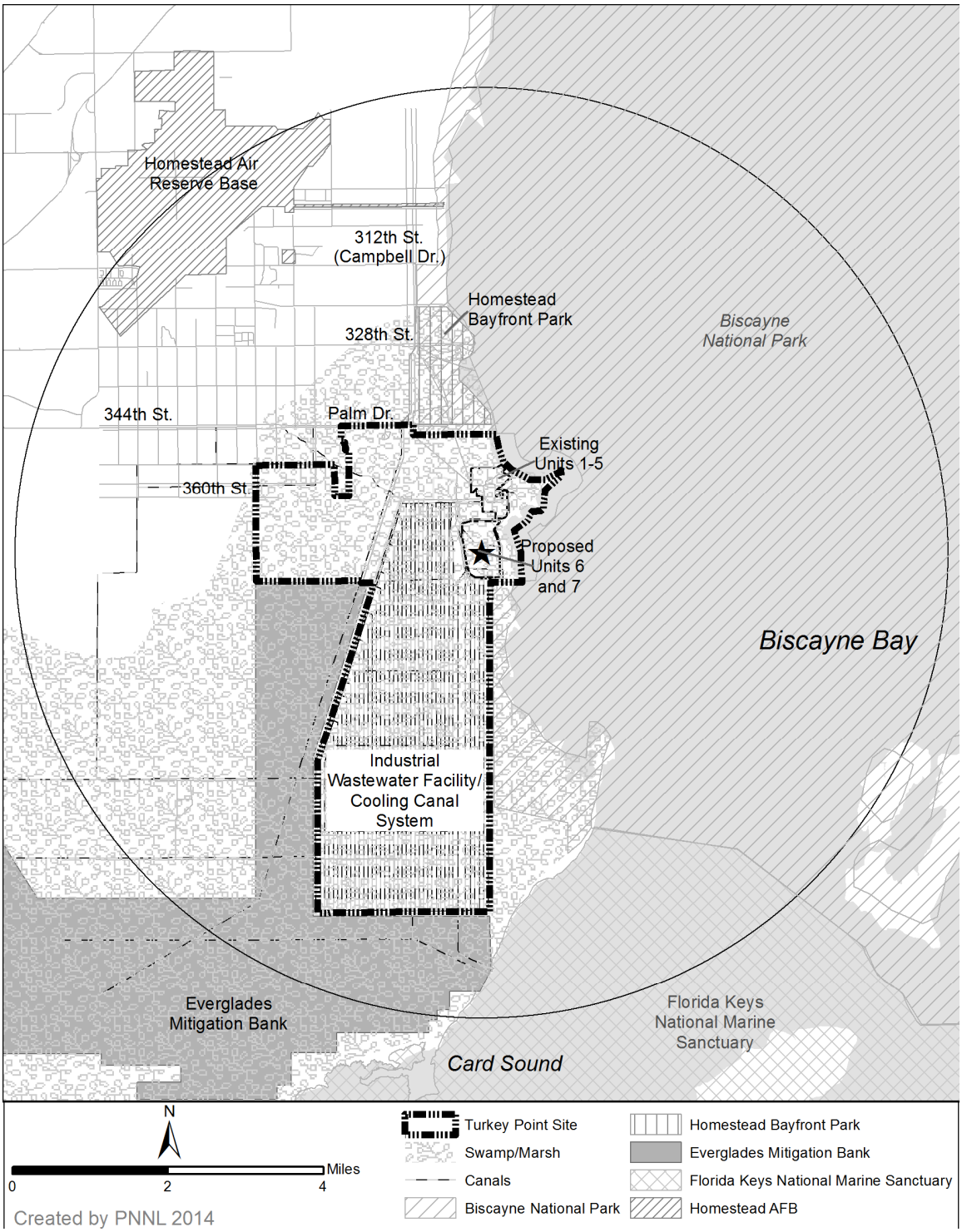


Figure 2-2. Proposed Units 6 and 7 Plant Area and 6-Mile Vicinity

Table 2-1. Proposed Coordinates for the Units 6 and 7 Containment Buildings

Coordinate System	Unit	Coordinates	
Geographic, Decimal Degrees, North American Datum of 1983 (NAD83) (NOAA 1986-TN1163)	Unit 6	25.424186 N	-80.331961 W
	Unit 7	25.424186 N	-80.334536 W
Universal Transverse Mercator Zone 17, Meters, NAD83	Unit 6	2812086.79	N 567179.31 E
	Unit 7	2812086.79	N 566920.31 E
Florida State Plane East, U.S. Feet, NAD83	Unit 6	396968	N 876646 E
	Unit 7	396968	N 875796 E

Source: FPL 2014-TN4058

2.2 Land Use

This section discusses existing land uses on and in the vicinity of the Turkey Point site, as well as in the region. Section 2.2.1 describes the site and vicinity (i.e., the area encompassed within a radius of 6 mi of the plant area, measured from the center point between proposed Units 6 and 7). Section 2.2.2 discusses land use within the existing and proposed transmission line corridors. Section 2.2.3 discusses land use in the region, defined as the area within 50 mi of the plant area, also as measured from the center point between proposed Units 6 and 7.

2.2.1 The Site and Vicinity

As shown in Figure 2-2 and Figure 2-3, the proposed Units 6 and 7 plant area would be located on an island of land surrounded by existing canals. The plant area is adjacent to waters that are part of Biscayne National Park and approximately 2 mi south of the Biscayne National Park Visitors Center. The site is within 3 mi of the Model Lands Basin, a South Florida Water Management District (SFWMD) conservation area. A portion of the Biscayne Bay Aquatic Preserve is located adjacent to the coastal boundary of the Turkey Point site. The Homestead Bayfront Park, a city park, is approximately 1.5 mi north of the proposed Units 6 and 7 plant area. The SFWMD L-31E Canal runs along Biscayne Bay past the Turkey Point site. The site is also located just east of the 13,000 ac Everglades Mitigation Bank (EMB)—an FPL-owned and operated wetland restoration project.

2.2.1.1 Mineral Resources

No oil or gas wells or mines are located within the Turkey Point site boundaries. The most important mineral resource in the vicinity is limestone (USGS 2004-TN678). Limestone is found at or near the land surface throughout the vicinity and is used as a base material for roads and airport runways, as construction aggregate, and in the manufacture of cement (USGS 2004-TN678). Other minerals are not commercially mined in the area (USGS 2004-TN680).

FPL states that it owns the land contained within the Turkey Point site, subject to certain encumbrances (FPL 2014-TN4058). Specifically, the Trustees of the Internal Improvement Fund of the State of Florida hold canal, drainage, reclamation, oil, gas, and mineral rights reservations, and Miami-Dade County holds a canal reservation (FPL 2014-TN4058).

Figure 2-3. Oblique Aerial Photograph of the Proposed Units 6 and 7 Plant Area and Surrounding Area (Adapted from FPL 2014-TN4058)

2.2.1.2 Nearby Population Centers, Schools, and Hospitals

Figure 2-2 provides a map of the vicinity within 6 mi of the plant area. The City of Homestead, in Miami-Dade County, is the nearest population center to the proposed plant site. Other land uses nearby that attract substantial numbers of people include the Homestead/Miami Speedway 5 mi to the northwest and Homestead Air Reserve Base, which contains both civilian and military operations, 4.5 mi northwest. The nearest public school is the Keys Gate Charter School, which is approximately 6 mi away. No hospitals or prisons are located within 6 mi of the proposed Units 6 and 7 project area.

2.2.1.3 Rail and Ports

There are no ports or rail systems located within 6 mi of the Turkey Point site. Biscayne Bay, which lies directly east of the site, is the nearest navigable waterway.

2.2.1.4 Comprehensive Plans and Zoning

Florida's growth management system includes an adopted State Comprehensive Plan (Fla. Stat. 8-187 2011-TN1503) and requirements for regional planning councils to prepare and adopt comprehensive regional policy plans consistent with that plan. The South Florida Regional Planning Council (SFRPC), which includes Miami-Dade, Broward, and Monroe Counties, has adopted the *Strategic Regional Policy Plan for South Florida* (SFRPC 2004-TN1151), the policy

document that guides all of the SFRPC's activities (Local Government Comprehensive Planning and Land Development Regulation Act) (Fla. Stat. 11-163.3164-TN1240).

Florida also requires counties and municipalities to adopt local government comprehensive plans that guide future growth and development. The comprehensive plans must contain chapters or "elements" that address future land use, housing, transportation, infrastructure, coastal management, conservation, recreation and open space, intergovernmental coordination, and capital improvements. State law (Fla. Stat. 8-187 2011-TN1503) requires that facilities be constructed and services be provided so as to be available concurrent with demand and the impacts of development. Local comprehensive plans must identify specific level-of-service standards for traffic, mass transit, parks, water, sewer, solid waste, and drainage. No development orders can be issued in accordance with State law, if they would cause adopted levels of service to not be met. Local plans, the applicable regional plan, and the State Comprehensive Plan are required by State law to be mutually consistent, and all development regulations and orders must be consistent with the adopted local comprehensive plan.

The Turkey Point site is within the area covered by the Miami-Dade County Comprehensive Development Master Plan (CDMP; Miami-Dade County 2012-TN1150). The CDMP addresses both incorporated and unincorporated areas but focuses land-use regulation on unincorporated areas. Local municipalities' own comprehensive plans address land use in the incorporated areas. According to the CDMP, nearly 500 mi^2 of the more than 2,000 mi^2 of land in Miami-Dade County have already been developed for urban uses. The land-use diagram in the CDMP identifies recommended future land uses by major categories, each of which is interpreted locally through compatible zoning designations.

The Miami-Dade County CDMP designates the Turkey Point site as Environmental Protection Subarea F (Coastal Wetlands and Hammocks). These areas are low-lying, flood-prone, and characterized predominantly by coastal wetland communities. Electrical generation and transmission facilities are permitted uses under this designation.

The Miami-Dade County zoning for the location of existing Units 1−5, I U-3, Industrial District, Unlimited Manufacturing, allows a full range of institutions, communications, and utilities. The proposed Units 6 and 7 plant area is zoned as Interim Use District (GU) (Miami-Dade Code of Ordinances 33-196-TN1241). The Interim Use (GU) District is applied countywide and used for areas where there is predominately one classification of use (Miami-Dade Code of Ordinances 33-196-TN1241). Nuclear reactors are a permitted use in this district with the approval of an Unusual Use application by Miami-Dade County, as described below (Miami-Dade County 2012-TN1150).

In 2007, Miami-Dade County approved an Unusual Use application submitted by FPL to build two new nuclear power plants and associated facilities. The approval was issued by the Miami-Dade County Board of County Commissioners as Resolution Z-56-07 (Miami-Dade County 2007-TN1085) and included specific conditions of approval for environmental protection.

The Turkey Point site is within the Florida coastal zone (Fla. Stat. 28-380-TN1147). The U.S. Nuclear Regulatory Commission (NRC) has issued guidance (NRC 2009-TN1242) regarding compliance with the Federal Coastal Zone Management Act (16 USC 1451 et seq.) (TN1243).

This guidance acknowledges that Florida has an approved Coastal Management Program (Fla. Stat. 28-380-TN1147). Activities of Federal agencies, including issuing licenses or permits, that are reasonably likely to affect coastal zones are required to be consistent with the approved Coastal Zone Management Plan (CZMP) of the State or territory to the maximum extent practical (16 USC 1451 et seq.) (TN1243). Applicants for Federal licenses that are likely to affect a State's coastal zone must document the consistency of planned Federal agency activities with the State's or territory's CZMP in a Federal consistency certification, which must be submitted to the State or Federal licensing agency.

2.2.1.5 Site Access

Existing public access to the Turkey Point site is provided via SW 344th Street/Palm Drive. Existing barge access to the site is provided by a channel across Biscayne Bay for the delivery of heavy equipment and fuel oil (FPL 2014-TN4058).

2.2.1.6 Existing Land Uses on the Turkey Point Site and in the Vicinity

This section describes the existing land uses on the site, focusing on areas that would be occupied by the proposed new Units 6 and 7 facilities (i.e., the project area, including the plant area), and in the vicinity of the site.

Land-Use/Land-Cover Data

Table 2-2 and Table 2-3 identify the current Florida Land Use, Cover, and Forms Classification System (FLUCFCS) land-use/land-cover classifications within the Turkey Point site and vicinity as provided by FPL (2014-TN4058). The classification data were generated as part of the Land Cover/Land Use 2004/5 Mapping Update Project by the SFWMD (FPL 2014-TN4058).

Developed land on the Turkey Point site is used for power generation and supporting facilities and activities, including environmental mitigation and compensation activities required as conditions of ongoing permits associated with existing power generation facilities. The Turkey Point site presently includes two natural-gas/oil steam electric generating units (Units 1 and 2), two pressurized water reactor nuclear units (Units 3 and 4), and one natural-gas combined-cycle steam electric generating unit (Unit 5). As proposed, Units 6 and 7 would be built in an area south of Units 1 through 5 (Figure 2-2) that is previously undeveloped (Figure 2-4). The industrial wastewater facility (IWF), located south and southwest of the existing power-generation units, comprises approximately 5,900 ac of cooling canals (Figure 2-2).

Land surrounding the Turkey Point site consists mostly of undeveloped land and protected natural areas; some agricultural lands lie to the west and northwest (Figure 2-4) (FPL 2014-TN4058). Most nearby land in the area outside of Turkey Point site is undeveloped or in agriculture. On the Turkey Point site, most areas adjacent to the proposed Units 6 and 7 plant area are currently undeveloped land. Other land near the plant area is used for the existing generating units and associated infrastructure.

Table 2-2. Major Land-Use Acreages on the Turkey Point Site (FPL 2014-TN4058)

Level 3	FLUCFCS Land-Use Category	Acres
140	Commercial and Services	13.77
422	Brazilian Pepper	26.29
437	Australian Pines	2.35
510	Streams and Waterways/Canals	256.57
511	Ditches	9.34
512	Channelized River, Stream, Waterway/Canals	40.48
530	Reservoirs	12.54
531	Reservoirs Larger than 500 Acres (202 Hectares)	12.83
534	Reservoirs Less than 10 Acres (4 Hectares) which Are Dominant Features	13.59
541	Embayments Opening Directly into the Gulf of Mexico or the Atlantic Ocean	166.06
542	Embayments Not Opening Directly into the Gulf of Mexico or the Atlantic Ocean	<0.01
543	Enclosed Saltwater Ponds within a Salt Marsh	0.78
612	Mangrove Swamps	310.94
612-A	Mangrove Heads	12.20
612-B	Dwarf Mangroves	113.29
612-B/6411	Dwarf Mangroves/Sawgrass	42.87
617	Mixed Wetland Hardwoods	324.61
617-P	Mixed Wetland Hardwoods Planted	0.48
619	Exotic Wetland Hardwoods	12.81
619-AP	Exotic Wetland Hardwoods-Australian Pine	0.58
641	Freshwater Marshes	1,490.53
6411	Sawgrass Marsh	14.03
642	Saltwater Marshes	12.28
643	Wet Prairies	6.29
650	Non-Vegetated	216.35
651	Tidal Flats	149.26
740	Disturbed Land	27.74
743	Spoil Areas	61.98
743-WET	Wetland Spoils Areas	9.12
744	Fill Areas <Highways-Railways>	393.96
814	Roads And Highways	23.12
831	Electric Power Facilities	5,682.84
832	Electrical Power Transmission Lines	0.08
	Total[(a)]	**9,459.94**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2-3. Major Land-Use Acreages Within the 6-Mile Vicinity

Level 3	FLUCFCS Land-Use Category	Acres	% of Total
110	Residential, Low Density <Less Than Two Dwelling Units per Acre>	1.73	<0.01
133	Multiple Dwelling Units, Low Rise <Two Stories or Less>	45.92	0.07
140	Commercial and Services	13.88	0.02
155	Other Light Industrial	6.40	0.01
170	Institutional	8.45	0.01
173	Military	110.56	0.18
183	Race Tracks	513.45	0.82
185	Parks And Zoos	36.04	0.06
187	Stadiums <Those Facilities not Associated with High Schools, Colleges or Universities>	3.68	0.01

Table 2-3. (contd)

Level 3	FLUCFCS Land-Use Category	Acres	% of Total
190	Open Land	7.76	0.01
214	Row Crops	616.75	0.98
215	Field Crops	176.18	0.28
221	Citrus Groves	13.90	0.02
222	Fruit Orchards	39.17	0.06
241	Tree Nurseries	1,961.41	3.12
243	Ornamentals	39.47	0.06
261	Fallow Crop Land	10.58	0.02
320	Shrub and Brushland	1,100.42	1.75
420	Upland Hardwood Forests	24.63	0.04
422	Brazilian Pepper	2,181.43	3.47
434	Hardwood − Coniferous Mixed	26.95	0.04
437	Australian Pines	15.85	0.03
510	Streams and Waterways	301.87	0.48
511	Ditches	19.42	0.03
512	Channelized River, Stream, Waterway	298.38	0.47
520	Lakes	29.73	0.05
530	Reservoirs	85.62	0.14
531	Reservoirs Larger Than 500 Acres (202 Hectares)	12.83	0.02
534	Reservoirs Less Than 10 Acres (4 Hectares) which Are Dominant Features	13.59	0.02
542	Embayments not Opening Directly into the Gulf of Mexico or the Atlantic Ocean	24,412.85	38.79
543	Enclosed Saltwater Ponds Within a Salt Marsh	870.59	1.38
611	Bay Swamps	115.66	0.18
612	Mangrove Swamps	3,343.7	5.31
612/618	Mangrove Swamps/Exotic Wetland Hardwoods	1.85	<0.01
612/618	Mangrove Swamps/Willow and Elderberry	<0.01	<0.01
612-A	Mangrove Heads	12.20	0.02
612/619	Mangrove Swamps/Exotic Wetland Hardwoods	3.12	<0.01
612-B	Dwarf Mangroves	113.29	0.25
612-B/6411	Dwarf Mangroves/Sawgrass	42.87	
617	Mixed Wetland Hardwoods	4,022.29	6.39
617/641	Mixed Wetland Hardwoods/Freshwater Marshes	16.93	0.03
617-P	Mixed Wetland Hardwoods Planted	0.48	<0.01
619	Exotic Wetland Hardwoods	45.08	0.07
619/631	Exotic Wetland Hardwoods/Wetland Scrub	30.71	0.05
619-AP	Exotic Wetland Hardwoods-Australian Pine	0.58	<0.01
625	Hydric Pine Flatwoods	83.61	0.13
630	Wetland Forested Mixed	552.64	0.88
631	Wetland Shrub	4.42	0.01
641	Freshwater Marshes	11,246.07	17.87
6411	Sawgrass Marsh	14.03	0.02
642	Saltwater Marshes	35.20	0.06
643	Wet Prairies	1,129.69	1.79
650	Non-Vegetated Wetlands	393.92	0.63

Table 2-3. (contd)

Level 3	FLUCFCS Land-Use Category	Acres	% of Total
651	Tidal Flats	1,128.20	1.79
740	Disturbed Land	120.85	0.19
743	Spoil Areas	61.98	0.10
743-WET	Wetland Spoils Areas	9.12	0.01
744	Fill Areas <Highways-Railways>	516.92	0.82
811	Airports	1,067.36	1.70
814	Roads and Highways	103.49	0.16
831	Electric Power Facilities	5,725.28	9.10
832	Electrical Power Transmission Lines	0.08	<0.01
	Total[(a)]	**62,941.15**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Source: Adapted from FPL 2014-TN4058, Table 2.2-2.

The FPL Turkey Point site is adjacent to Biscayne Bay and the Intracoastal Waterway, a 3,000 mi waterway along the Atlantic and Gulf Coasts of the United States. Portions of the coastline consist of natural inlets, saltwater rivers, bays, and sounds. Other portions include man-made canals. The City of Homestead is located 4.5 mi west of Turkey Point site (Figure 2-1).

Residential Uses

No residences are located adjacent to the Turkey Point site. The closest residence is approximately 2.7 mi from the proposed Units 6 and 7 plant area (FPL 2014-TN4058).

Parks and Preserves

Parks and preserves in the vicinity include a State-managed aquatic preserve, a wetlands habitat preserve, two national parks, and a national wildlife refuge, as described below.

Biscayne Bay Aquatic Preserve

Biscayne Bay Aquatic Preserve consists of approximately 67,000 ac of submerged State land that has been designated as an Outstanding Florida Water, Class III, and is managed by the Florida Department of Environmental Protection (FDEP), Office of Coastal and Aquatic Managed Areas. Activities at the preserve include recreational and commercial water-related activities, such as boating, water sports, and fishing (FDEP 2010-TN156).

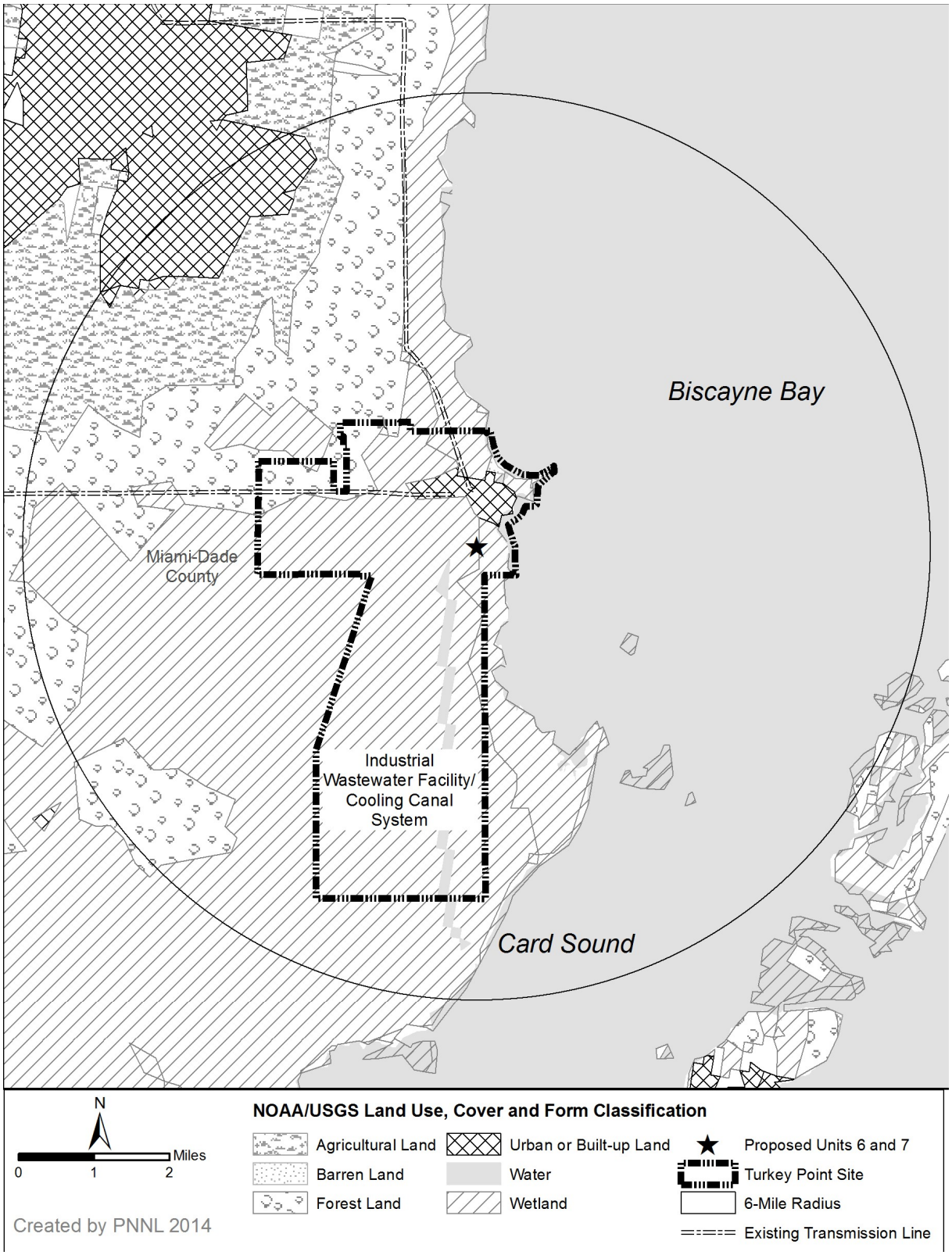


Figure 2-4. Principal Land Uses in the 6-Mile Vicinity of the Turkey Point Site (Adapted from FPL 2014-TN4058)

South Dade Wetlands

The South Dade Wetlands is a collective project consisting of the Model Lands Basin, much of the Model Lands Addition, and Southern Glades Addition projects. This project is a collaborative endeavor by the Environmentally Endangered Lands Program of Miami-Dade County (County) and the Save Our Rivers (SOR) Program of the SFWMD (District). The project consists of a broad zone of wetlands located in Miami-Dade County, south of Palm Drive (SW 344th Street) between the boundaries of Everglades National Park, the Southern Glades Wildlife Environmental Area (SGWEA), and the Turkey Point power plant facility. The Model Lands Basin, parts of the Model Lands Addition, and the Southern Glades Addition are being combined into the South Dade Wetlands for management purposes because both agencies own land within the collective project area. These lands are subject to the South Dade Wetlands Conceptual Land Management Plan (SFWMD 2005-TN217).

Biscayne National Park

Biscayne National Park is adjacent to Turkey Point site—to the north and east (Figure 2-1 and Figure 2-2). The waters adjacent to the proposed Units 6 and 7 plant area are within the boundary of Biscayne National Park. The park headquarters building is approximately 2.3 mi north of the proposed Units 6 and 7 plant area (NPS 2012-TN1284). Biscayne National Park was established in 1968 as a national monument and was expanded in 1980 to encompass approximately 173,000 ac of water, coastal lands, and 42 keys (islands). Activities at the multi-use park include boating, recreational and commercial fishing, snorkeling, diving, camping, picnicking, and hiking (NPS 2012-TN1284).

Biscayne National Park was first designated a national monument in 1968 before being expanded and re-designated a national park in 1980. The park was established “to preserve and protect for the education, inspiration, recreation and enjoyment of present and future generations a rare combination of terrestrial, marine, and amphibious life in a tropical setting of great natural beauty.” Biscayne National Park is home to a large segment of the Florida reef tract (the only living coral reef tract in the continental United States), contains the majority of Biscayne Bay, and is an Outstanding Florida Water (OFW). The park supports an incredible array of wildlife, including more than 600 species of fishes, many of which are commercially and recreationally used, over 200 species of birds, and 21 Federally threatened or endangered species. Biscayne National Park is home to both the longest protected stretch of mangrove shoreline and protects the finest examples of coastal hardwood hammock on the east coast of the United States.

Everglades National Park was created in 1934 as a “public park for the benefit of the people. It is set aside as a permanent wilderness, preserving essential primitive conditions including the natural abundance, diversity, behavior, and ecological integrity of the unique flora and fauna.”

Public concern for the Everglades unique flora and fauna, which the wading birds epitomize, were the primary motivation for the establishment of Everglades National Park, as well as the addition of Northeast Shark River Slough and the East Everglades to the Park in 1989 (Everglades National Park Protection and Expansion Act of 1989 [16 USC 410r-5 et seq.] [TN4096]). Through these Acts, Congress intended to improve the protection of these

resources and the ecosystems upon which they depend. The park's unique ecosystems support 34 native species that are listed as Federally threatened or endangered, or are candidates for listing. Seven of these species are currently considered to be extirpated from the park, and the remaining 27 species may occur in the park today. In addition, critical habitat is designated within Everglades National Park for 10 of these species, and well over half of the park is designated critical habitat for one or more species. Everglades National Park supports the entire range of the endangered Florida leafwing butterfly and nearly all of the remaining population of Cape Sable seaside sparrows. Everglades National Park's rich biodiversity has been recognized by United National Educational, Scientific and Cultural Organization (UNESCO) as a World Heritage Site and an International Biosphere Reserve. Because of alterations of the hydrological regime (quantity, timing, and distribution of Shark Slough inflows); adjacent urban and agricultural growth (flood-protection and water-supply requirements that affect the property's resources by lowering water levels); and increased nutrient pollution from upstream agricultural activities, UNESCO has added the park to its list of World Heritage Sites in Danger in 2014. The park is also designated a Ramsar Wetland of International Importance, Specially Protected Area under the Cartagena Convention, an OFW, and includes the Marjorie Stoneman Douglas Wilderness, the largest wilderness area east of the Rocky Mountains.

The broader Everglades ecosystem, which includes Biscayne National Park, has been in decline and many of the species found in the two park's fragile ecosystems are in danger of extinction or regional extirpation. The Central Everglades Restoration Program (CERP) is a major restoration initiative that will restore the quantity, quality, timing, and distribution of fresh water in an effort to reverse decades of unintended environmental decline. The Biscayne Bay Coastal Wetlands (BBCW) project is an effort under CERP that will rehydrate wetlands and reduce point-source discharge to Biscayne Bay. CERP is vital to revitalizing habitat within Everglades and Biscayne National Parks and is a major initiative of the Department of Interior and a wide range of other agencies, including the U.S. Army Corps of Engineers (USACE). At a cost of more than $10.5 billion and with over a 35-year time-line, it is the largest hydrologic restoration project ever undertaken in the United States.

Homestead Bayfront Park

The nearest local park is Homestead Bayfront Park—a 97 ac public park. It is 1.5 mi from the proposed Units 6 and 7 plant area south of the North Canal on Biscayne Bay and adjacent to Biscayne National Park (Figure 2-2). The park has a marina and a public swimming area (FPL 2014-TN4058; NRC 2010-TN1457).

Everglades Mitigation Bank

FPL owns the 13,000 ac EMB (Figure 2-2), which is a preserve that is also operated as a mitigation bank, and not a recreational facility (FPL 2014-TN4112). It contains relatively undisturbed freshwater and estuarine wetlands (FPL 2014-TN4058).

Commercial Uses

The 2,938 ac Homestead Air Reserve Base (approximately 4.5 mi northwest of the proposed Units 6 and 7 plant area) (Figure 2-2) is the nearest airport and is primarily devoted to military

uses. U.S. Air Force plans provide for future mixed economic uses that could include commercial development as well as residential or recreational uses, but would not include use as a civilian commercial airport (HAFRC 2007-TN1427).

The Homestead-Miami Speedway is 5 mi northwest of the proposed Units 6 and 7 plant area. The speedway has the capacity to seat 65,000 people in grandstands and accommodate more people in other areas of the facility (FPL 2014-TN4058). The City of Homestead recently approved expansion of the speedway (Miami-Dade County 2011-TN1504).

Industrial Uses

Nearby industrial uses include the RMC Florida Group Ltd. active limestone mine (6 mi west), and an abandoned quarry (6 mi north) of the Turkey Point site (FPL 2014-TN4058).

Agriculture – Prime and Unique Farmland

Agricultural land composes approximately 9 percent (3,500 ac) of land use within the 6 mi vicinity of the Turkey Point site (Figure 2-4; Table 2-2). The land acreage with a use/cover designation of agricultural in the vicinity is concentrated in an area adjacent to the west-northwest corner of the Turkey Point site within Miami-Dade County. No prime farmland or unique farmland, or other special status farmlands as defined in the Farmland Protection Act (7 U.S.C. Section 4201(b)) (TN708), occur on the Turkey Point site or in the vicinity (USDA 2012-TN1314).

2.2.2 Transmission-Line Corridors and Offsite Areas

The existing Turkey Point power-generation units are currently connected to the transmission system by eight 230 kV transmission lines in two corridors, one going north and one west (FPL 2014-TN4058). The existing transmission lines are shown in Figure 2-5. According to FPL (FPL 2014-TN4058), two 230 kV substations exist on the Turkey Point site, the 1 ac McGregor substation and the approximately 6 ac Turkey Point substation. Existing transmission line corridors connecting the existing generation facilities at the Turkey Point site to the power grid occupy approximately 1,111 ac of land, all within Miami-Dade County (FPL 2014-TN4058).

2.2.2.1 Transmission-Line Corridors

To connect proposed Units 6 and 7 to the power grid, two new 500 kV circuits and three new 230 kV circuits are proposed. FPL proposes to build the new transmission lines originating from a proposed new onsite substation (Clear Sky substation) and connecting to the existing Levee substation (500 kV circuits), and to the existing Turkey Point, Davis, and Pennsuco substations (230 kV circuits) (Table 2-4 and Figure 2-5). Two major corridors are proposed—the West and the East corridors—and several transmission lines are proposed within these corridors.

Table 2-4. Existing and Proposed Transmission-Line Corridors

Corridor	Number of Lines/kV	Length (mi)	Total Acres
Existing Corridor			
Turkey Point – Davis	Three 230 kV double circuit lines One 230 kV single circuit	19	NA
Turkey Point – Levee	One 230 kV single circuit	23	NA
Proposed West Preferred Corridor			
Clear Sky – Levee	Two 500 kV lines		
Leg 1		27.5	1,378.9
Leg 2		13	1,412.9
Leg 3		4.5	252.3
TOTAL		44	3,044.1
Clear Sky – Pennsuco	One 230 kV Line	52	
Leg 1		27.5	1,378.9
Leg 2		13	1,412.9
Leg 3		4.5	252.3
Levee to Pennsuco		8	312.3
TOTAL		52	3,357.4
East Corridor			
Clear Sky – Davis	*One 230 kV Line*	*19*	*634.9*
Davis – Miami	One 230 kV Line	18	1,000.0
TOTAL		37	1,634.9
West Secondary Corridor			
Clear Sky – Levee	Two 500 kV line		
Leg 1		27.5	1,378.9
Leg 2		12	498.9
Leg 3		4.5	252.3
TOTAL		43	2,130.1
Clear Sky – Pennsuco	One 230 kV Line		
Leg 1		27.5	1,378.9
Leg 2		12	498.9
Leg 3		4.5	252.3
Levee to Pennsuco		8	312.3
TOTAL		52	2,442.4
Source: FPL 2014-TN4058			

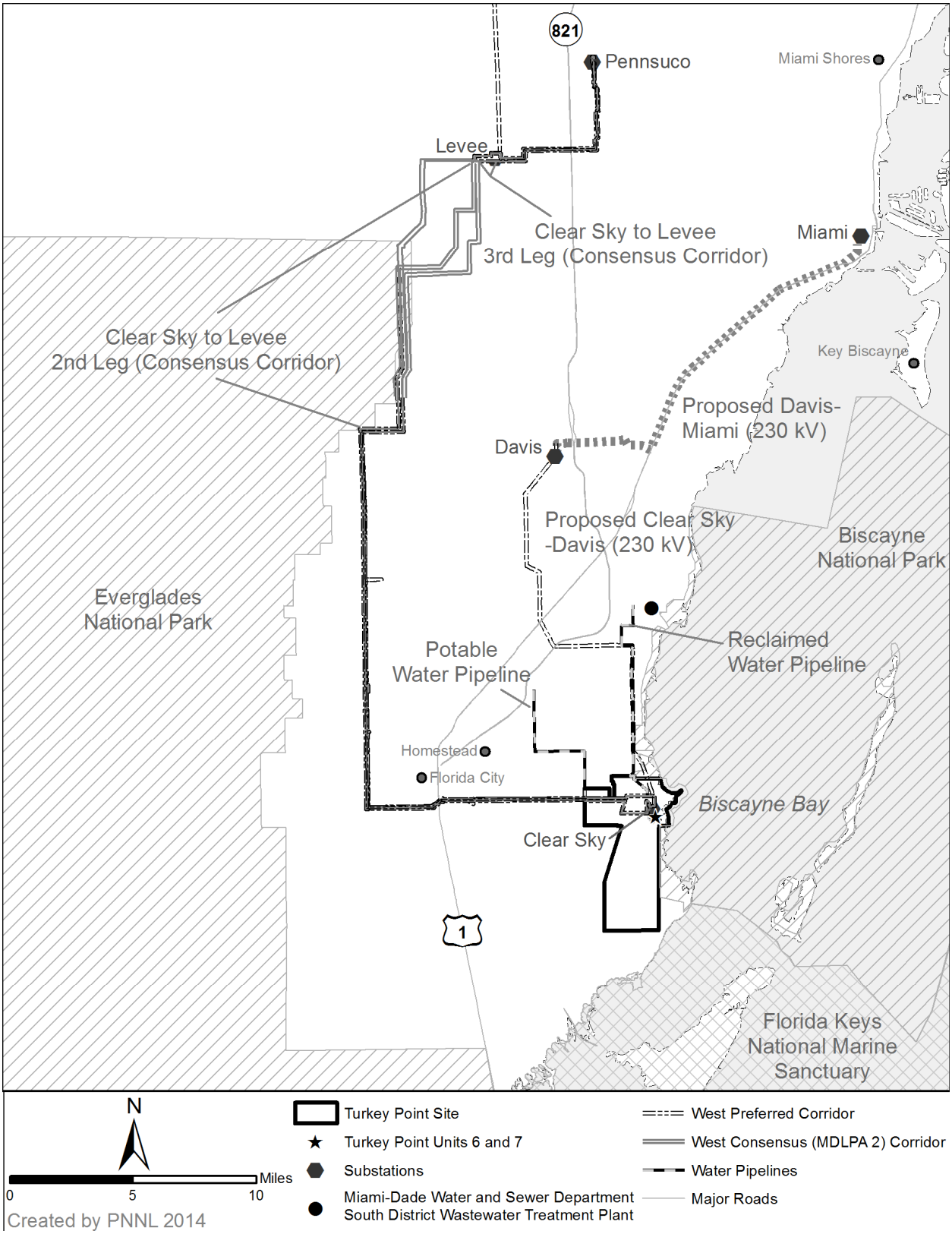


Figure 2-5. Locations of Proposed Transmission-Line Corridors and Water Pipelines at the Turkey Point Site (FPL 2013-TN2941)

As FPL described in Section 2.2.2.2 of its Environmental Report (ER) (FPL 2014-TN4058), existing linear features would generally be followed where available, within two proposed corridors, the West corridor and the East corridor—from the Units 6 and 7 plant area to existing substations (Figure 2-5). These corridors feature several land uses (listed in Table 2-5) (FPL 2014-TN4058). FPL has outlined two options for the West corridor that differ primarily with respect to where the corridor would pass near Everglades National Park (even though no part of the corridor would actually pass through the park). The first option, termed the West Preferred corridor, passes along a segment of the eastern perimeter of the park. The second option, termed the West Consensus corridor, avoids the park perimeter by passing through lands to the east used mostly for limerock mining. Details regarding the proposed alignment of new transmission lines in each of the corridors (and for the West corridor, each of the options) are presented below.

- West Preferred corridor: The West Preferred corridor, as described in the FPL's ER (FPL 2014-TN4058), consists of a corridor from the proposed new Clear Sky substation to the existing Levee 500 kV substation and then to the existing Pennsuco substation. The segment connecting the Clear Sky and Levee substations would be built in three segments (legs). The first leg passes just south of Homestead and Florida City, then travels north to SW 120th St. Major land use includes fields, pastures, row crops, tree nurseries, and citrus groves. The second and third legs traverse a landscape just east of Everglades National Park characterized by wetlands and disturbed wetlands with some agricultural land, limerock quarries, and scattered urban development. Part of the second leg would abut the eastern perimeter of the park. The segment between the Levee to Pennsuco substations also traverses a landscape characterized by mostly agricultural land, sawgrass wetlands, existing limerock quarries, and scattered urban development.

- West Consensus corridor: FPL describes the West Consensus corridor in a letter dated November 5, 2013 (FPL 2013-TN2941). It differs from the West Preferred corridor only in that portions of the second and third legs of the segment between the Clear Sky and Levee substations have been shifted to the east to avoid abutting the eastern perimeter of Everglades National Park. This corridor still crosses a landscape consisting mostly of wetlands and disturbed wetlands, but FPL states that its use would reduce the potential for adverse impacts on multiple Federally endangered species (FPL 2013-TN2941).

- East corridor: The East corridor is also described in the ER (FPL 2014-TN4058). A new, 230 kV, approximately 19 mi long, transmission line would be constructed to connect the proposed new Clear Sky substation to the existing Davis substation, and a new, approximately 18 mi long, 230 kV line would be constructed to connect the Davis substation to a new 230 kV bay position at the Miami substation. FPL stated (FPL 2014-TN4058) that these transmission lines would be largely collocated in an existing right-of-way or other linear/transportation corridors. FPL also stated that installation of these lines would require acquisition of additional easements. The existing land uses traversed by the East corridor are listed by segment in Table 2-5. The segment connecting the Clear Sky and Davis substations traverses a mostly rural landscape consisting predominantly of agricultural land interspersed with wetlands and rangeland and with widely scattered urban areas and forests. The segment between the Davis and Miami substations would traverse a mostly urban landscape but would be built mostly along existing roadways.

In addition to the transmission lines built within the corridors noted above, a new underground transmission line would be built within the plant area to connect Units 6 and 7 to the proposed new Clear Sky substation. The existing land use of the plant area is described above.

Transmission-line siting in Florida is regulated under the Florida Power Plant Siting Act (PPSA) (Fla. Stat. 29-403.501 2011-TN1068), and Chapter 62-17 of the Florida Administrative Code (Fla. Admin. Code 62-17-TN1247). FPL is required to obtain certification through the Florida PPSA Site Certification Application (SCA) process for the new 500 kV and 230 kV transmission lines. FPL undertook a route-selection process to select the transmission line corridors that was submitted for approval under the Florida PPSA (Fla. Stat. 29-403.501 2011-TN1068).

Table 2-5 summarizes the major land uses along each corridor/option.

Table 2-5. FLUCFCS Land-Cover Acreage Within Proposed Transmission-Line Corridors and Transmission Access Roads

Segment	100	200	300	400	500	600	700	800	Total
West Preferred Corridor									
Clear Sky - Levee 1st Leg	3.2	732.6	19.9	5.6	234.2	286.6	68.1	15.1	1,365.4
Clear Sky - Levee 2nd Leg	5.2	116.4	69.4	61.7	167.1	830.9		162.3	1,413.0
Clear Sky - Levee 3rd Leg						229.1	1.8	21.5	252.3
Levee to Pennsuco	86.9				1.77	169.4	19.4	24.8	312.3
West Consensus Corridor									
Clear Sky - Levee 1st Leg	3.2	732.6	19.9	5.6	234.2	286.6	68.1	15.1	1,365.4
Clear Sky - Levee 2nd Leg	82.2	99.0	264.1	44.8	107.5	2,454.5	71.8	10.0	3,134.0
Clear Sky - Levee 3rd Leg						90.1			90.1
Levee to Pennsuco	86.9				1.77	169.4	19.4	24.8	312.3
East Corridor									
Clear Sky - Davis	9.4	418.3	76.1	1.1	17.7	71.7	1.6	38.9	634.9
Davis-Miami	483.0	13.6	19.2	2.1	16.7			465.4	1,000.0
West Preferred Access Roads									
Krome Ave.					85.3	200.2		79.2	364.7
Tamiami Trail					2.7	3.1		4.7	10.5
West Consensus Access Roads									
88th St.	2.1		0.8	12.0	0.01	18.3	0.3		33.5
L-31 Canal					11.4	4.2	21.0		37.1
NW 12th St.	13.3	6.5	0.1	0.4					20.2
SW 117 Ave S					0.01	6.5		1.2	7.7
SW 117th Ave N		0.04			1.6	0.2		6.9	8.7
SW 137 Ave	0.6				1.7	3.5		1.6	7.4
SW 328 St.	0.5	7.3			2.1	4.0		10.6	24.5

Table 2-5. (contd)

Segment	100	200	300	400	500	600	700	800	Total
SW 344 St.	0.6							1.0	1.7
SW 359 Ave E				0.8	1.9	31.6	6.9	5.6	46.8
SW 359 Ave W					0.1	27.8		3.1	31.0
Tamiami Trail						19.6			19.6

Source: Adapted from Tables 2.2-4 of FPL 2014-TN4058 and FPL 2013-TN2941

As part of the West Preferred and West Consensus corridor alignments, multiple access roads would be built to provide vehicular access to the transmission lines. Two proposed access road corridors for the West Preferred corridor have been designated as the Tamiami Trail corridor and the Krome Avenue corridor. Four proposed access road corridors for the West Consensus corridor have been designated as the NW 12th Street, Tamiami Trail, L-31 Canal and Levee, and SW 88th Street corridors. Land uses in these corridors are primarily waterways, marshes, rock quarries, roads and highways, and other open lands with vegetation indicative of disturbed areas.

2.2.2.2 Transmission Substation Improvements

Proposed substation improvements include building one new substation (Clear Sky), and upgrading and expanding the existing Turkey Point, Miami, Levee, Davis, and Pennsuco substations (Figure 2-5). Improvements at the Turkey Point, Levee, and Davis substations would require site expansions. In its ER (FPL 2014-TN4058), FPL stated that site expansions at these substations would take place on existing FPL property in previously disturbed areas, but that the improvements proposed at the Pennsuco substation would require acquisition of additional property. Existing land uses for the areas of substation expansion are summarized below.

- Turkey Point substation: The Turkey Point substation would be expanded by approximately 0.9 ac to accommodate proposed new facilities. In its ER (FPL 2014-TN4058), FPL stated that the expansion area is already fully occupied by uses associated with the existing operation. Areas adjacent to the existing substation are currently used for parking lots or are unused but surrounded by electrical power-generation facilities.
- Levee substation: The existing Levee substation, at NW 41st Street and NW 147th Avenue, would be expanded by 2.3 ac to accommodate proposed new facilities. Existing land use in the expansion area for the Levee substation comprises approximately 1.81 ac of hardwoods and 0.52 ac of electric power facilities (FPL 2014-TN4058).
- Pennsuco substation: The existing Pennsuco substation, at 10800 NW 107th Avenue, would be expanded by 2.42 ac to accommodate proposed new facilities. The expansion area for the Pennsuco substation is currently used for rock quarrying (FPL 2014-TN4058).
- Davis substation: The existing Davis substation, at 12701 SW 136th Street would be expanded by 1.12 ac to accommodate new installations. Existing land in the expansion area for the Davis substation is used for tree nurseries (FPL 2014-TN4058).

- Miami substation: The proposed improvements at the Miami substation, at 122 SW 3rd Street, would take place entirely within the existing fence line of the facility (FPL 2014-TN4058).

2.2.2.3 Makeup and Potable Water Systems

As described in Chapter 3, proposed new reclaimed wastewater pipelines would require approximately 9 mi of pipeline corridor between the FPL reclaimed wastewater-treatment facility (RWTF) on the Turkey Point site and the Miami-Dade Water and Sewer Department (MDSAWD) South District Wastewater-Treatment Plant (SDWWTP) to the north (Figure 2-5). For about 6.5 mi, the pipelines would be collocated with the existing Clear Sky to Davis transmission line right-of-way. Existing land uses along this route include wetland, agricultural, and electrical power transmission line uses. A new 2.5 mi right-of-way would be located adjacent to a new pipeline corridor. The reclaimed wastewater pipelines from the FPL RWTF (FPL 2014-TN4058) would be routed south along the eastern side of the cooling canals to the makeup-water reservoir, traversing a mangrove forest and the laydown area on the western side of the Units 6 and 7 plant area (Figure 2-5). Existing land uses within the reclaimed wastewater pipeline corridor are summarized in Table 2-6.

Table 2-6. Major Land-Use Acreage Along the Reclaimed Water Pipeline to the FPL Reclaimed Wastewater–Treatment Facility and Potable Water Pipeline

	FLUCFCS Land-Use Category	Reclaimed Water Pipeline (ac)	Potable Water Pipeline (ac)
100	Urban and Built-Up Land	51.36	19.67
200	Agriculture	496.64	69.92
300	Rangeland	99.28	1.63
400	Upland Forest	2.06	7.69
500	Water	74.89	24.75
600	Wetlands	447.80	159.95
700	Barren Land	31.27	4.05
800	Transportation, Communications, and Utilities	672.05	39.21

Source: FPL 2014-TN4058

Potable water pipelines, approximately 10 mi long, would be constructed to deliver potable water from the Miami-Dade Water and Sewer Department (MDWASD) potable water source facility to the Units 6 and 7 plant area as shown in Figure 2-5. New land disturbance would occur along approximately 2.5 mi of the pipeline corridor. The disturbance would occur from SW 288th Street and SW 137th Avenue/ Tallahassee Road to SW 328th Street/North Canal Drive (FPL 2014-TN4058).

Existing land uses in the area to be disturbed by the potable water pipelines would be approximately 20 percent agricultural land, 19 percent urban or built-up land, and approximately 30 percent marsh and wetland (FPL 2014-TN4058).

Makeup-water pipelines would be installed within the site in areas currently used for power-generation purposes, and therefore would not require new land disturbance (FPL 2014-TN4058).

2.2.2.4 Fill Material Source Site

FPL proposes to obtain the offsite fill from established regional sources. A number of fill sources in the region could meet the needs of FPL at the Turkey Point site.

To provide context for the potential impacts of fill mining, the review team considered the Atlantic Civil, Inc. mine located about 10 mi west of the Turkey Point site as a viable commercial fill source (USACE 2013-TN3473). The review team also considered a rock mine in the Lake Belt region as another viable commercial source of fill. This allowed the review team to consider a nearby location with limited capacity and a more distant site with extensive capacity. The Atlantic Civil rock mine is located about 10 mi west of the FPL site; it is a complex of quarries, fill areas, and mitigation areas occupying approximately 3,200 ac (SFWMD 2010-TN3553; SFWMD 2014-TN3554).

The rock mines in the Lake Belt region in northwest Miami-Dade County are located approximately 40 road miles northwest of the Turkey Point site. The USACE issued project-specific permits to several companies including to Cemex Construction Materials Florida for its FEC Quarry, named for the Florida East Coast (FEC) Railway that serves the quarry. The FEC Quarry and rail center are located near the intersection of the Florida Turnpike and Okeechobee Road (USACE 2010-TN3555; SFWMD 2010-TN3556). Other permitted quarries in the Lake Belt region include White Rock Quarries (North and South), Tarmac America, Florida Rock Industries, and APAC Southeast (USACE 2010-TN3559; USACE 2010-TN3560; USACE 2010-TN3561).

2.2.2.5 Emergency Operations Facility

FPL states that the existing facility for Units 3 and 4 would also be used for Units 6 and 7. This facility is located offsite at the intersection of West Flagler Street and SW 92nd Avenue. FPL further states that it proposes no changes to this facility (FPL 2014-TN4058).

2.2.2.6 Roads and Highways

The major area roads and highways, shown in Figure 2-6, are as follows:

- U.S. highways
  - US-1
  - Interstate 75
  - Interstate 95

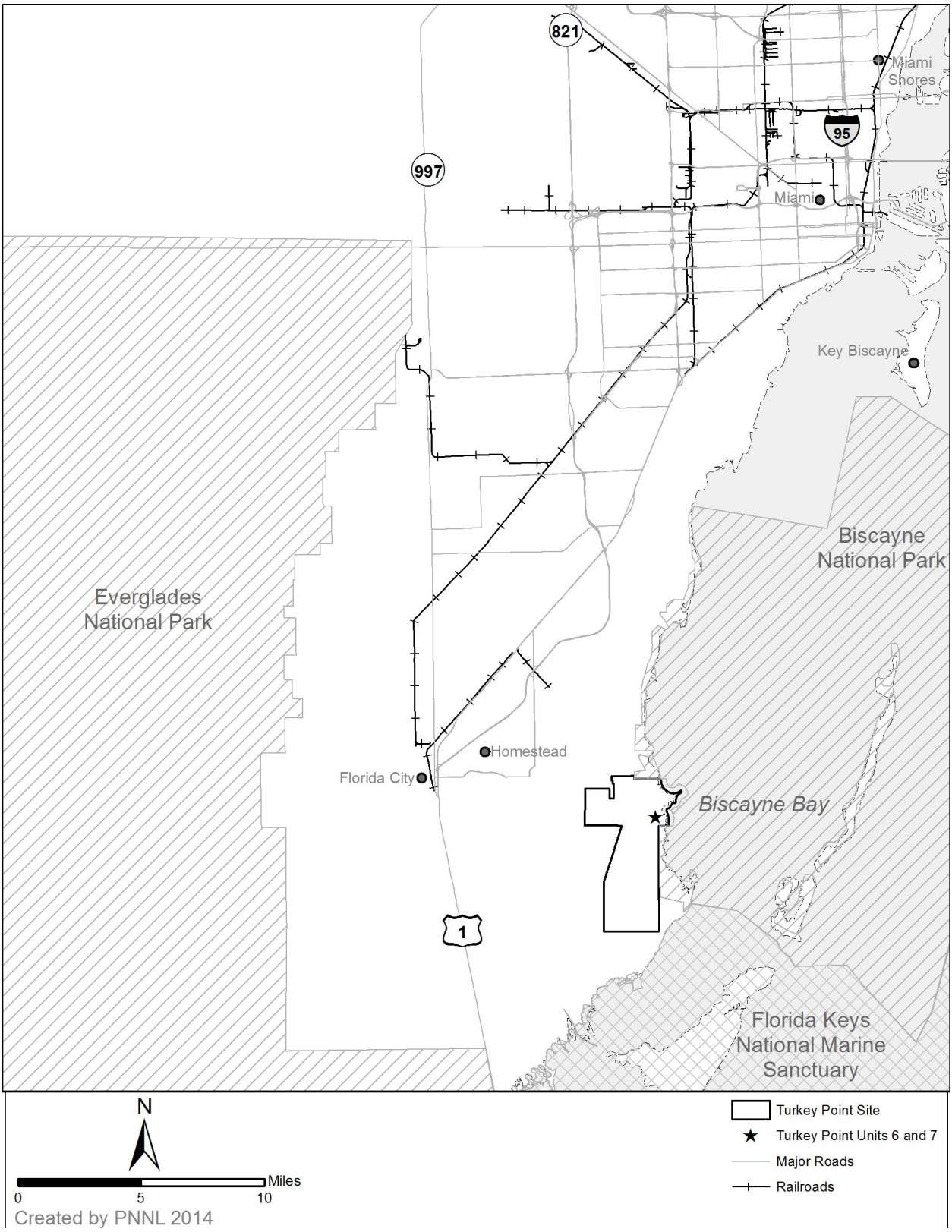


Figure 2-6. Map Showing Major Roads, Highways, and Rail Lines Within the Turkey Point Site Vicinity (FPL 2014-TN4058)

- State highways
  - Florida's Turnpike (Homestead Extension, SR-821)
  - SR-997

Local roadways serving the project site (Figure 2-2) are as follows:

- SW 344th Street/Palm Drive. SW 344th Street/Palm Drive intersects with US-1 and SR-997.
- SW 328th Street/North Canal Drive, paralleling SW 344th Street/Palm Drive to the north, connecting to US-1.
- From Florida's Turnpike, via the exit at SW 312th Street/Campbell Drive or via the Turnpike terminus at US-1.

Existing land uses in the areas to be used for the proposed access road improvements largely include roadways, urban and built-up land, marshes, mangroves, and agriculture (FPL 2014-TN4058).

2.2.3 The Region

Land within 50 mi falls into four counties: Broward, Collier, Miami-Dade, and Monroe. Existing major land-use classifications and waterways in the region are listed in Table 2-7 and shown in Figure 2-7. Major highways and rail lines are shown in Figure 2-6.

Table 2-7. Regional Land Use

FLUCFCS Code		Acres
100	Urban and Built-Up Land	353,440
200	Agriculture	83,286
300	Rangeland	21,369
400	Upland Forest	23,729
500	Water	690,568
600	Wetlands	1,409,912
700	Barren Land	3,030
800	Transportation, Communications, and Utilities	42,570

Source: FPL 2014-TN4058

All four counties within the region have adopted comprehensive land-use plans (Broward County 2010-TN1505; Collier County 2012-TN1506; Miami-Dade County 2012-TN1150; Monroe County 2012-TN1507). Because the project area, transmission line corridors, and offsite areas are located in Miami-Dade County, the Miami-Dade CDMP is the relevant land-use planning document for the proposed project.

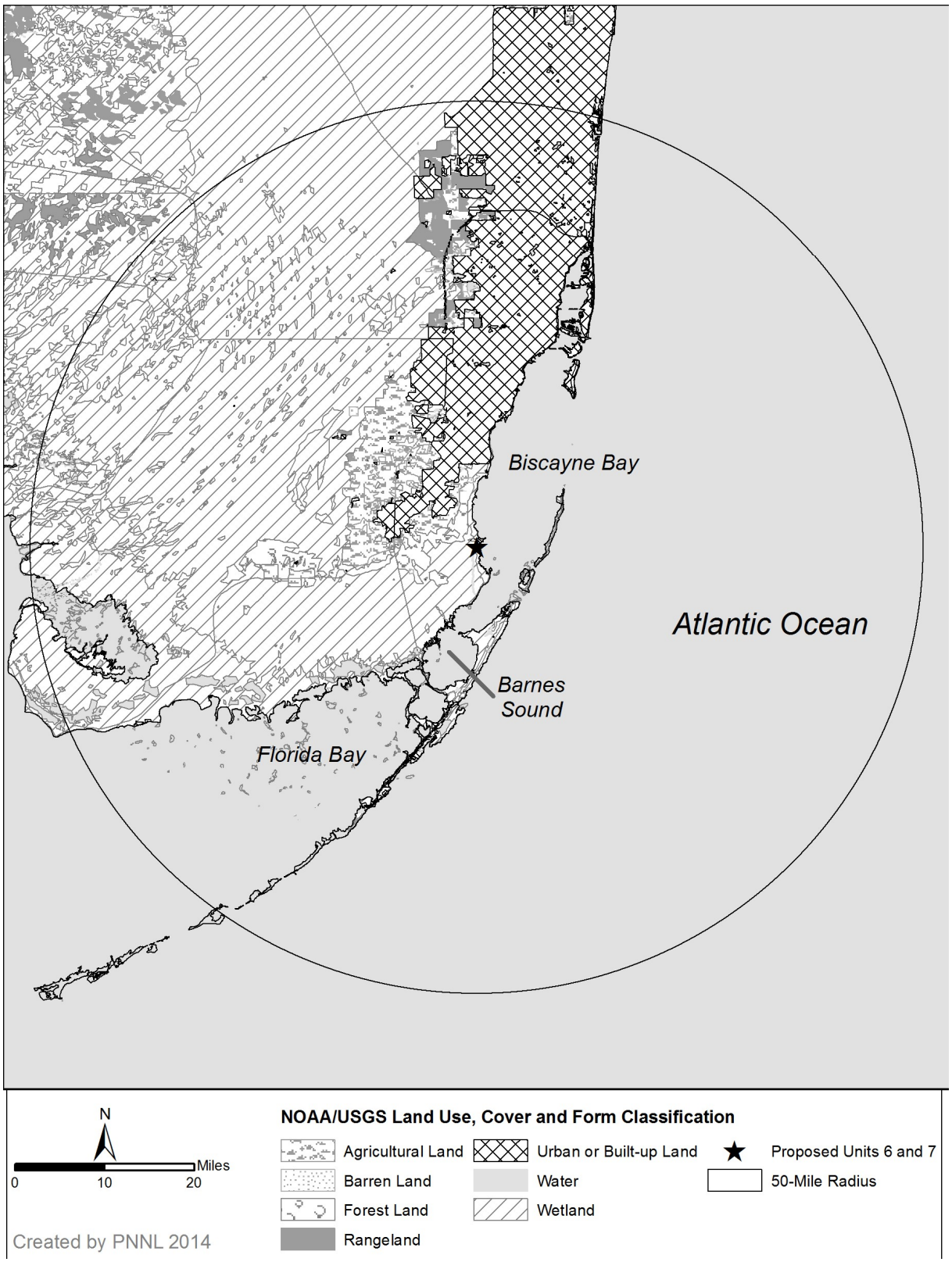


Figure 2-7. Land Use Within the 50-Mile Radius of the Turkey Point Site (FPL 2014-TN4058)

2.2.3.1 Rail and Ports

The nearest rail line is located 10 mi west of the proposed Units 6 and 7 plant area (Figure 2-1), (DOI 2012-TN1335). The rail line is part of the FEC Railway. The Port of Miami is located approximately 26 mi from the site.

2.2.3.2 Regional Land Uses and Jurisdictions

Land Uses

As described in ER Table 2.2-8 (FPL 2014-TN4058), the region within 50 mi of the proposed Units 6 and 7 plant area encompasses 2,634,939 ac of land (mostly excluding the Atlantic Ocean, Gulf of Mexico, Biscayne Bay, Card Sound, and Florida Bay). Most of this land is wetland (approximately 54 percent) and water (approximately 26 percent); urban or built-up lands account for approximately 15 percent (FPL 2014-TN4058). The remaining lands are agricultural land (approximately 3 percent), forestland (less than 1 percent), rangeland (less than 1 percent), and less than 1 percent barren land.

Public Lands

Federal, State, County, and city public lands account for much of the land in the region. Specific parks and other public lands are described below.

Everglades National Park

Everglades National Park, 10 mi southwest of Turkey Point site (Figure 2-1), encompasses approximately 1,509,000 ac, including most of Florida Bay and its uninhabited islands. Ernest Coe Visitors Center is located approximately 16 mi southwest of the proposed Units 6 and 7 plant area (NPS 2010-TN192).

Crocodile Lake National Wildlife Refuge

The Crocodile Lake National Wildlife Refuge is located approximately 10 mi south of the Turkey Point site in the northern part of Key Largo. The refuge is not open to the public except for the interpretive butterfly garden at the refuge headquarters (FWS 2012-TN706).

Big Cypress National Preserve

Big Cypress National Preserve, located approximately 35 mi northwest of the Turkey Point site, consists of 729,000 ac of freshwater swamp and other inland habitats, which support the rich marine estuaries along Florida's southwest coast, including parts of Everglades National Park. The preserve contains a mixture of tropical and temperate plant communities that are home to a diversity of wildlife, including the endangered Florida panther (*Puma concolor coryi*). Activities at the preserve include a wide variety of recreational pursuits, including camping (NPS 2012-TN707).

Indian Reservations

Indian reservations in the region include the Miccosukee Indian Reservation (approximately 50 mi northwest) and the Seminole Tribe of Florida, Hollywood Reservation (approximately 50 mi north) (Figure 2-1).

Agriculture

Information about principal agricultural products, crop areas, and average annual yields is presented in Table 2-8 and was taken from the AgCensus, which is conducted every 5 years; the most recent data available were from 2007 (USDA 2009-TN1669).

Table 2-8. Agriculture in the Region

County	Total Agricultural Land (acres)	Harvested Cropland (acres)		Pastureland (acres)		Major Agricultural Products
Broward	8,737	2,577	(29%)	4,141	(41%)	Cattle, orchard crops, vegetables, poultry, hogs and pigs, and hay
Collier	109,934	35,288	(32%)	63,612	(58%)	Cattle and calves, poultry, orchards crops, vegetables, hogs and pigs, and hay
Miami-Dade	67,050	49,065	(73%)	9,108	(14%)	Cattle and calves, poultry, orchards crops, vegetables, hogs and pigs, sheep and lambs, sweet potatoes, and hay
Monroe	187	156	(83%)	12	(6%)	Not disclosed in 2007

Source: USDA 2009-TN1669.

2.3 Water

This section describes the hydrologic processes and water bodies in and around the Turkey Point site, the existing water use, and the quality of water in the environment of proposed Turkey Point Units 6 and 7. The description is limited to only the parts of the hydrosphere that may affect or be affected by building and operating the proposed units. For plant operations, there would be two independent sources of makeup water for nonsafety-related circulating-water system cooling. Each source would be capable of supplying 100 percent of the makeup water demand. The primary source would be reclaimed water from the MDWASD, and the alternative source would be saltwater supplied from horizontal radial collector wells installed in the Biscayne aquifer between 25 and 40 ft beneath the bed of Biscayne Bay and adjacent to Biscayne National Park (FPL 2014-TN4058).

The reclaimed water, prior to being used in the circulating-water system (CWS), would receive further treatment at the FPL RWTF. The alternative source supplied by the radial collector wells would only be used when needed to supplement makeup water demand when reclaimed water is not available in sufficient quantity or quality, and would be limited to a maximum of 60 days per year by the Florida State Conditions of Certification (State of Florida 2014-TN3637).

The blowdown from the cooling towers and other plant discharge effluents from proposed Units 6 and 7 would be collected in a sump and would be injected to the Boulder Zone – a cavernous, high-permeability South Florida geologic horizon within the Lower Floridan aquifer system. As such, the surrounding surface waterbodies would neither be directly used for the primary water supply, nor for heat sink for proposed Units 6 and 7. However, if the radial collector wells are used, the water would be pumped directly from the Biscayne aquifer beneath the bay and most of this water would be drawn downward from Biscayne Bay in an area adjacent to Biscayne National Park. No waste effluent from proposed Units 6 and 7 would be discharged directly to the surrounding surface waterbodies. As described in Chapter 3, potable and service water for the proposed units would be brought from the MDWASD using the existing water-supply pipeline. The original source of this water is the Biscayne aquifer in Miami-Dade County. Therefore, the affected environment described in this section includes surface-water resources such as the following:

- Biscayne Bay, BBCW, and adjacent marine waters (Card and Barnes Sound)
- Everglades hydrologic system including Shark River Slough and Taylor Slough
- South Florida canal system
- the FPL IWF.

The following groundwater resources are also described:

- the Biscayne aquifer
- the Upper Floridan aquifer
- the Boulder Zone of the Lower Floridan aquifer.

2.3.1 Hydrology

This section describes the site-specific and regional hydrological features that could be affected by building and operation of proposed Turkey Point Units 6 and 7. The hydrologic conditions at the Turkey Point site are described in Section 2.4 of the Final Safety Analysis Report (FSAR) (FPL 2014-TN4069). A summary of the hydrologic conditions of the Turkey Point site is provided in Section 2.3 of the ER (FPL 2014-TN4058). The following descriptions are based on information from the FSAR (FPL 2014-TN4069), the ER (FPL 2014-TN4058), and sources of publicly available hydrological data referenced below.

2.3.1.1 Surface-Water Hydrology

Topographic and geologic features over a range of spatial scales influence the surface-water hydrology at the Turkey Point site. The largest of these features is the South Florida Hydrologic System, within which the regional hydrology of the Biscayne Bay and Turkey Point hydrologic systems function. These are described in the following subsections.

South Florida Hydrologic System

South Florida is characterized by low topographic relief; the elevations south of Lake Okeechobee are mostly below 20 ft NAVD88 (Zilkoski et al. 1992-TN1232). Along the eastern

portion of South Florida lies the Atlantic Coastal Ridge (ACR); its elevations are nearly 20 ft NAVD88 at the northern end and around 10 ft NAVD88 at the southern end (Figure 2-8). Extending southward from Lake Okeechobee is a relatively low trough (Everglades trough), which includes Shark River Slough draining to the south into Everglades National Park (Figure 2-8). Shark River Slough is more than 30 mi wide and has an elevation of around 8 ft NAVD88 north of Miami and around 4 ft NAVD88 west of Miami. Historically, it was inundated much of the time and remains subject to seasonal flooding (Renken et al. 2005-TN110). While the ACR generally forms a barrier to flows from Shark River Slough, historically natural swales (relatively low areas locally referred to as “glades”) transverse the coastal ridge, which allowed conveyance of flows toward the Atlantic Coast as hydrologic conditions allowed (Renken et al. 2005-TN110). Taylor Slough flows eastward south of the ACR providing potential freshwater flows to the southeastern region of South Florida, including Barnes and Card sounds and southern Biscayne Bay. Limestone bedrock underlies the region, while layers of muck and peat cover the bedrock in the Everglades trough with historical thicknesses ranging from 24 ft near Lake Okeechobee to 2.5 ft in the southern Everglades (Renken et al. 2005-TN110).

In the early twentieth century, canal construction began in Southeast Florida to support agricultural land development (Renken et al. 2005-TN110; Cantillo et al. 2000-TN108). Increases in population and changes in land use led to modifications of the hydrologic system to reduce flooding associated with conversion of wetlands to agricultural uses (Renken et al. 2005-TN110; Cantillo et al. 2000-TN108). The first canals to drain the Everglades were constructed in 1903 (Cantillo et al. 2000-TN108). Figure 2-9(a) shows the extent of the canal network by 1920, when the canals primarily provided drainage from the area south of Lake Okeechobee. Increased population in Southeast Florida led to the need for additional dry land so that the canal network was greatly expanded by 1990 (Figure 2-9(b)). In general, the construction of the canal network had its intended effect of controlling the hydrologic system of Southeast Florida including flood control and land drainage. As illustrated in Figure 2-10, the surface-water hydrologic system went from one characterized by sheet flow down the Everglades trough (Figure 2-10(a)) to one characterized by channel flow through the canal network (Figure 2-10(b)). Under the channelized flow regime, most of the freshwater was discharged to Biscayne Bay, Card Sound, Barnes Sound, and Florida Bay, which greatly reduced sheet flow into the southernmost section of the Everglades (now established as Everglades National Park). Smith et al. (1989-TN122) estimated the reduction in freshwater flow from the Everglades into Florida Bay to be as much as 59 percent between pre- and post-canal building periods; the estimated annual flows into Shark River Slough during the period 1881–1939 were 1,145,777 ± 96,700 ac-ft, while the estimated annual flow during the period 1940–1986 was 471,610 ± 62,829 ac-ft. The rate of sheet flow down the poorly defined channel of Shark River Slough is estimated to be 80.5 km/yr during high-flow conditions, while during low-flow conditions the rate may drop to zero and have an average rate of 32 km/yr (Smith et al. 1989-TN122).

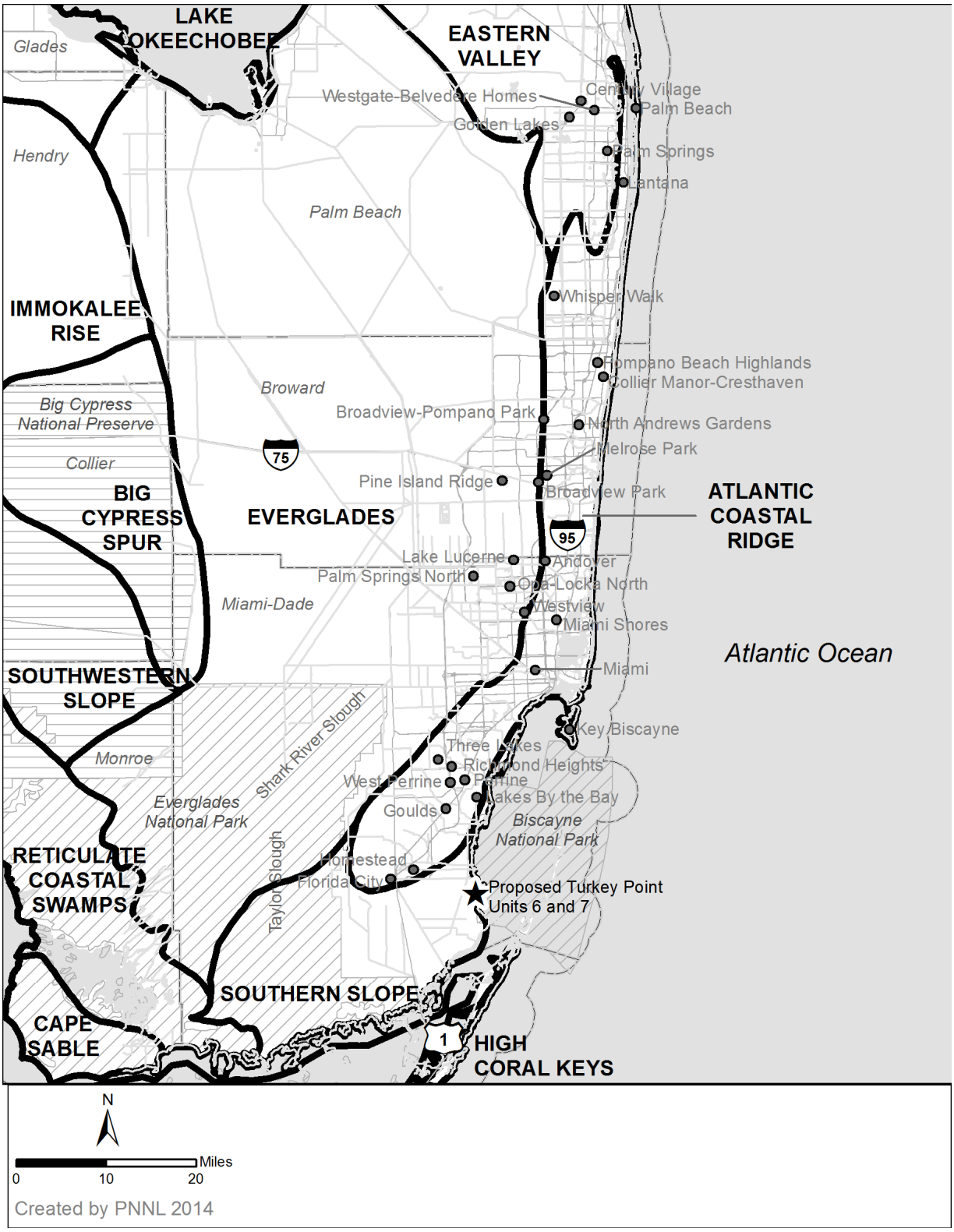


Figure 2-8. Physiographic Provinces in Southeast Florida

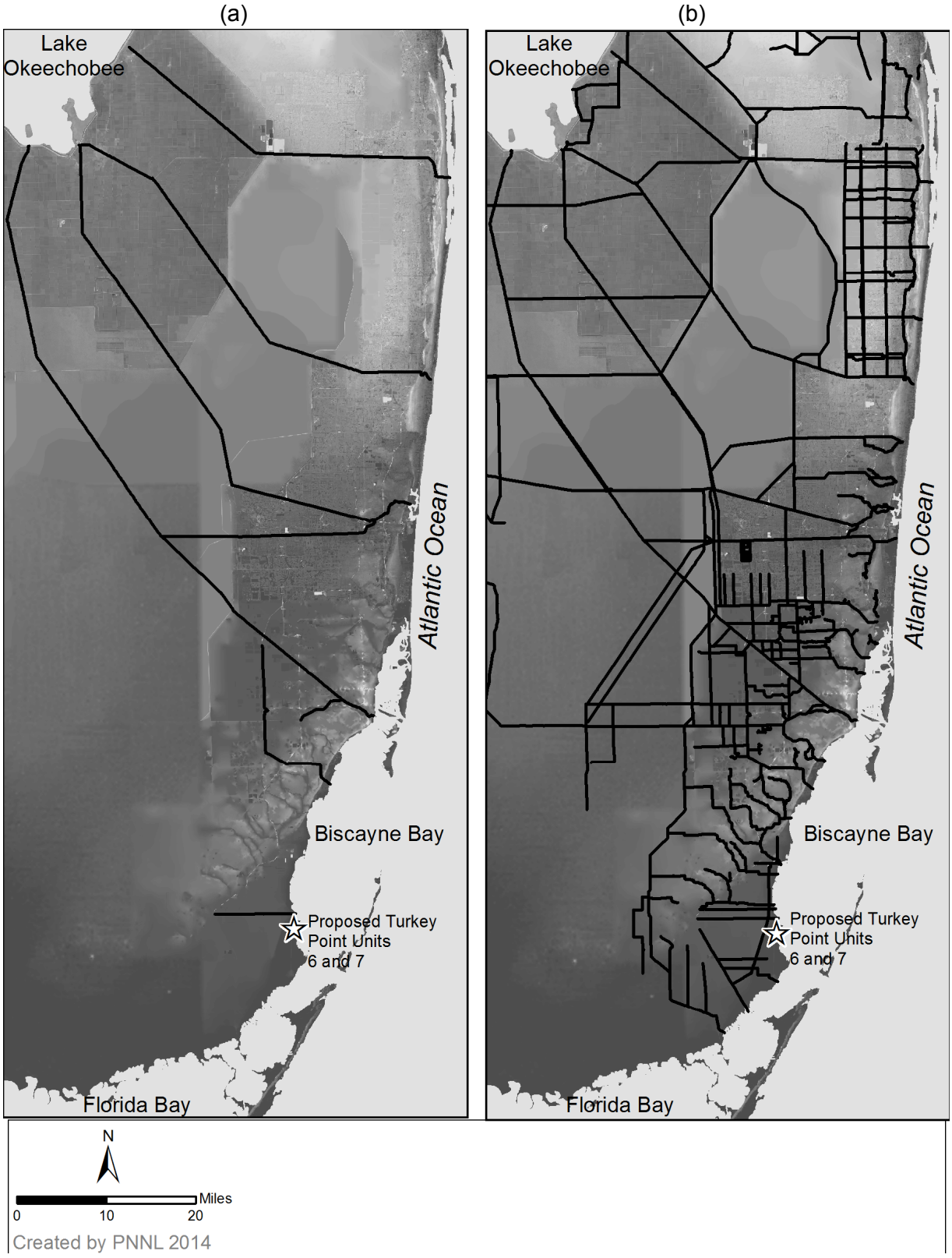


Figure 2-9. South Florida Canal System (a) 1920 and (b) 1990

(a) (b)

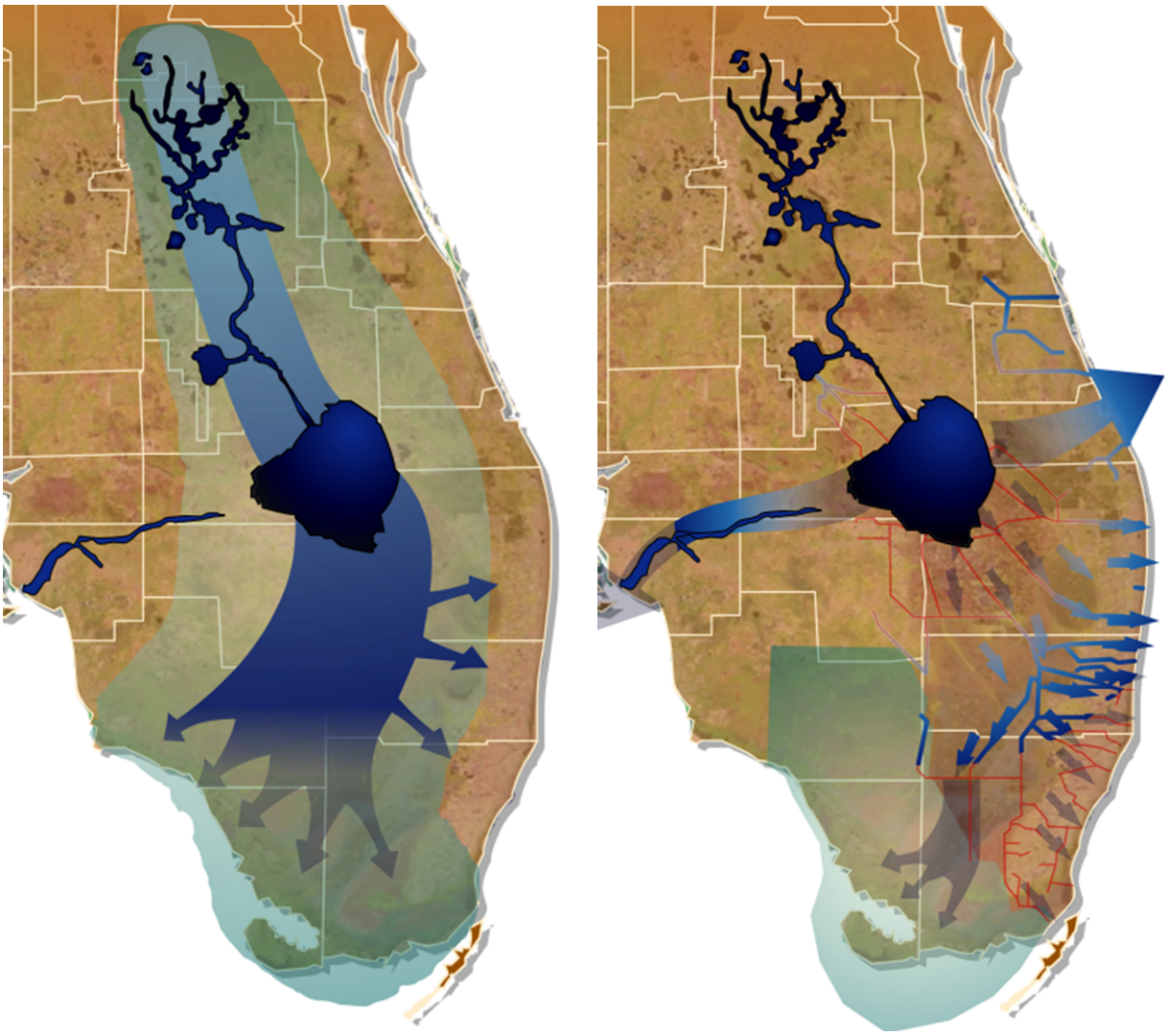


Figure 2-10. South Florida Typical Surface Hydrologic Flows (a) Historic and (b) Present. *Adapted from the Comprehensive Everglades Restoration Program (USACE 2010-TN113).*

Comprehensive Everglades Restoration Program

In 1992 and 1996, Congress authorized feasibility studies of structural and operational modifications that could restore the Everglades and the South Florida ecosystem (USACE/SFWMD 1999-TN116). In 2000, Congress approved as part of the Water Resources Development Act (WRDA) the development of the Comprehensive Everglades Restoration Program (CERP)—a long-term effort to capture, store, and redirect freshwater for environmental restoration of the entire Everglades ecosystem (USACE 2010-TN113). The work accomplished for the 2005 reporting period included projects with relatively rapid implementation schedules and included studies and reports for planning additional actions and managing the restoration of the Everglades.

The 2010 report to Congress summarizes the progress over the previous 5 years and briefly discusses progress since the inception of the project. The work accomplished for the 2010 reporting period included implementation of restoration actions to re-establish flows into the Everglades and important environments to the east, particularly the BBCW. The 2010 report also identifies anticipated projects through 2020. As identified in Figure 2-11, these projects include the following:

- WCA3 Decompartmentalization and Sheetflow Enhancement
- L-31N (L-30) Seepage Management Pilot
- West Miami-Dade Reuse
- South Miami-Dade Reuse
- Wastewater Reuse Technology Pilot
- BBCW (Biscayne Bay Coastal Wetlands)
- Restoration of Pineland and Hardwood Hammocks in C-111 Basin
- C-111 Spreader Canal.

The goal of the South Miami-Dade Reuse project is to supply additional water to South Biscayne Bay and the Coastal Wetlands restoration projects after advanced treatment of the wastewater. The West Miami-Dade Reuse project is to supply additional water for recharge to Shark River Slough after advanced treatment of the wastewater. One of the goals of the Wastewater Reuse Technology Pilot project was to determine the ecological effects of reuse of wastewater after advanced treatment. The hydrologic modifications implemented and planned by CERP will have an effect on the regional-scale hydrology near the Turkey Point site, particularly those modifications that increase sheet flow to the nearshore coastal waters around the Turkey Point site, as well as potential modifications of the freshwater groundwater hydrology. Future CERP projects that are discussed in the 2010 report (USACE 2010-TN113) are included in the cumulative effects analysis discussed in Chapter 7.

In the vicinity of Turkey Point, the role of CERP is limited to the Model Lands. The Model Lands are described in Section 2.2.1.6 and include FPL's 13,367 ac South Dade Mitigation Bank, (USACE/SFWMD 2011-TN1330) which is targeted for restoration through CERP. The CERP project BBCW is discussed below in the Biscayne Bay System subsection.

Regional Hydrologic System

For surface water, the regional hydrologic system is considered to encompass the area east and south of the section of the ACR near Biscayne Bay (Figure 2-12). As described in the subsection on the South Florida Hydrologic System, the ACR has swales that connect Shark River Slough to the coastal areas west of Biscayne Bay. At the southern end of the ACR, Taylor Slough heads southward from Shark River Slough and connects to the coastal wetlands to the south and east. These areas include those west of the Turkey Point site such as the Model Lands. Under historical conditions and during higher flow periods, freshwater could be conveyed eastward through the various swales or glades and sloughs to the coastal wetlands (Figure 2-10(a) and Figure 2-12).

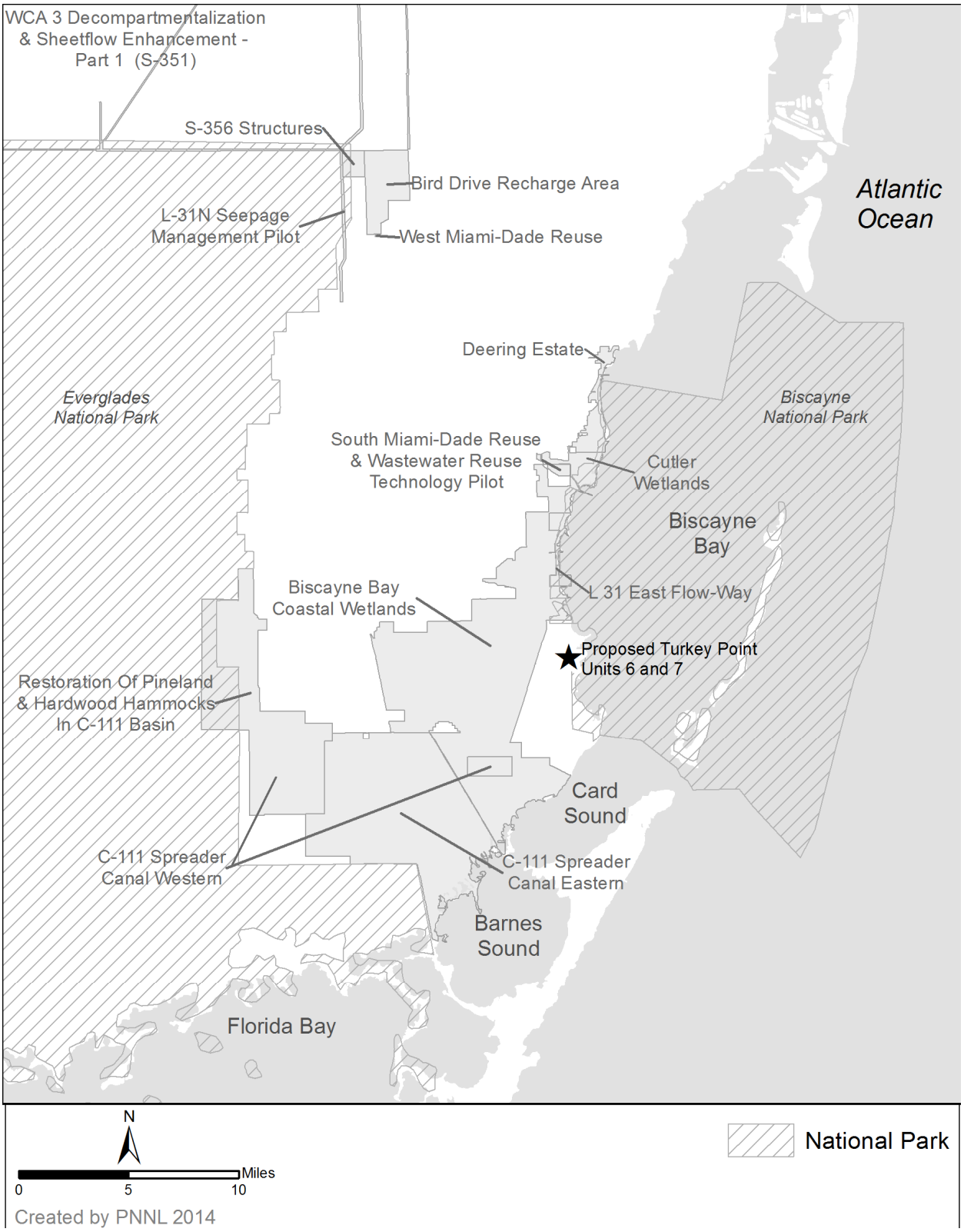


Figure 2-11. Comprehensive Everglades Restoration Plan Projects in Southeastern Florida that are Planned Through 2020 (USACE 2010-TN113)

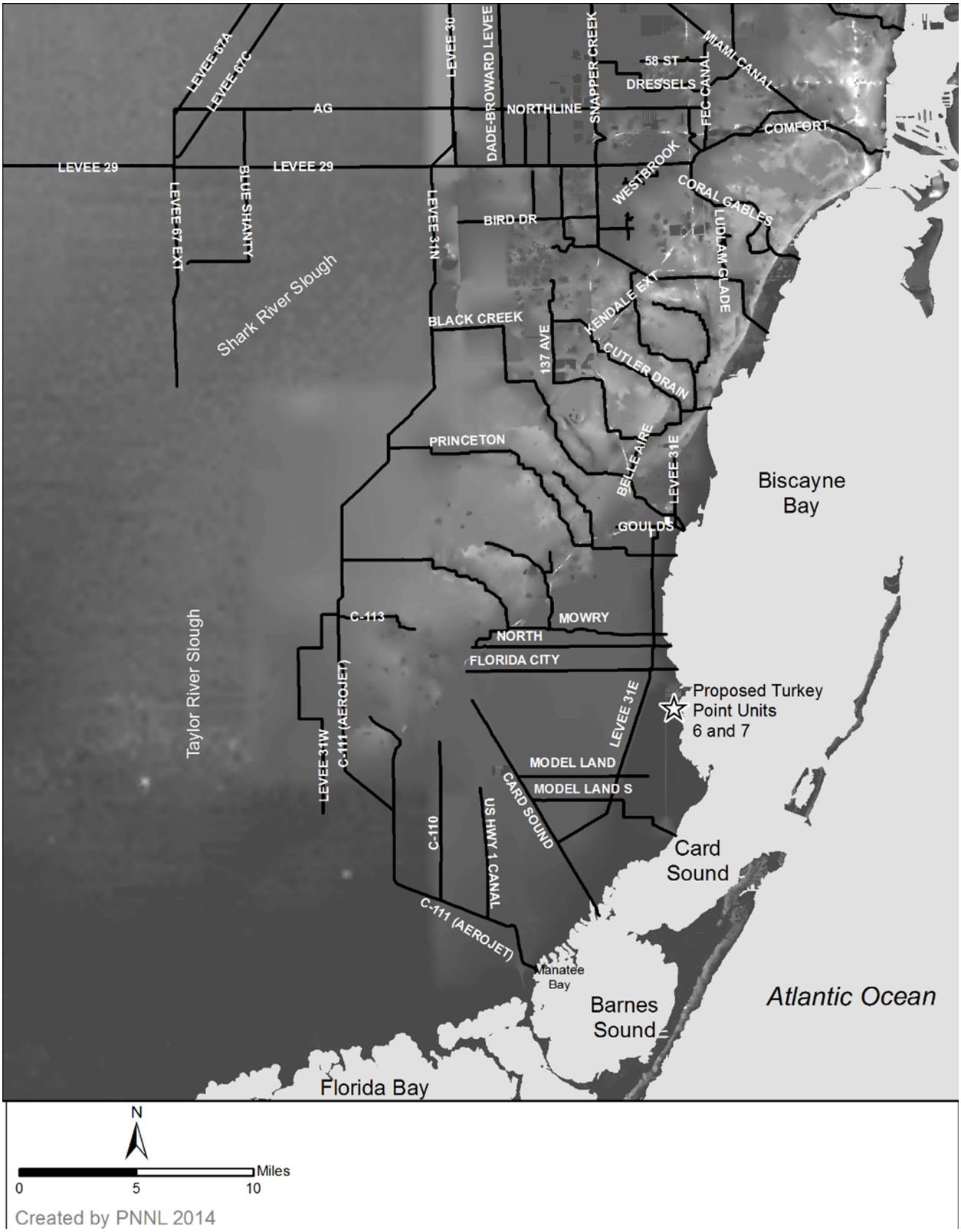


Figure 2-12. Regional Hydrologic System Showing the Canals, Glades, etc. (Adapted from Renken et al. 2005-TN110). *The 1990 canal system is shown, as are the transverse swales through the Atlantic Coastal Ridge.*

Under current conditions, canals crisscross the landscape and discharge into Biscayne Bay and Card Sound. As seen in Figure 2-12, the canals are routed through the transverse swales or glades to drain interior regions. The following are the major canals in the region, particularly those near the Turkey Point site:

- L-31E Canal extends southward along Biscayne Bay past Turkey Point site and the cooling canals.
- Florida City, North, and Mowry canals extend from the ACR to Biscayne Bay north of Turkey Point site.
- Model Land, Model Land S, and Card Sound Canals are west and south of Turkey Point site and extend from the Model Lands Area eastward; the Card Sound Canal extends to the Card Sound.
- The C-111 Canal is the southernmost canal of the system, which ultimately discharges into Manatee Bay (Figure 2-12).
- Aerojet Canal is west of Turkey Point site and on the west and south sides of the ACR, extending to Manatee Bay and Barnes Sound via the C-111 canal (Figure 2-12).
- Princeton, Goulds, Black Creek, Cutler Drain, Snapper Creek, and Coral Gables Canals are north of Turkey Point site, are placed in swales crossing the ACR, and extend to Biscayne Bay.

As discussed in the CERP section above, several projects have been or are being implemented in the region near the Turkey Point site. Of these, the ones that are designed to enhance sheet flow into Everglades National Park via Shark River Slough (Figure 2-12), including increased sheet flow into Taylor Slough (Figure 2-12), are expected to increase the hydroperiod of the regional wetlands by exceeding the hydroperiod observed prior to restoration. The projects for the restoration of BBCW are discussed in the Biscayne Bay System subsection below.

The implementation of the C-111 spreader canal system is intended to create a hydraulic ridge along the east side of Everglades National Park, which in turn will improve the quantity, timing, and distribution of flows through Taylor Slough into Florida Bay (USACE/SFWMD 2011-TN1330). Improvements in hydroperiod and distribution are anticipated in the Model Lands and Southern Glades. Reduction of salinities in Florida Bay and adjacent water bodies is also expected.

Biscayne Bay System

The hydrology and hydrodynamics of Biscayne Bay are influenced by several factors: tidal exchange with the marine waters of the Atlantic Ocean, surface and groundwater inflows of freshwater, precipitation, and evaporation.

Tidal exchange occurs through the channels and openings between the keys that define the east margin of Biscayne Bay (Figure 2-13). Tidal exchange with the Atlantic Ocean influences both the tidal elevations and the salinity of Biscayne Bay. Along the western margin, the salinity of the coastal region of Biscayne Bay is affected by freshwater inflows, which historically entered via sheet flow and creek flows across the landscape, but which at present enter via the

many canals that discharge to Biscayne Bay. In addition, historical reports of freshwater springs bubbling up through the saltwater in Biscayne Bay appear in the literature (Cantillo et al. 2000-TN108). Bellmund et al. (2008-TN123) supporting the assertion that there is continued influx of freshwater to the bay from groundwater, although it is reduced from historical levels. Rainfall is another significant source of freshwater entering Biscayne Bay. Evaporation from the surface of Biscayne Bay during warmer periods tends to increase salinity to concentrations greater than those present in the nearby Atlantic Ocean, especially if freshwater inflows are at a minimum.

The development of South Florida and the construction of canals throughout southern Florida have altered the quality, quantity, timing, and distribution of freshwater flow into Biscayne Bay. The modified hydrology can produce hypersaline (with salinity greater than marine waters) conditions during the dry season (November to June) in Biscayne Bay and a coastal region of low productivity (USACE/SFWMD 2011-TN1038). The addition of canals that discharge into Biscayne Bay has increased freshwater flows into the bay but at discrete locations rather than as widespread sheet flow.

Stalker et al. (2009-TN124) used isotope tracer analysis to estimate the fraction of freshwater inflows from available sources using monthly samples collected from 2004 to 2006. Stalker et al. (2009-TN124) found the respective bay-wide percentages of canal, precipitation, and groundwater input to Biscayne Bay to be 37 percent, 53 percent, and10 percent during the wet season and 40 percent, 55 percent, and 5 percent during the dry season. The largest groundwater fractions were found at stations near the western coastline of Biscayne Bay, but overall freshwater groundwater inflows accounted for less than 2 percent of the total input of marine waters and freshwaters (Stalker et al. 2009-TN124). Drainage canal inflows accounted for the greatest variability of salinity in the western areas of Biscayne Bay of the three freshwater sources, while precipitation accounted for the greatest salinity variation in the eastern portion of Biscayne Bay (Stalker et al. 2009-TN124). The review team's examination of Stalker et al.'s Figure 7 (Stalker et al. 2009-TN124) indicates that the areal extent of groundwater influence on salinity variation in the western portion of Biscayne Bay was greatest during the wet season.

The CERP-related restoration plans for the Biscayne Bay System are summarized in the EIS Regional Hydrologic System a subsection of the Final Integrated Project Implementation Report and Environmental Impact Statement (EIS) (USACE/SFWMD 2011-TN1038). The restoration plan for Biscayne Bay uses a phased approach. Phase 1 encompasses 3,761 ac in three hydrologically distinct regions. The three regions include the following:

- Deering Estate – construction of a freshwater wetland and delivery of freshwater to the coastal wetlands via the Cutler Drain Canal
- Cutler Wetlands – conveyance of freshwater via a lined canal to a spreader canal in a saltwater wetlands
- L-31 East Flow Way – isolation of the L-31E Canal from the major discharge canals and allowing freshwater flow through the L-31E Levee into saltwater marsh. Pump stations and culverts are to be added to facilitate freshwater discharges.

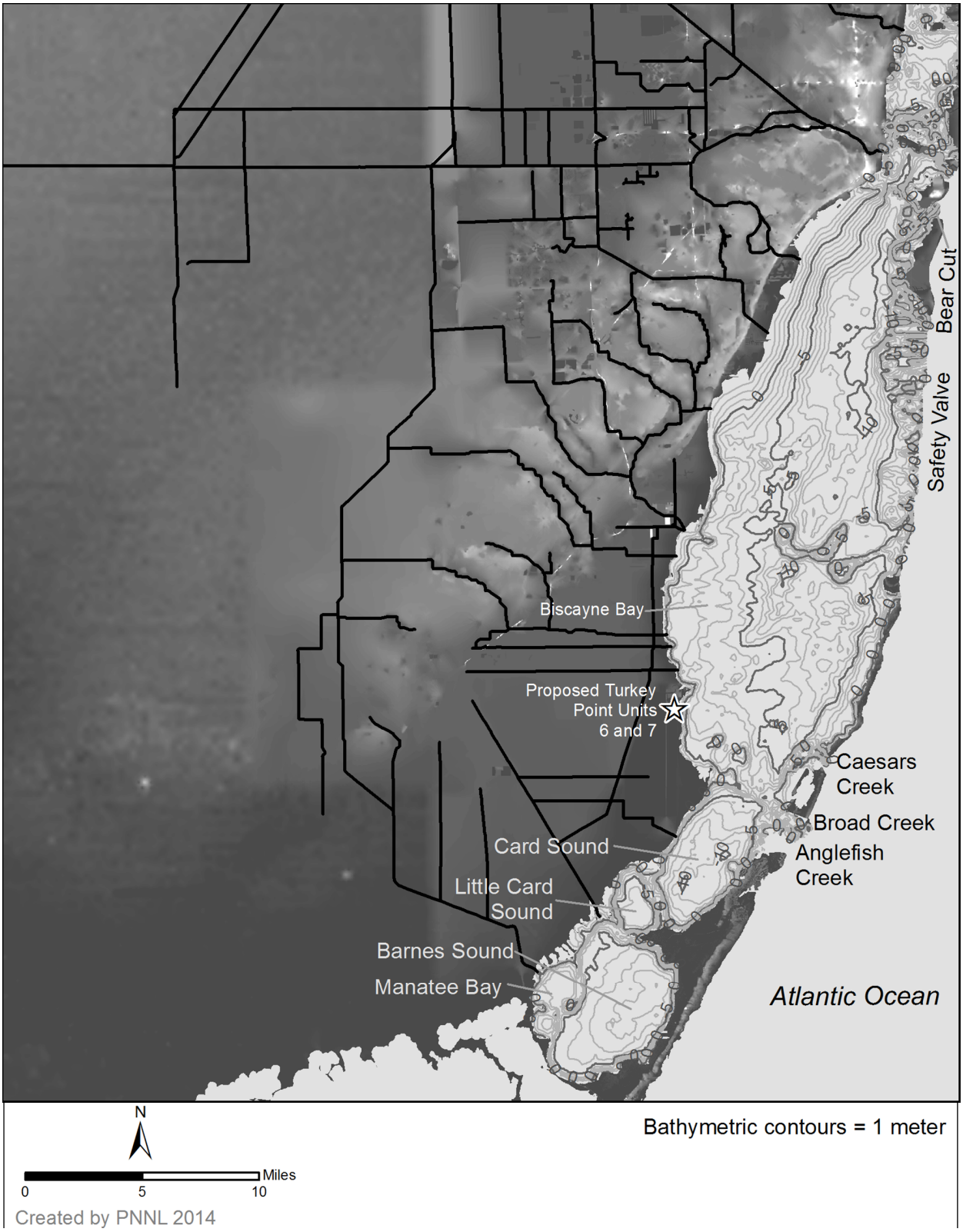


Figure 2-13. Biscayne Bay Bathymetry and Features (major canals, openings to the Atlantic Ocean)

A fourth region included in the overall restoration plan is the Model Lands west of Turkey Point site, but it is not part of the Phase 1 effort.

Phase 1 is anticipated to divert 59 percent of the freshwater discharges from the current direct discharges to Biscayne Bay and add them to the freshwater and saltwater wetlands along the coast (USACE/SFWMD 2011-TN1038). The Phase I effort is expected to also reduce nitrogen and phosphorus loading to Biscayne Bay by 50 percent (USACE/SFWMD 2011-TN1038).

Bellmund (2011-TN1317) presents the results of a salinity study of Biscayne Bay through 2008 from 34 stations largely found in the western portion of the bay. Several surface-water sampling stations are near Turkey Point site, and the review team used the measurements to examine salinity variability under the existing conditions. Bellmund (2011-TN1317) designates the months of June through October as the wet season and November through May as the dry season; the review team used these same periods to define wet and dry seasons.

To analyze the salinity results, the review team considered several factors: average ocean salinity, evaporative losses, and freshwater inflows. Average ocean salinity provides the baseline around which salinities vary. Evaporation varies seasonally; the highest rates of evaporation occur during the summer (the wet season), which tends to increase salinity. Freshwater inflows (canal discharges and precipitation) vary seasonally; the highest rates occur in the summer to early fall (wet season), which tends to decrease the salinity. The review team analysis considered available measurements at four stations near Turkey Point site (Figure 2-14). These samples were collected from the bottom of the water column.

The salinity time series (at 15-minute intervals) for these stations are shown in Figure 2-15. Salinities vary seasonally with the wet and dry season due to freshwater inflows and evaporation. The lowest salinities typically appear in late summer through the end of the calendar year, while the highest salinities occur in spring to early summer, which corresponds with the generally accepted dry period of November through May. The seasonal range is greater for the nearshore stations than for the mid-bay stations. A statistical summary of the salinity data for the nearshore stations (BISCA6 and BBCW10) and the mid-bay stations (BISC12 and BISC18) is provided in Table 2-9. The nearshore stations have larger ranges and standard deviations than the mid-bay stations (Table 2-9), indicating higher salinity variability at the nearshore stations. The minimum salinities at the nearshore stations are less than 10 psu, while the minimum salinities at the mid-bay stations are just below 20 psu. The maximum salinities at the nearshore stations are between 45 and 50 psu, while the mid-bay stations have maximum salinities just below 45 psu. The nearshore stations have a larger range and standard deviation because they are influenced by freshwater inflows and evaporation in the nearshore (evaporation from a smaller depth and volume increases the salinity more than evaporation from a greater depth).

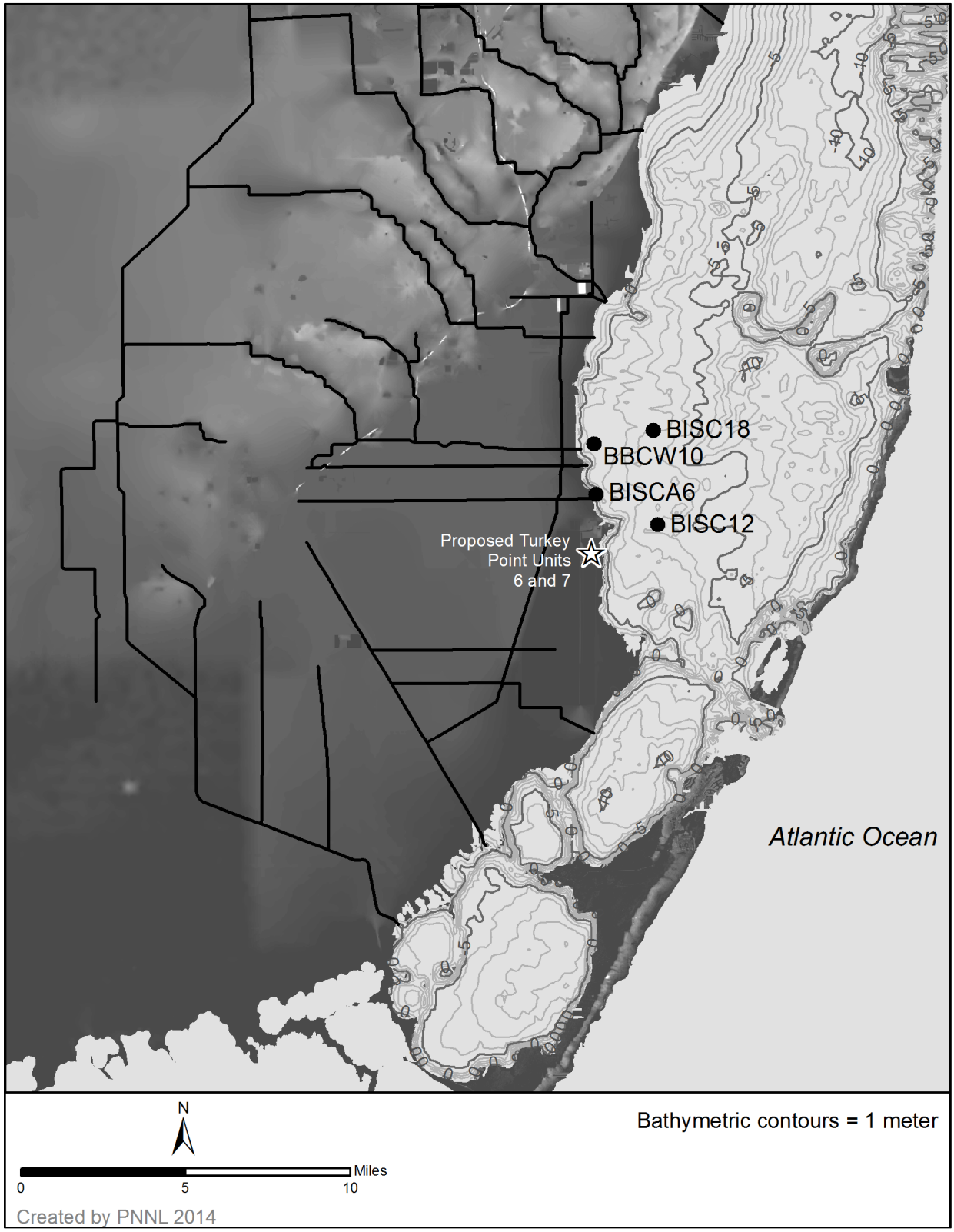


Figure 2-14. Salinity Station Locations in Biscayne Bay. ***Stations BISC12 and BISC18 are mid-bay stations, while stations BISCA6 and BBCW10 are nearshore stations (Bellmund 2012-TN4118)***

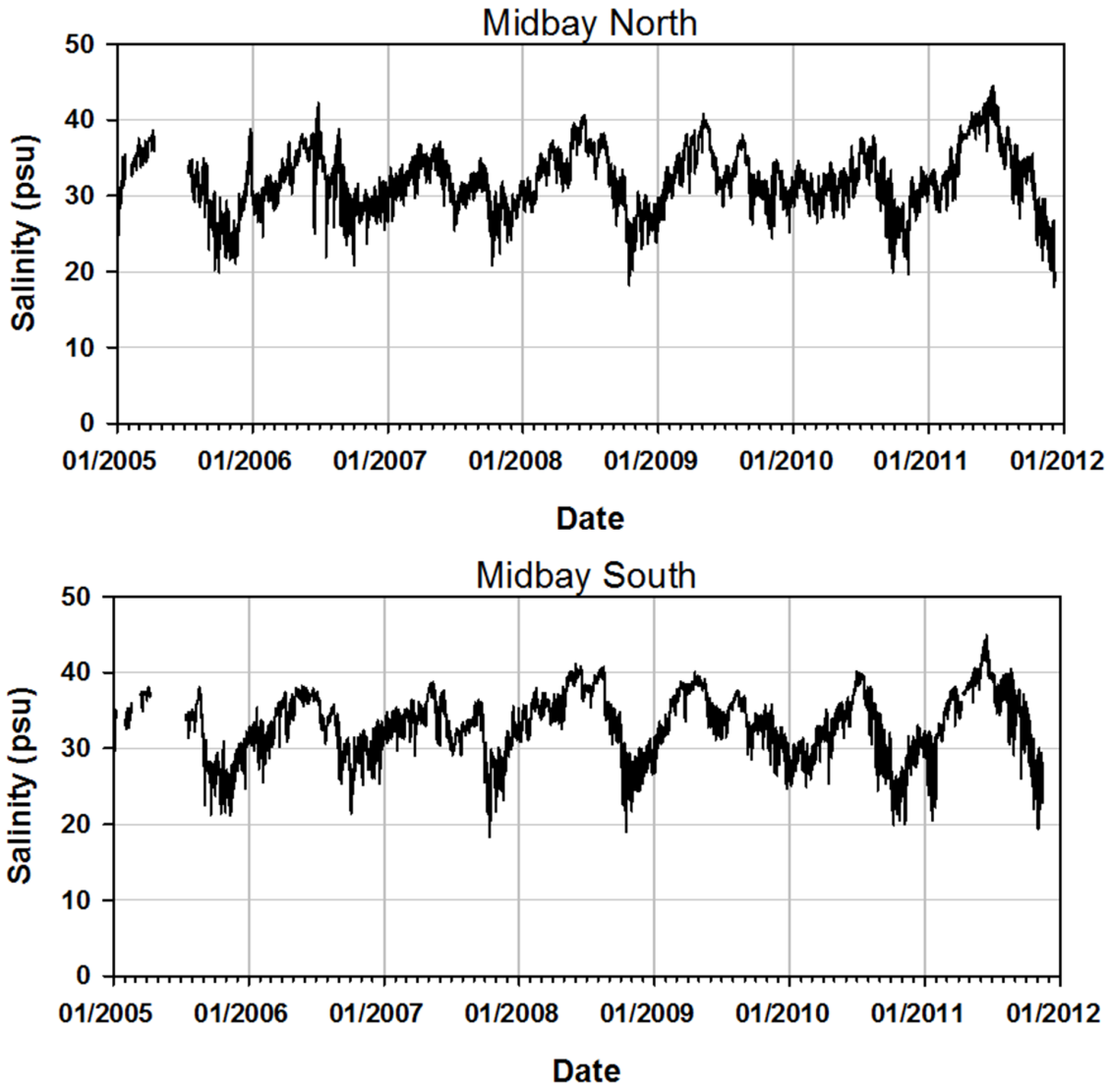


Figure 2-15. Salinity Time Series from 2005 through 2012 for the Four Stations near the Turkey Point Site (Bellmund 2012-TN4118)

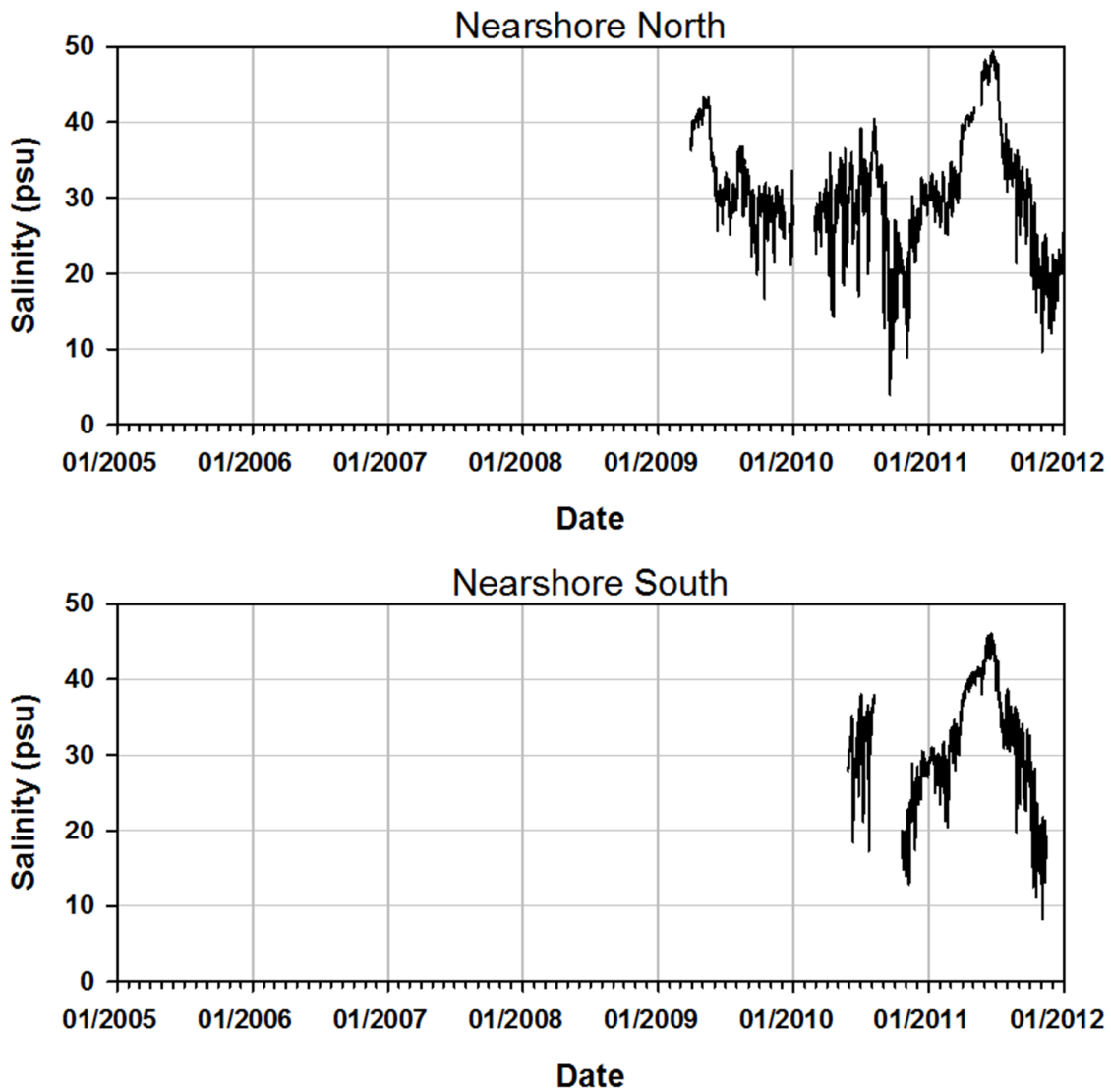


Figure 2-15. (contd)

Table 2-9. Summary Statistics of Salinity at the Four Measurement Stations near the Turkey Point Site

Station	Number of Sample	Mean (psu)	Standard Deviation (psu)	Minimum (psu)	Median (psu)	Maximum (psu)
Nearshore North	86,371	30.2	7.6	4.0	30.1	49.4
Midbay North	232,583	32.1	4.0	17.9	32.0	44.5
Nearshore South	44,233	31.1	7. 7	8.2	31.6	46.1
Midbay South	226,683	33.1	4.1	18.3	33.5	44.9

psu = practical salinity units

Local (Site) Hydrologic System

Local drainage areas include the proposed Units 6 and 7 plant area, the RWTF, and the facilities for the radial collector wells. In addition, natural hydrologic features that are near the Turkey Point site include the Model Lands to the west and south and the immediate coastal areas of Biscayne Bay to the east. Another important local hydrologic feature are the cooling canals, which cover an area of approximately 4,370 ac south of the Turkey Point site (Figure 2-2). The cooling canals are part of the IWF; they are not considered a natural water body and are not subject to State and Federal (EPA) water-quality standards. Releases of industrial wastewater to the IWF and eventual infiltration into groundwater are authorized by State Industrial Wastewater Facility Permit No. FL0001562 (FPL 2014-TN4058).

Site Drainage

To estimate a water budget for the environmental review, the review team estimated average and maximum annual runoff from the facilities of proposed Units 6 and 7 using the areas reported in FPL's stormwater management plan (FPL 2011-TN303). Within the 507 ac Units 6 and 7 project area, the sub-basin areas considered by FPL (2011-TN303) for the existing condition include the following (Figure 2-16):

- Units 6 and 7 power block including the area of the proposed makeup water reservoir (198.3 ac) and laydown areas (46.0 ac west of the plant site across the west-return canal of the cooling-canal system [CCS]). Both the plant area and laydown areas drain into the IWF.
- The proposed locations for east and west administration and training buildings and parking area (31.8 ac). There is currently no stormwater discharge from these areas because they are surrounded by berms, and stormwater is retained within the berms and infiltrates into the ground.
- The proposed location for the RWTF (43.5 ac) is west-northwest of the plant area. The location currently is undeveloped with drainage to the surrounding wetlands.

The review team located the nearest continuous precipitation gage at Homestead General Aviation (Coop ID 084095) (NOAA 2012-TN1316), which is about 15 mi northwest of the site. The review team estimated an average annual precipitation of 57.10 in. and maximum annual precipitation of 71.53 in. during the period from 2001 through 2010. USDA (2012-TN1314) reports that the soil type at the proposed RWTF location, from which stormwater discharge is anticipated to discharge to the local area, is largely Pennsuco marl with some Terra Ceia muck. Both of these soil types are described as being poorly drained, having water tables very near (within 6 in.) or at the surface, and being subject to frequent flooding. Since the water table is so close to the surface the soil has almost no capability to absorb precipitation. Hence, the review team conservatively assumed 100 percent of precipitation runs off the areas. As stated above, the proposed locations for east and west administration and training buildings and parking area are enclosed by berms, but for the other areas, the review team again conservatively assumed that all precipitation runs off because of the shallow water table. Using the average precipitation rate and conservatively assuming 100 percent runoff with no losses to groundwater or evaporation, the review team computed the annual average runoff from the proposed RWTF area to be approximately 207 ac-ft (Table 2-10), which discharges to its

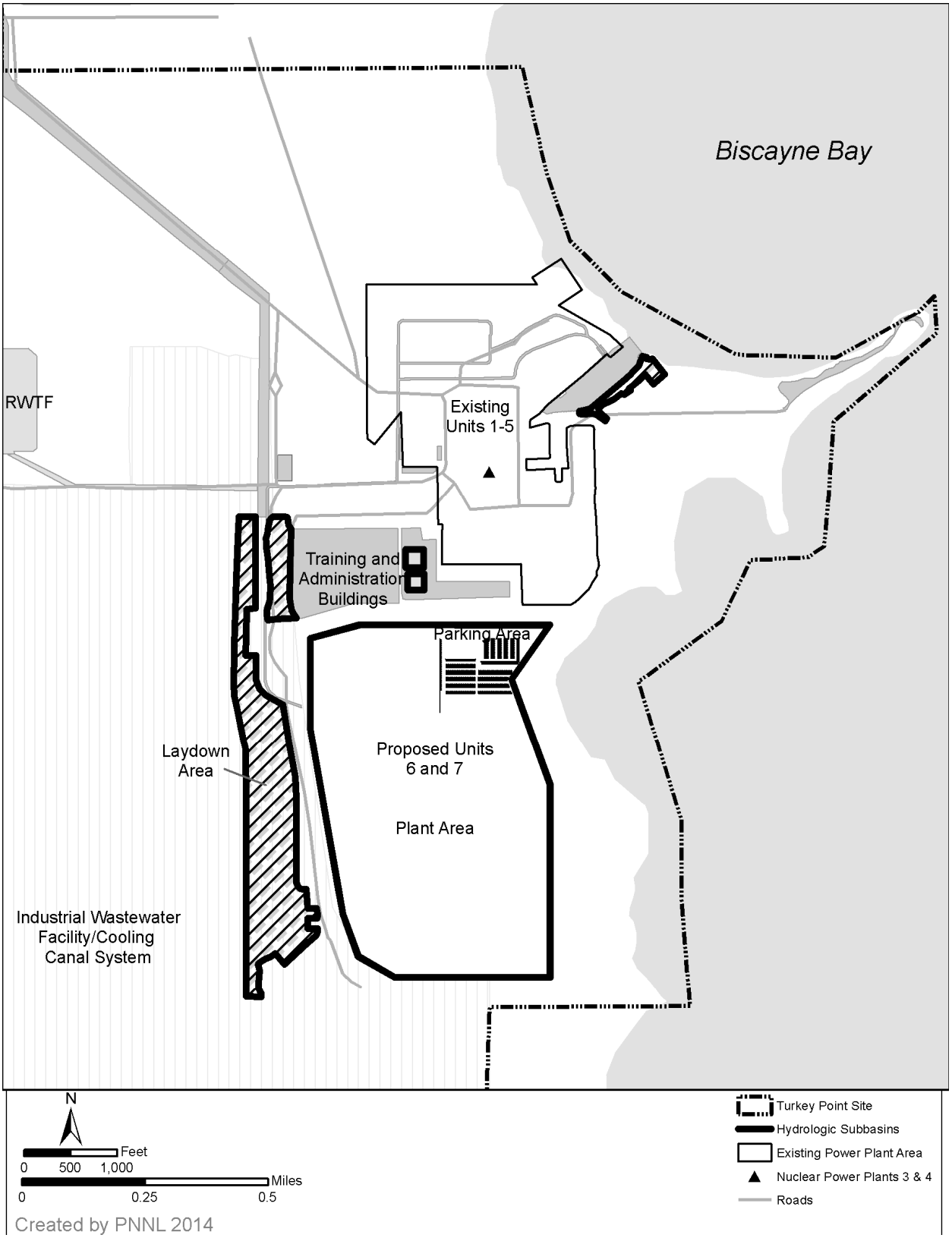


Figure 2-16. Site Drainage Sub-Basins for the Existing Condition (FPL 2011-TN303)

Table 2-10. The Review Team Estimates of Average and Maximum Annual Runoff Under the Existing Condition from Sub-Basins on FPL Property at the Turkey Point Site

Sub-Basin	Area (ac)	Average Annual Runoff (ac-ft)[(a)]	Maximum Annual Runoff (ac-ft)[(b)]
Units 6 and 7 Power Block and Laydown Areas	244.3	1,163	1,456
Proposed Admin Buildings and Parking Areas	31.8	No Runoff[(c)]	No Runoff[(c)]
Subtotal	276.1	1,163	1,456
Proposed RWTF	43.5	207	259
Total	319.6	1,307	1,715

(a) Based on review-team-computed runoff for 2001 through 2010. Assumes 100 percent runoff from the average annual rainfall for the period.
(b) Assumes 100 percent runoff from the maximum annual rainfall for the period.
(c) Area is surrounded by berms so there is no surface drainage (FPL 2014-TN4058)

surrounding wetland area. With maximum annual precipitation, the review team computed the maximum annual runoff to be 259 ac-ft from the proposed RWTF area. For the combined Units 6 and 7 power block and laydown areas, which drain into the IWF, the review team computed the annual average runoff to be 1,163 ac-ft and the maximum annual runoff to be 1,456 ac-ft. Since the proposed locations of the east and west administration and training buildings and parking area are enclosed by berms, they do not drain to the Biscayne Bay or the IWF but infiltrate into the surficial aquifer.

Nearby Hydrologic Features

The natural surface-water hydrologic systems near the Turkey Point site include the Model Lands to the west (which function as wetlands) and the nearshore of Biscayne Bay to the east. The Model Lands include FPL's 13,367 ac South Dade Mitigation Bank (USACE/SFWMD 2011-TN1330). At present, the Model Lands are hydrologically isolated from Everglades flows due the presence of roads and drainage canals (USACE/SFWMD 2011-TN1330). Currently, the area is composed of wetlands that can experience extreme hydroperiod events (periods without inundation) (USACE/SFWMD 2011-TN1330). Biscayne Bay to the east is a shallow saline estuary in a limestone depression (USACE/SFWMD 2011-TN1038). The Biscayne Bay coast near the Turkey Point site is lined by mangrove wetlands, particularly north of the site (USACE/SFWMD 2011-TN1038). An existing barge-turning basin dredged from the shoreline of the Turkey Point site in 1979 to provide for oil and equipment delivery (FPL 2014-TN4058) to the existing site.

Industrial Wastewater Facility

Biscayne Bay is the most important and most visible natural hydrologic feature in the vicinity of the proposed site and the IWF is by far the most important and most visible anthropogenic feature in the vicinity of the proposed site. The IWF covers an area running approximately 5 mi along the Biscayne Bay shoreline and covering an area of about 5,900 ac (FPL 2014-TN4058)..

The initial cooling system design for the existing power-generation facilities at the Turkey Point site was a once-through design that withdrew water from and discharged water to the Biscayne Bay through intake and discharge structures. In order to reduce the impacts on the Biscayne Bay, based on an agreement with the U.S. Environmental Protection Agency (EPA) the cooling system was changed and the IWF was constructed as an alternative to the earlier once-through design. The IWF does not rely on intake and discharge structures with a direct connection to the Biscayne Bay.

The IWF is a closed-cycle cooling system, but is not a closed hydrologic system. Instead of rejecting heat to nearby water bodies, the closed-cycle cooling system was designed to reject waste heat to the atmosphere. Heat exchange to the atmosphere occurs through a variety of processes including evaporation. Evaporation results in an overall net loss of water in the cooling canals. However, water from the cooling canals also infiltrates the underlying Biscayne aquifer in some areas (FPL 2012-TN3439).

The design of the IWF uses gravity to force the cooling water to follow a long and slow trajectory through a series of parallel canals from where the heated water leaves plants to where it returns to the plant after having lost heat to the atmosphere. Pumping the water from the return side of the IWF closest to Biscayne Bay to a higher elevation on the inland side of the existing units causes the water to circulate.

The water in the IWF is designed to circulate from north to south and then return from the south to the north along the east side of the IWF cooling canals. During normal operation of the existing nuclear power units 3 and 4, this results in the lower overall water surfaces along the eastern berm with the lowest water surface at the north end along the eastern berm because of the drawdown created by the existing plant cooling-water intake (FPL 2014-TN4069).

Evaporation from the IWF causes freshwater to enter the atmosphere causing the concentration of remaining solutes to increase proportionally. Salinity in the IWF can exceed the typical value of ocean salinity by a factor of two or more. The increase in salinity results in an increase in the density of the water in the cooling canals (FPL 2012-TN3439).

The temperature of the water discharged from the existing plant's cooling systems is elevated by the rejected heat. The increase in temperature results in a slight decrease in density of the water in the cooling canals. However, density increase associated with the increase in salinity dominates. The water in the IWF cooling canals is more dense than either seawater or freshwater.

The normal operation of the existing nuclear power units 3 and 4, results in the release of tritium to the IWF. Unlike other constituents in the water (e.g., salt), evaporation results in tritium being released to the atmosphere. Radioactive decay also reduces tritium concentrations so that they do not continue to build up in the cooling canals.

The water quality in the canals varies inter-annually and intra-annually in response to plant operation and meteorological conditions. Rainfall will cause the salinity in the canals to decrease. Evaporation from induced evaporation and hot, dry meteorological conditions will cause salinity to increase over time. Temperatures in the cooling canal will decrease during the winter (FPL 2012-TN3439).

The construction of the IWF and the canals outside the IWF has prevented freshwater sheet flow from inland areas from reaching Biscayne Bay adjacent the cooling canals. Given the vast extent of the canals this has likely further increased the hypersalinity in poorly mixed shallow coastal areas subject to natural evaporation, although, the exact magnitude of this alteration is unknown.

While the IWF is appropriately called a closed-cycle cooling system, this does not mean it is a closed hydrologic system. The unlined canals allow the water in the IWF to exchange with adjacent surface waterbodies and groundwater aquifers beneath the site. The rates of water exchange are determined by the potentiometric head gradients between the various water bodies. These potentiometric head gradients change spatially and temporally (FPL 2012-TN3439).

Water can seep through the unlined berms surrounding the IWF. Based on the potentiometric gradient at a given time, water can move either into or out of the IWF from the adjacent water bodies. Given the length of the berms and the proximity to water bodies, seepage through the western berm into the interceptor ditch and eastern berm into Biscayne Bay are the largest and most significant exchanges.

The interceptor ditch was installed to create a hydraulic barrier outside the western berm to prevent migration of hypersaline seepage westward. Water seeping into the interceptor ditch is pumped back into the IWF (FPL 2014-TN4058).

The potentiometric gradient along the eastern berm is controlled by the tidal elevation in Biscayne Bay, the water-surface elevation in the IWF along the eastern berm, and the density of the water in the IWF. During low tide conditions the potentiometric gradient could cause water to seep from the IWF into Biscayne Bay along the entire length of the eastern berm. During high tide conditions the potentiometric gradient could cause water to seep into the IWF from Biscayne Bay along the entire length of the eastern berm. Since during operation the water-surface elevation within the cooling canals along eastern berm decreases from south to north, there will be times when water may seep out of the IWF at the south end of the berm and seep into the IWF at the north end of the berm. Actual seepage will be attenuated by the tidal cycle relative to the travel time through the berm. The volume of the IWF and this attenuation masks any response between the IWF and Biscayne Bay to daily tidal fluctuations. The review team does acknowledge that some degree of hydraulic connection related to the tidal cycle exists.

Water from the IWF also can move into and out of the aquifer beneath the IWF. The downward movement of water is impelled by the increased density because of the elevated salinity of the water in the IWF. Observations of water quality beneath the IWF suggest a hypersaline plume extending down to the base of the Biscayne aquifer that may increase in size because of the continued presence of hypersaline water in the IWF. While the overall general movement is from the IWF downward, during certain conditions water from the aquifer can also move upward. High potentiometric heads in the regional groundwater system possibly associated with high tides and wet conditions can cause water from the aquifers to move back up into the IWF (FPL 2012-TN3439).

Recently, the IWF has experienced algal blooms, increased water temperatures, and increases in concentrations in salinity and nutrients. The precise cause of this anomaly is not understood

at this time. However, FPL has been working to assess the causes and take actions to mitigate these changes in the IWF (Tetra Tech 2014-TN4126). In October 2014, the review team conducted a supplemental site audit to determine if the aforementioned changes in the IWF would result in additional information to inform the environmental review for the proposed new units or alter conclusions submitted by FPL in the ER (NRC 2014-TN4115). The review team's audit found no indication that the recent changes to the IWF would result in changes to the environmental review for the proposed Units 6 and 7 (NRC 2014-TN4115).

2.3.1.2 Groundwater Hydrology

Groundwater aquifers in the region and the vicinity of the Turkey Point site are described in Section 2.3 of the ER (FPL 2014-TN4058). Additional information about the site groundwater and geology is also provided in Sections 2.4.12 and 2.5 of the FSAR (FPL 2014-TN4069). Geohydrologic descriptions provided in these documents are consistent with regional descriptions for Southeast Florida provided in the U.S. Geological Survey (USGS) Ground Water Atlas of the United States, Chapter 6 (Miller 1990-TN550).

The two major aquifer systems found at Turkey Point are the surficial aquifer system and the deeper Floridan aquifer system. The uppermost surficial aquifer system in the vicinity of Turkey Point site is called the Biscayne aquifer. Low-permeability confining units separate the Biscayne aquifer and the underlying Floridan aquifer system and limit exchange of groundwater between these aquifer systems (Miller 1990-TN550). Figure 2-17 shows the sequence of aquifer systems and their relative depths and thicknesses at the site. The review team compiled this information based on local site investigations presented in the FSAR (FPL 2014-TN4069), results from FPL's exploratory well EW-1 presented in FPL 2012-TN1577, and information from Reese and Richardson 2008-TN3436.

Biscayne Aquifer

The Biscayne aquifer has an area of about 4,000 mi^2 and underlies nearly all of Dade and Broward Counties. It varies from 0 ft thick in the south-central part of Florida to more than 240 ft thick north of Fort Lauderdale (Miller 1990-TN550) and is approximately 80 to 115 ft thick in the vicinity of the Turkey Point site (FPL 2014-TN4058).

Regionally, the Biscayne aquifer is primarily under unconfined conditions. However, stratification caused by beds of lower and higher permeability may cause semi-confined or locally confined conditions (Fish and Stewart 1991-TN1340). At the Turkey Point site, the Miami Limestone (Miami Oolite) unit of the Biscayne aquifer is overlain by a surficial layer of "organic muck" described as light to dark gray to pale brown with trace amounts of shell fragments, or as black to brown with organic fibers (FPL 2014-TN4058). This organic layer was estimated to vary from 2 to 7 ft thick in the Units 6 and 7 plant area. The water table at the site is found either in the Miami Limestone or in the overlying organic muck (FPL 2014-TN4058). The bottom of the Biscayne aquifer is defined by the top of laterally extensive beds of much lower permeability rock called the Intermediate Confining Unit, which separates it from the underlying Floridan aquifer system (Reese 1994-TN1439). At the plant site, the Intermediate Confining Unit is about 870 ft thick and contains extensive layers of clay-rich sediments within the lower part of the Tamiami Formation and the underlying Hawthorne Group (Fish and Stewart 1991-TN1340; FPL 2012-TN1264; FPL 2012-TN1577).

SERIES	STRATIGRAPHIC UNIT		LITHOLOGY	TOP DEPTH (ft)	THICK-NESS (ft)	HYDRO-GEOLOGIC UNIT	TOP DEPTH (ft)
HOLOCENE	organic muck		organic soil and silt	0	3	Biscayne Aquifer	0 - 3
PLEISTOCENE	Miami Formation		sandy, oolitic limestone	3	25		
	Key Largo Limestone		well indurated, vuggy, coraline limestone	28	22		
	Ft Thompson Formation		poor/well indurated fossiliferous limestone	50	65		
PLIOCENE	Tamiami Formation		sand and silt with calcarenite limestone	115	105		
						Intermediate Confining Unit	140
MIOCENE	Hawthorne Group	Peace River Formation	silty calcareous sand and silt	220	235		
		Arcadia Formaion	calcareous wackestone with indurated limestone, sandstone and sand	455	555		
OLIGO-CENE	Suwannee Limestone		fine-grained limestone and dolomitic limestone	1010	245	Upper Floridan Aquifer (USDW)	1010
EOCENE	Avon Park Formation		fine-grained limestone and dolomite	1255	(~445)	Middle Floridan Confining Unit	1450
			permeable limestone	(~1700)	(~75)	APPZ (?)	(1700)
			fine-grained limestone and dolomite	(1775)	745	Middle Floridan Confining Unit	1930
	Oldsmar Formation		limestone, dolomitic limestone and dolomite	2580	450		
						Lower Floridan Aquifer	2915
			Boulder Zone	3030	>200	Boulder Zone	3030

APPZ (?) denotes uncertainty

Figure 2-17. Geologic Stratigraphy and Major Aquifers Beneath the Turkey Point Site (based on information from FPL 2012-TN1577 and FPL 2014-TN4069).

Recharge of the Biscayne aquifer from precipitation occurs primarily during the wet season, from June to October with minimal recharge during the dry season, from November to May. However, seepage from freshwater canals usually continues to recharge the aquifer during the dry season (Fish and Stewart 1991-TN1340).

Before development, including construction of canals to drain inland areas, the wet season recharge was greater than it is today, and resulted in higher subsurface flows of groundwater into Biscayne Bay (Renken et al. 2005-TN110). In a study of groundwater discharge to Biscayne Bay, Langevin (2001-TN1338) used a regional-scale model to estimate that the

average rate of fresh groundwater discharge to Biscayne Bay for the 10-year period (1989–1998) was about 53 Mgd over a 100 km length of coastline. He estimated that this simulated discharge rate was about 6 percent of the measured surface-water discharge to Biscayne Bay over the same period, which compares favorably with the 5 percent estimated by Stalker et al. (2009-TN124). Langevin (2001-TN1338) also determined that nearly all of the groundwater discharge occurs in the northern part of Biscayne Bay with very little occurring south of the Cutler Drain Canal, which is north of Turkey Point. Discharge of groundwater in the southern area was small because the low elevation of the water table reduces the hydraulic gradient toward the coast. This indicates that the freshwater canals are a much larger source of freshwater flow to Biscayne Bay in this area than is flow from the inland Biscayne aquifer. As discussed in Section 2.3.1.1 above, efforts are under way through the CERP BBCW Project to restore some of the diminished infiltration into the Biscayne aquifer and the resultant flow of groundwater to Biscayne Bay (USACE 2010-TN113).

Limited groundwater discharge from the aquifer to Biscayne Bay combined with pumping of groundwater for irrigation and water supply has caused saltwater to migrate inland (Klein and Hull 1978-TN1351; Renken et al. 2005-TN110). Although the EPA has designated the Biscayne aquifer in this area as a “sole-source aquifer,” saltwater intrusion to the aquifer along the coast has made the groundwater too salty to meet drinking water standards over an area from the bay coastline to about 6 to 8 mi inland (Langevin 2001-TN1338; Renken et al. 2005-TN110) near the Turkey Point site, as illustrated in Figure 2-12.

Hydraulic Properties of Biscayne Aquifer

The permeable limestones and sandstones forming the Biscayne aquifer are highly heterogeneous with varying hydraulic properties and may form one or more aquifers separated by locally confining units. USGS studies indicate that the Biscayne Bay sediments form a dual-porosity system consisting of (1) unconnected pores and larger vugs (cavities) in the rock matrix; and (2) connected vugs and solution channels (Cunningham and Sukop 2011-TN1339). These secondary porosity features can result in a layered system with very high horizontal permeability and significantly lower vertical permeability. At the Turkey Point site, two relatively thin high-permeability zones were found during geophysical investigations that included the drilling of 20 groundwater monitoring wells and two deeper geotechnical piezometer boreholes (FPL 2014-TN4069). Well MW-1 was drilled on the Turkey Point peninsula near the planned location of the radial collector wells. At this well, an upper high-permeability zone occurred at the base of the Miami Limestone and in the underlying Key Largo Limestone at a depth of about 25 to 34 ft below ground surface; and another potential lower high-permeability zone was identified within the Fort Thompson Formation at a depth of about 66 to 75 ft below ground surface (FPL 2009-TN1263). However, additional recently drilled boreholes showed that this lower zone of increased permeability is not a laterally persistent layer, but consists of more isolated zones at varying depths below the top of the Fort Thompson Formation (FPL 2009-TN1263).

FPL conducted tests to estimate aquifer hydraulic properties for the Biscayne aquifer. Slug tests were conducted at several monitoring wells in both the upper and lower portions of the aquifer. However, the slug test results are not considered valid because of the high hydraulic conductivity of the aquifer and the effects of the well filter pack, which can limit groundwater flow into the well in very high-permeability aquifers. In addition to the slug tests, FPL conducted

aquifer performance (pumping) tests at each of the proposed reactor unit locations and on the Turkey Point peninsula near the planned radial collector well locations.

Results of the pumping tests at proposed reactor locations are described in FPL's FSAR (FPL 2014-TN4069). At each of the proposed reactor sites, separate pumping tests were conducted in both a well completed in the upper Biscayne aquifer (Key Largo Limestone) and a well completed in the lower Biscayne aquifer (Fort Thompson Formation). These completion zones were chosen to pump water from the identified high-permeability zones. The upper zone pumping wells were open from about 22 to 45 ft below ground surface. The lower zone pumping wells were open from 67 to 87 ft at the proposed Unit 6 site, and from 66 to 105 ft below ground surface at the proposed Unit 7 site. At each reactor site pumping test location, water-level responses were monitored in four observation well clusters about 10 ft from the pumped well and two additional observation well clusters about 25 ft from the pumped well. Each observation well cluster consisted of two or three wells completed at different depths. Duration of pumping was 24 hours for each test and recovery was monitored for more than 24 hours. Results of these tests indicated averaged horizontal hydraulic conductivity of 9,400 to 12,000 ft/d for the upper interval and 300 to 1,000 ft/d for the lower interval (FPL 2014-TN4069). Although the pumping test analysis results presented in FPL 2014(TN4069) may be affected by the complexity of the groundwater flow system and assumptions of the Hantush leaky-aquitard analysis technique (Hantush 1967-TN1860), the review team determined that the test results verify the Biscayne aquifer conceptual model of vertically discrete permeable zones separated by less permeable rocks, with the highest permeability in the interval from about 22 to 45 ft below ground surface. Comparison of the results from the different test sites and from different observation wells at the same site also shows that permeability varies laterally within the Biscayne aquifer.

The aquifer performance test conducted on the Turkey Point peninsula is described by FPL (2009-TN1263). The pumping well was open from 22 to 46 ft below ground surface and five observation wells were completed over approximately the same depth interval at radial distances from 80 to about 2,600 ft. However, a measurable response was detected at only the four nearest observation wells, which were within about 2,000 ft of the pumping well. The longest duration pumping test was 7 days at an average rate of 7,097 gpm. Water-level responses at the observation wells were consistent with the conceptual model of a "leaky" aquifer separated from a constant-head water source (Biscayne Bay) by a confining layer.

FPL's analyses of drawdown at the four observation wells resulted in reported aquifer transmissivity ranging from 368,000 to about 1,000,000 ft^2/d based on a water-level drawdown versus time analysis method that accounted for leaky aquifer conditions (Hantush 1964-TN3655). The FPL-calculated transmissivity values appeared to increase with distance from the pumped well and FPL (2009-TN1263) hypothesized that the increase in hydraulic conductivity with distance was related to aquifer heterogeneity. However, the review team determined that the increase in calculated hydraulic conductivity with distance resulted from the analysis methodology. The review team's independent analysis of the drawdown data (described in Appendix G) was consistent with the aquifer transmissivity of 800,000 ft^2/d estimated by FPL (2009-TN1263) using a distance-drawdown analysis (Cooper and Jacob 1953-TN1508) based on the drawdown at four observation wells. This resulting calculated transmissivity equates to an average hydraulic conductivity of 10,000 ft/d for an aquifer thickness of 80 ft.

The confining layer consists of a combination of relatively low-permeability sediment on the bay floor and the moderately permeable upper portion of the Miami Limestone. The vertical permeability of the Miami Limestone is typically lower than the horizontal permeability. FPL estimated the bay floor sediment to have an average vertical hydraulic conductivity of 0.7 ft/d (FPL 2009-TN1263). The review team's independent analysis of the aquifer performance test resulted in an average vertical hydraulic conductivity of 0.6 ft/d for the confining layer above the Biscayne aquifer.

Groundwater Flow Direction

Regional groundwater flow in both the Biscayne and Upper Floridan aquifers is generally west to east toward the coast (Miller 1990-TN550). However, local flow direction in the Biscayne aquifer near the Turkey Point site is affected by tides and canals (Langevin 2001-TN1338). FPL installed 10 monitoring well pairs (20 wells) in 2008 across the proposed plant area for measuring groundwater levels. Each pair included a well completed in the Miami Limestone/Key Largo Limestone at depths ranging from 14 to 28 ft and a well completed in the Fort Thompson Formation at depths ranging from 85 to 110 ft below ground surface. Results showed that water levels and flow directions in the proposed plant area vary for both the shallow and deep Biscayne aquifer wells depending on the tidal influence of Biscayne Bay (FPL 2014-TN4058). At high tide, the groundwater hydraulic gradient was toward the inland aquifer and at low tide the hydraulic gradient was toward the bay.

The presence of the unlined 4,370 ac IWF cooling canals affects groundwater levels in the proposed location of Units 6 and 7. The canals interact with groundwater in the underlying Biscayne aquifer. Because of high rates of evaporation of the heated water in the IWF, there is an average net inflow of groundwater to the cooling canals (FPL 2012-TN3439). However, groundwater movement between the cooling canals and the underlying aquifer varies by location and is affected by several factors including precipitation, IWF discharge rate, air temperature and humidity, and tidal fluctuations. The salinity of the cooling canal water is greater than that of seawater and about twice the average salinity of Biscayne Bay (FPL 2014-TN4058). The higher density has caused hypersaline water to migrate downward into the aquifer beneath the cooling canals. Movement of cooling canal water into the aquifer was simulated using a numerical model (Hughes et al. 2010-TN1545), which showed that "finger plumes" of hypersaline water likely form beneath the cooling canals and move downward from the base of the cooling canals to the bottom of the permeable zone in a period of days to several years, depending on density differences and the hydraulic conductivity of the aquifer. The hypersaline water would then mix with water in the aquifer through advective and dispersive processes. Water samples collected during the pre-uprate monitoring for Turkey Point Units 3 and 4 from 2010 to 2012 showed that groundwater beneath the approximate center of the cooling canals had chloride concentrations over 35,000 mg/L (Figure 2-18) and tritium concentrations greater than 4,000 pCi/L compared to about 2,200 mg/L chloride and 15 pCi/L tritium in Biscayne aquifer groundwater under Biscayne Bay (FPL 2012-TN3439). Based on this information, the review team concluded that downward migration of cooling canal water into the underlying Biscayne aquifer has occurred and is likely still occurring. However, information from the Units 3 and 4 pre-uprate monitoring also shows that interaction between the cooling canals and aquifer varies both spatially and temporally. Precipitation events were shown to have a large impact of water levels in monitoring wells. Tidal effects on well water levels were only

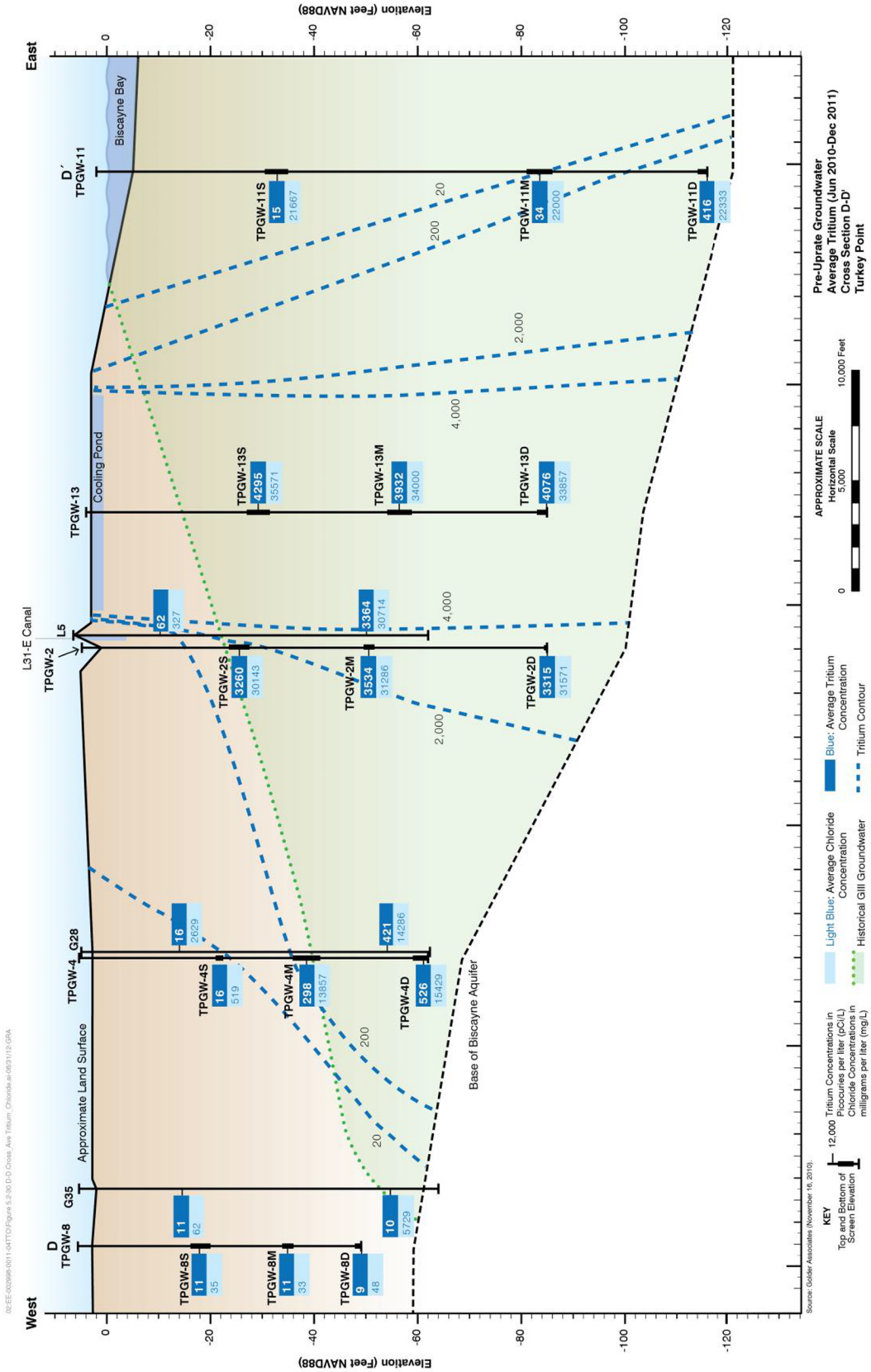


Figure 2-18. Specific Conductance Isopleths Along a West-to-East Cross Section Through the IWF (FPL 2012-TN3439)

observed in wells in or near the bay. Inland wells showed much greater water-level variation between wet and dry seasons than wells near the bay. Increases in operating unit discharges to the IWF could cause increases in both the cooling canal water level and wetted surface area, which are expected to affect the movement of groundwater between the cooling canals and the aquifer.

Groundwater flow in the Biscayne aquifer is also affected by an interceptor ditch adjacent to the west side of the cooling canals and east of the L-31E Canal. Water is pumped from the interceptor ditch into the IWF cooling canals when needed to maintain a water level in the ditch that is lower than the water level in the L-31E Canal. This is designed to keep groundwater from moving westward from the interceptor ditch toward the L-31E Canal and keep cooling canal water from affecting groundwater quality to the west (FPL 2014-TN4069). However, because deeper permeable layers within the Biscayne aquifer may be isolated from hydraulic head in the ditch by lower permeability layers, it is possible that some water from the cooling canals could move to the west. As discussed in Section 2.2.3 below, monitoring by FPL indicates that hypersaline water from the cooling canals has moved west of the L31-E Canal in the deeper part of the Biscayne aquifer.

Floridan Aquifer System

Below the Biscayne aquifer is the Floridan aquifer system, which is composed of dolomite and limestone (Miller 1990-TN550). The Floridan aquifer system is separated from the shallower Biscayne aquifer by the Intermediate Confining Unit (Figure 2-17), which is composed mainly of rocks from the Tamiami Formation and the deeper Hawthorne Group. At the site, the top of the Intermediate Confining Unit occurs at a depth of about 140 ft and is over 800 ft thick (Figure 2-17). The Floridan aquifer system consists of three units which are, from shallowest to deepest; the Upper Floridan aquifer, a less permeable formation known as the Middle Confining Unit (MCU), and the Lower Floridan aquifer. In most areas of South Florida the MCU may also be separated into three distinct units; an upper confining zone known as MC1, a permeable zone called the Avon Park Permeable (or Producing) Zone (APPZ), and a lower confining zone known as MC2 (Reese and Richardson 2008-TN3436).

The Upper Floridan aquifer is an important source of freshwater in parts of Florida, but water from the Upper Floridan is too saline (dissolved solid concentrations greater than 2,000 mg/L) in southeastern Florida to be used for drinking water without treatment (Renken et al. 2005-TN110).

Within the Lower Floridan aquifer in southern Florida there is a cavernous, high-permeability geologic horizon called the Boulder Zone, which is the zone identified for deep-well injection of blowdown water from proposed Units 6 and 7. The extremely high permeability is thought to result from horizontal caverns occurring at multiple elevations connected by large vertical tubes (Miller 1990-TN550) within the unit. The water in the Boulder Zone is very similar to modern seawater both in salinity and temperature. It is thought that the Boulder Zone connects to the Atlantic Ocean at a depth of about 2,500 ft about 25 mi off the coast of Miami. The salinity precludes any interest in the Boulder Zone as a supply of freshwater. The low-permeability dolomite and limestones of the MCU limits the upward migration of water from the Boulder Zone. Because of its isolation and high permeability, the Boulder Zone has been used for

injection of municipal and industrial wastewater in Florida (Miller 1990-TN550). At the exploratory well (EW-1) constructed on the Units 6 and 7 plant site, the Upper Floridan aquifer is composed of relatively permeable layers of sediment within the Suwannee Limestone Formation and the upper portion of the Avon Park Formation, as shown in Figure 2-17 (FPL 2012-TN1577). Lower permeability confining layers that impede the vertical mixing of groundwater were also identified within these depth intervals. The bottom of the deepest underground source of drinking water (USDW) was determined to be between 1,430 and 1,505 ft below ground surface based on water samples collected during packer testing, and was estimated at 1,450 ft based on specific conductance logging (FPL 2012-TN1577). The deepest USDW is within the Avon Park Formation, and is considered part of the Upper Floridan aquifer because of its relatively low salinity.

As shown in Figure 2-17, the uppermost portion of the MCU (MC1), the APPZ, and the lower MCU (MC2) zones are within the Avon Park Formation with the deeper MCU extending into the Oldsmar Formation. The top of the APPZ zone was not explicitly identified by FPL in the report about exploratory well EW-1 or in the report about the dual-zone monitoring well DZMW-1 (FPL 2014-TN4052). Based on information from the EW-1 (FPL 2012-TN1577) and regional information, if it exists at the Turkey Point site, the APPZ is likely within the interval from 1,535 and 1,770 ft below ground surface where FPL documented the presence of both confining and permeable zones at EW-1. While drilling DZMW-1, FPL noted a "significant increase in salinity below a depth of 1,614 feet indicate (sic) the presence of a relatively saline productive interval below this depth." This zone may be part of the APPZ based on its permeability and high salinity. Reese and Richardson (2008-TN3436) show the top of the APPZ at a depth of approximately 1,700 ft at a borehole south of Turkey Point, and missing at a borehole north of Turkey Point. The APPZ is probably less than 100 ft thick based on regional information.

The section of the middle Floridan confining unit between 1,930 and 2,915 ft below ground surface was primarily composed of low-permeability sediments at EW-1. This section includes the lower portion of the Avon Park Formation from 1,930 ft to 2,580 ft and the upper portion of the Oldsmar Formation from 2,580 ft to the top of the Lower Floridan aquifer at about 2,915 ft below ground surface (FPL 2012-TN1577). FPL identified the interval from 1,930 to 2,915 ft as the primary confinement for injectate at the site. The top of the Boulder Zone was identified at a depth of 3,030 ft and extended below the bottom of the EW-1 borehole at 3,230 ft. These depths and thicknesses are consistent with the mapping of statewide information of the Floridan aquifer presented in Reese and Richardson 2008-TN3436.

Seismic-reflection data recently acquired by the USGS in southeastern Florida have identified both linear tectonic faults and "karst collapse" structures up to about 2 mi in diameter that may result in areas of increased vertical flow through the Floridan confining units (Reese and Cunningham 2014- TN4051). One of these karst collapse structures was implicated in the observed migration of injected wastewater from the Boulder Zone to the uppermost permeable zone within the Lower Floridan aquifer at an injection well operated by the City of Sunrise in Broward County, around 60 mi north of the Turkey Point site. An assessment concluded that the observed migration "was a result of the lack of confinement between the two permeable zones and not of lack of mechanical integrity in the existing injection wells." Migration of contaminants above the upper section of the Lower Floridan aquifer was not observed at this site. There is currently no evidence of similar features at the Turkey Point site.

Groundwater Flow Directions within the Floridan Aquifer

Regional groundwater flow within the Floridan aquifer system in South Florida has been generally characterized as complex by Meyer (1989-TN2255) who evaluated previous studies, water quality, hydraulic head, age dating and water temperatures. Based on this data Meyer found that a groundwater divide in the Upper Floridan aquifer runs the length of the Floridan Peninsula with groundwater west of this divide flowing west and east of this divide flowing east. Groundwater levels in wells within the Upper Floridan aquifer near the Turkey Point site confirm that groundwater flows eastward.

The FDEP has permitted around 180 Class I injection wells for municipal and industrial wastewater disposal. The wells predominately inject into the Boulder Zone of the Lower Floridan aquifer. As a result a number of site-specific and regional studies have evaluated fluid movement within the MCU and Boulder Zone. Meyer indicates that in eastern Florida, flow from the Boulder Zone is generally lateral with a component of upward flow into the MCU. However, hydraulic parameters and age dating indicate that this flow is driven by temperature differences and may take many thousands of years (Meyer 1989-TN2255) due to the confining nature of the MCU. Other studies, conducted primarily at injection sites, indicate that transit times may be shortened when pathways within the MCU are created through improper well construction or a network of interconnected fractures. This is discussed in more detail below. There is evidence from a study by Walsh and Price (2010-TN3656) conducted at the SDWWTP north of the Turkey Point site showing that while flow within MC1 and MC2 is generally vertical, flow within the APPZ is horizontal providing for more rapid flow and mixing of waters entering the APPZ from the underlying MC2 confining unit.

Upward migration of treated municipal wastewater injected into the Boulder Zone has been observed 12 mi north of the proposed Turkey Point site at the Miami-Dade SDWWTP, where injection rates are around 97 Mgd. Several studies have been performed to evaluate the cause and extent of this migration. This observed migration may have been caused by either natural geologic features or by a well construction problem. A smaller-diameter pilot hole is often drilled first, and then the pilot hole is reamed to a larger diameter. Maliva et al. (2007-TN1483) states that “If the reamed hole for a casing string diverged from the pilot hole, then the pilot hole may become a conduit for vertical fluid migration. However, well construction problems as a cause for vertical fluid migration have not yet been conclusively confirmed at any injection well site”. Such a construction problem is not expected at the Turkey Point site because the pilot hole would be cemented before reaming and tests would be performed every 5 years to verify well integrity (FPL 2011-TN51).

In addition, Maliva et al. (2007-TN1483) present evidence from site studies of vertical migration at two water facilities in South Florida as well as dual density transport modeling that shows dolostones with sufficiently low vertical hydraulic conductivities can provide local confinement sufficient to prevent migration into the USDW, even if the underlying rock is fractured.

Walsh and Price (2008-TN3657) evaluated water chemistry data from wells at the SDWWTP site and determined that injected wastewater likely migrated upward through a lower section of the MCU and into the APPZ section of the MCU. However, wastewater migration was not apparent in the low-permeability portion of the MCU that lies above the APPZ and below the

Upper Floridan aquifer. Additional analysis by Walsh and Price (2010-TN3656) concluded that in three of the four instances of upward migration of injected wastewater at the SDWWTP the plumes moved into the APPZ and in the fourth instance the plume moved into the low-permeability layer below the APPZ. As a result, this report presented a conceptual model that postulates the vertical migration through the MC2 of the MCU is density driven due to salinity or temperature differences between the formation water and injectate. If migration to the APPZ occurred, horizontal flow and mixing would likely diminish the buoyant forces and reduce the impact above the APPZ.

An EPA study of 93 deep-well injection facilities in South Florida also indicates that fluid movement underground is influenced by buoyancy created by temperature and density differences between native and injected waters. Injection pressures, which are influenced by the geology and injection rates, can also induce upward migration (68 FR 23673) (TN3658). As mentioned above, injection rates at the SDWWTP site, where upward migration has occurred, are around 97 Mgd. As discussed above, FPL evaluated the confining ability of the MCU during the drilling and completion of EW-1 through geophysical logging, core analysis and pressure testing (FPL 2012-TN1577) and concluded that there was “no indication of vertically extensive or significant fracturing at several intervals throughout the MCU.”

Hydraulic Properties of the Floridan Aquifer System at the Turkey Point Site

Exploratory well EW-1 was constructed on the site to determine the properties of the Boulder Zone and the confining nature of the overlying MCU that separates the Boulder Zone from the USDW zone within the Upper Floridan aquifer. The exploratory well was constructed to a depth of 3,232 ft below the drill pad. At the well location water-quality samples and rock core were collected and analyzed at various depths, geophysical logging, video surveys and packer testing were performed to determine the hydraulic parameters of the rock layers. Based on these data the rocks encountered between depths of 1,535 and 3,232 ft were divided into three distinct zones (FPL 2012-TN1577; FPL 2012-TN1264). These zones roughly coincide with the APPZ of the MCU, MC2 of the MCU, and the Boulder Zone of the Lower Floridan aquifer, respectively, and are as follows:

- 1,535 to 1,980 ft: This interval is characterized as having variable lithology and porosity and therefore not providing a reliable barrier to vertical flow of water. Hydraulic conductivities and porosities were not determined for this interval however, total dissolved solids (TDS) values are at or below 10,000 mg/L indicated that the base of the USDW (TDS <10,000 mg/L) would be located at or above this interval, which is within the zone identified as the APPZ of the MCU. Selected depth intervals were isolated using packers and hydraulic flow tests were conducted to estimate the permeability of the rock in those intervals. Straddle packer test performance data indicate that specific capacities within this zone ranged from 0.003 to 2.43 gpm/ft. Specific capacity is a measure of the pumping rate corresponding to water-level drawdown of 1 ft.
- 1,980 to 2,915 ft: This interval below the drill pad was found to be composed of consistently softer material. Core laboratory data indicated that vertical hydraulic conductivities ranged from 1.6x10-6 to 5.4x10-4 cm/sec and total porosities ranged from 27.4 to 43.4 percent. Pumping tests of packer-isolated intervals from 1,930 to 1,950 ft, 1,970 to 1,972 ft, and 2,058 to 2,080 ft below the drill pad resulted in low specific capacity values of 0.03, 0.003 and

0.05 gpm/ft, respectively (FPL 2012-TN1265). These data indicate that this unit, which is the MC2 of the MCU, is more confining than over and underlying units, is over 900 ft thick, and likely provides a barrier to vertical groundwater flow. These preliminary results indicate that a thick low-permeability confining layer exists between the proposed injection point within the Boulder Zone and the overlying USDW aquifer. These site-specific findings are consistent with characterization data and conclusions presented in studies of these same formations in South Florida and near the Turkey Point site. Maliva et al. (2007-TN1483) found that a confining layer with vertical hydraulic conductivity of 10-6 cm/sec resulted in minimal vertical migration over a 25-year simulation period.

- 3,020 to 3,232 ft: This interval below the drill pad was found to contain highly porous and permeable rocks that form the Boulder Zone of the Lower Floridan aquifer. TDS values are greater than 30,000 mg/L which is comparable to seawater. Geophysical logging indicate a very large hole diameter consistent with open voids, low resistivity, and short formational acoustic travel times. Pumping tests indicated that this zone has a high specific capacity, with values measured around 49 gpm/ft. These preliminary results indicate that a thick low-permeability confining layer exists between the proposed injection point within the Boulder Zone and the overlying USDW aquifer. These site-specific findings are consistent with characterization data and conclusions presented in studies of these same formations in South Florida and near the Turkey Point site.

2.3.2 Water Use

Consideration of water use requires estimating the magnitude and timing of consumptive and nonconsumptive water uses. Nonconsumptive water use does not result in a reduction in the available water supply. An example near the Turkey Point site is the Everglades Alligator Farm that raises alligators (EAF 2014-TN3659). The farm pumps freshwater that is used in the farming of alligators but returns approximately the same volume of water to nearby watercourses or aquifers. On the other hand, consumptive water use results in a net reduction of the water supply available for downstream users. For instance, as a backup system of cooling water for proposed Turkey Point Units 6 and 7, water may be withdrawn from beneath Biscayne Bay for normal cooling. Most of that water would be evaporated in the cooling towers, and that evaporated water would be considered a consumptive loss. The following two sections describe the consumptive and nonconsumptive users of surface water and groundwater near the Turkey Point site. Although surface-water use and groundwater use are discussed separately, there is a close connection and interchange between surface-water and shallow groundwater resources in South Florida. For example, removing water from a pond will likely result in groundwater flow into the pond from the surficial aquifer, and pumping of a shallow well is likely to remove water from nearby surface-water features. One of the goals of the CERP is to increase sheet flow, and consequently enhance infiltration of surface water to the shallow Biscayne aquifer in the Biscayne coastal wetlands area.

2.3.2.1 Surface-Water Use

Regional water uses primarily support the restoration actions of CERP, in which surface runoff from areas to the north of the Everglades, including Lake Okeechobee, is being returned to natural channels (Shark River Slough and Taylor Slough) entering Everglades National Park.

CERP restoration actions also include the restoration of sheet flow into Biscayne Bay. CERP projects in the region are identified in EIS Section 2.3.1.1 in the CERP subsection and in Figure 2-8.

For the local area, 32 permitted surface-water users were identified within a 10 mi radius of Turkey Point; the identified uses of water include landscaping, agriculture, industrial, and recreational irrigation (a golf course) (FPL 2014-TN4058). Landscape use accounts for the largest number (31) of permitted users but the golf course represents the largest single permitted use of 115.8 Mgd/yr. The water sources range from onsite lakes/ponds, onsite canals, onsite borrow pits, and Biscayne aquifer/onsite canals. Given that significant exchange occurs between surface water and shallow groundwater it is somewhat arbitrary to assign certain sources as surface water, except that waters may be withdrawn from a body of surface water. The review team confirmed the water uses by examining permit information for surface-water sources from the SFWMD (2012-TN1319), which are listed in Table 2-11. These permit locations are broken down by township and range (approximately 6 mi by 6 mi blocks).

Table 2-11. Consumptive Use Surface-Water Permits in the Region Around the Turkey Point Site (from SFWMD 2012-TN1319). ***The surface-water sources include canals, lakes, and bays. The locations are by township and range; Turkey Point is located in T57S R40E, in the southeast portion of the grid (approximately Section 36).***

Location	Water Use	Number of Permits	Permit Volume (Mgm)
T56S-R40E	Agricultural	1	2.95
T56S-R40E	Industrial	3	1.52
T56S-R40E	Landscape	12	18.09
T56S-R39E	Landscape	6	13.6
T57S-R40E	Industrial	1	1.52
T57S-R39E	Golf Course	1	14.68
T57S-R39E	Industrial	1	42.00
T57S-R39E	Landscape	27	16.14
T57S-R38E	Industrial	1	0.30
T58S-R38E	Aquaculture (alligator farm)	1	2.25
T58S-R38E	Public Water Supply	1	6.30

Mgm = million gallons per month.

2.3.2.2 Groundwater Use

Biscayne Aquifer

The generally high permeability of the limestone, sandstone, and sand in the Biscayne aquifer has resulted in it being an important water supply. The USGS estimates that 486.2 Mgd of fresh groundwater was withdrawn from the Biscayne aquifer in Miami-Dade County during 2005 (Marella 2009-TN1521). About 400 Mgd of that was used for public water supplies, 46.5 Mgd was for agriculture, 29 Mgd was for industrial uses, 7.7 Mgd was used for recreational irrigation, and 2.9 Mgd went to household self-supply.

Nearly all of the potable water supplied by the MDWASD to southern Miami-Dade County comes from the Biscayne aquifer (Miami-Dade County 2014-TN3647). The exception is water from the Alexander Orr, Jr. water-treatment plant, which mixes some brackish groundwater from the Upper Floridan aquifer with Biscayne aquifer groundwater to serve County residents living between SW 8th Street and SW 264th Street (Miami-Dade County 2014-TN3647). The public water-supply wells located nearest to the proposed plant site serve the City of Homestead and are located at Newton Field, Harris Field and Witkop Park in Homestead (City of Homestead 2012-TN3648). These well fields are approximately 6.8, 7.3, and 7.7 mi, respectively, west-northwest of the plant site (distance measured from Google Earth). The potable water supply for the Florida Keys comes from Biscayne aquifer wells and an Upper Floridan aquifer well located west of Florida City (FKAA 2014-TN3649) approximately 9 mi west of the plant site.

The EPA has designated the Biscayne aquifer as a sole-source aquifer pursuant to Section 1424(e) of the Safe Drinking Water Act of 1974 (42 USC 300f et seq.) (TN1337). However, the Biscayne aquifer in the immediate vicinity of proposed Units 6 and 7 is too saline to be used as a potable water supply over an area from the coastline to about 6 to 8 mi inland (Langevin 2001-TN1338; Renken et al. 2005-TN110) near the Turkey Point site (see Figure 2-12).

Upper Floridan Aquifer

Marella (2009-TN1521) reports that 3.5 Mgd of Floridan aquifer groundwater was used in Miami-Dade County during 2005 and 93 percent of that water was saline. Upper Floridan aquifer water is used for irrigation at seven golf courses in Southeast Florida (SFWMD 2013-TN3461). Two of these, the Ocean Reef and Card Sound Golf Clubs, are located approximately 7.7 and 9 mi southeast of the Turkey Point site. The Upper Floridan aquifer in the immediate vicinity of the Turkey Point plant area is used to supply cooling-tower makeup water at a rate of about 12.6 Mgd to Turkey Point Unit 5 (FPL 2014-TN4058). Desalinization is used to treat brackish water from the Upper Floridan aquifer for domestic use at several locations in South Florida, including the well operated by the Florida Keys Aqueduct Authority (SFWMD 2013-TN3461) and two plants in Miami-Dade County (SFWMD 2012-TN1522). Therefore, additional future use of brackish water from the Upper Floridan aquifer is possible.

Projections of groundwater use for the SFWMD Lower East Coast Planning Area indicate an 18 percent increase in the demand for public water supplies from 2010 to 2030 for Miami-Dade County (SFWMD 2013-TN3461). The SFWMD determined that part of this increased demand will be met by “alternative supplies” including desalinization, reclaimed water treatment, water conservation programs, and aquifer storage systems. Additional freshwater will also be needed for ecosystem restoration projects such as CERP. This water will come mainly from rerouting of excess runoff and potentially from reclaimed water.

The FDEP has permitted around 180 Class I injection wells for injection of municipal and industrial wastewater into the Boulder Zone of the Florida aquifer system. The Boulder Zone of the Lower Floridan aquifer is used for injection of municipal and industrial wastewater because of its isolation, high permeability, and salinity similar to seawater (Miller 1990-TN550). The top of the Boulder Zone at the Turkey Point site about 3,000 ft below ground surface and is proposed for injection disposal of cooling-tower blowdown and other waste streams from Units 6

and 7. The Boulder Zone is currently used for treated municipal waste water injection at MDWASD's SDWWTP approximately 9 mi north of the Turkey Point site and at several other locations in Florida (Maliva et al. 2007-TN1483).

2.3.3 Water Quality

The following sections describe the quality of surface-water and groundwater resources in the vicinity of the Turkey Point site. Monitoring programs for thermal and chemical water quality are also described.

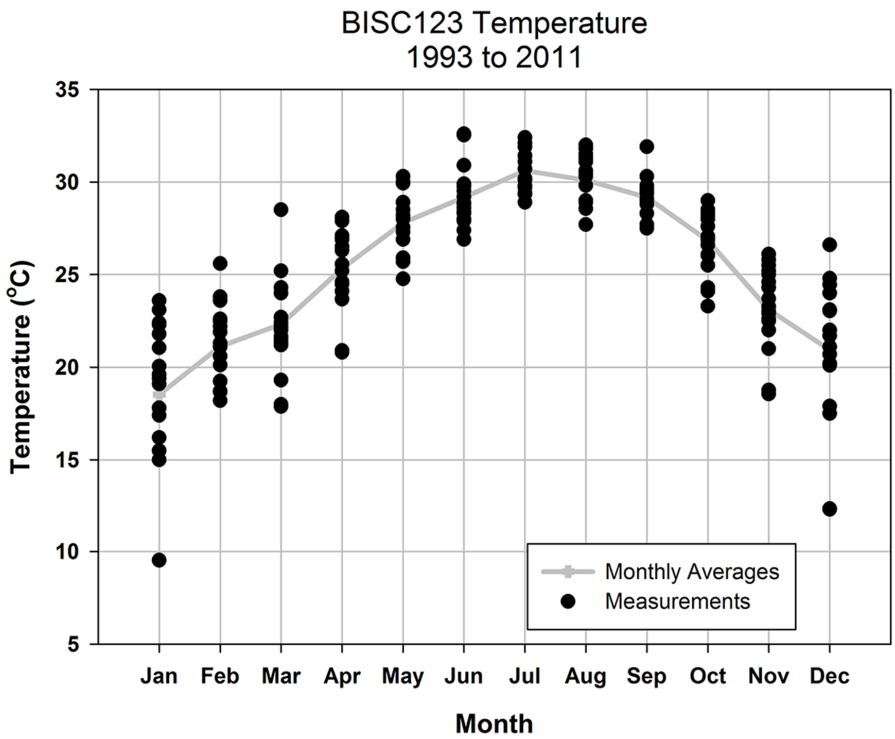
2.3.3.1 Surface-Water Quality

The FDEP, under the Federal Water Pollution Control Act (Clean Water Act) Section 305(b) (33 USC 1344 et seq.) (TN1019), prepares a statewide Water Quality Inventory. The FDEP also identifies impaired water bodies during this inventory process and lists them on the Clean Water Act's 303(d) List of Impaired Waters. Portions of the estuary and streams along the southeast coast, including Biscayne Bay, appear on the final 2010 303(d) List as impaired water bodies because of copper, fecal coliforms, mercury, and nutrients (FDEP 2010-TN1253).

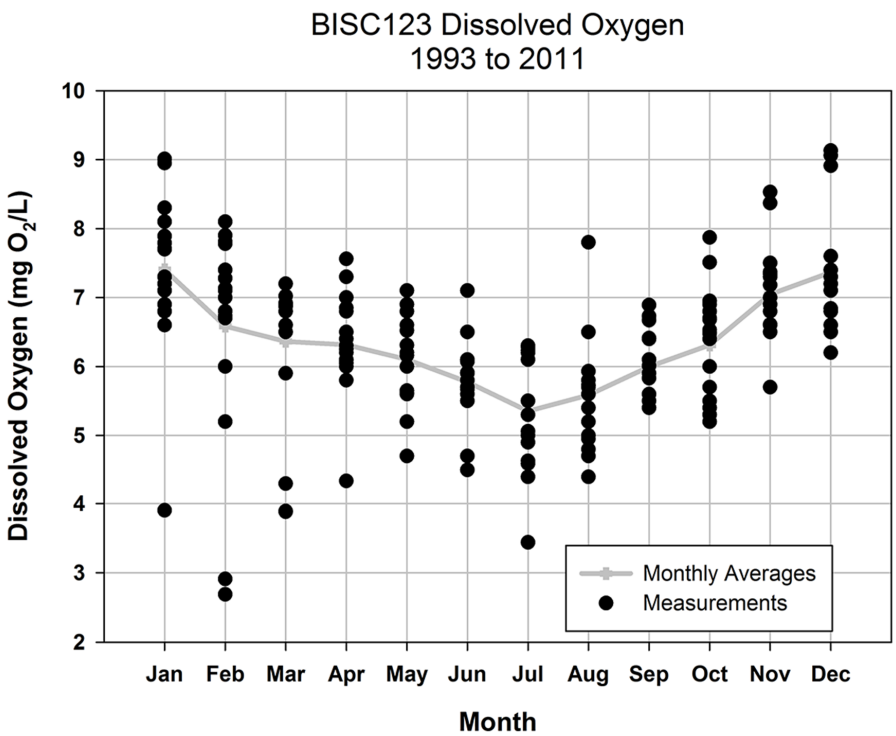
Surface-water quality is routinely monitored by the SFWMD and other agencies (SFWMD 2012-TN1318). For the purposes of the analysis of the impacts from the operation of the radial collector wells, FPL also collected a sample from Biscayne Bay and analyzed it for conventional and priority pollutants (FPL 2009-TN1263). For the data collected during the SFWMD's monitoring program, only results from station BISC123 (the same location as BISC12 in Figure 2-14) are examined because it is the station nearest the site. Routine monitoring occurred at monthly intervals. The review team reviewed the data for seasonal variations and the variability within each month of the year; hence, the measurements over the period of record are plotted by month (Figure 2-19) with the monthly data and the monthly averages for the period of record. The measurements are from samples collected at depths of <3 ft and are regarded as surface measurements. Measurements at >3 ft depths are not available for many of the constituents and are not examined here.

Average surface-water temperatures vary from 18.5°C during the winter months to 30.6°C during the summer months (Figure 2-19(a)). The temperature range during the summer months (approximately 3°C) is relatively small in comparison to the range during the winter (approximately 14°C). During the winter, air temperatures in South Florida can be much cooler than normal because of the penetration of cold fronts, while during the summer, weather patterns typically produce more uniform temperatures.

Dissolved oxygen is governed first by temperature; lower oxygen saturation concentrations occur at higher temperatures and the highest saturation concentrations occur at the lowest temperatures. Secondarily, dissolved oxygen is increased by production from photosynthetic organisms (algae, marine vegetation) and decreased by respiration from all organisms inhabiting Biscayne Bay. In addition, dissolved oxygen is decreased by the decay of organic matter present in the Biscayne Bay. Because of these factors, the average surface dissolved oxygen during the winter months reaches a maximum of 7.4 mg O_2/L, while during the summer, average dissolved oxygen concentrations decline to 5.4 mg O_2/L (Figure 2-19(b)). The

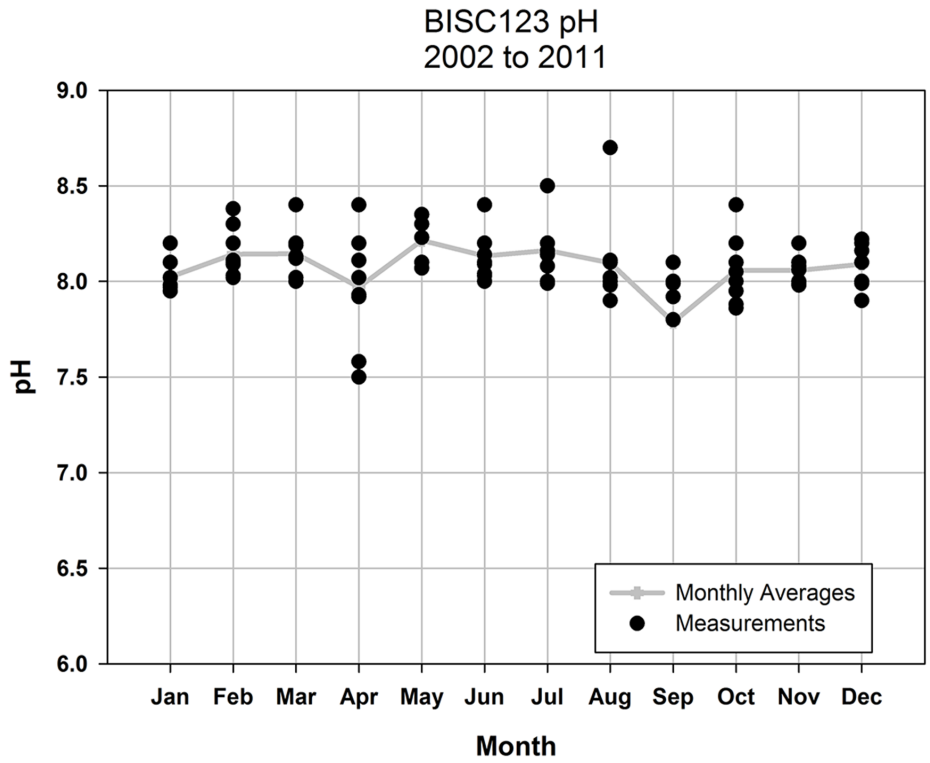


(a)



(b)

Figure 2-19. Monthly Water-Quality Measurements at Station BISC123 for the Period of Record Including the Monthly Averages for Each Constituent (SFWMD 2012-TN1318)



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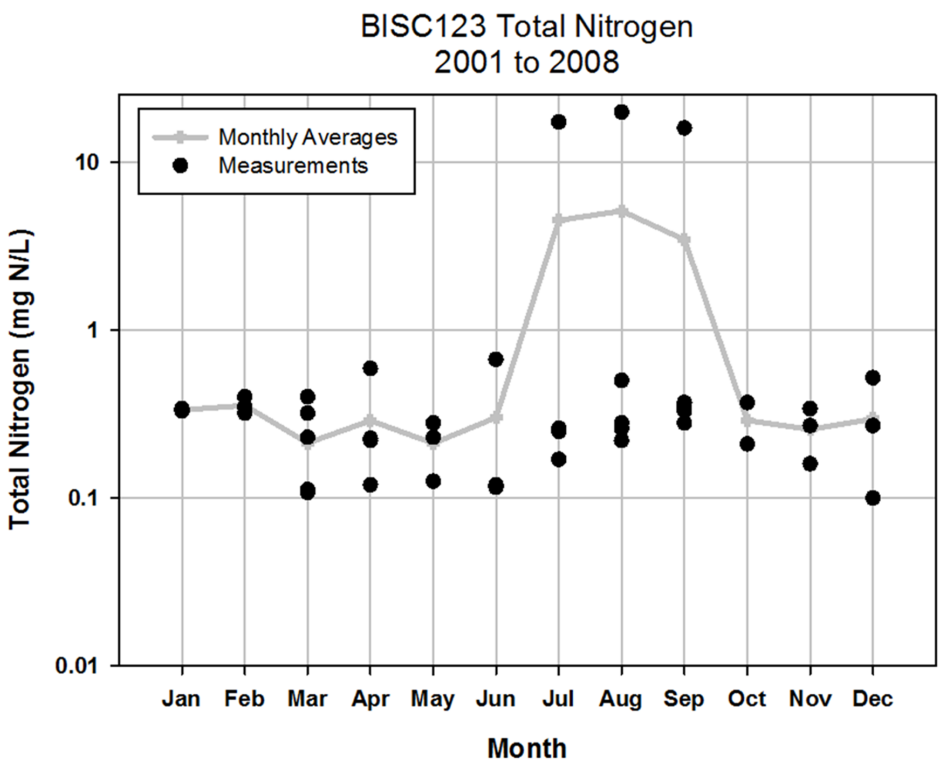
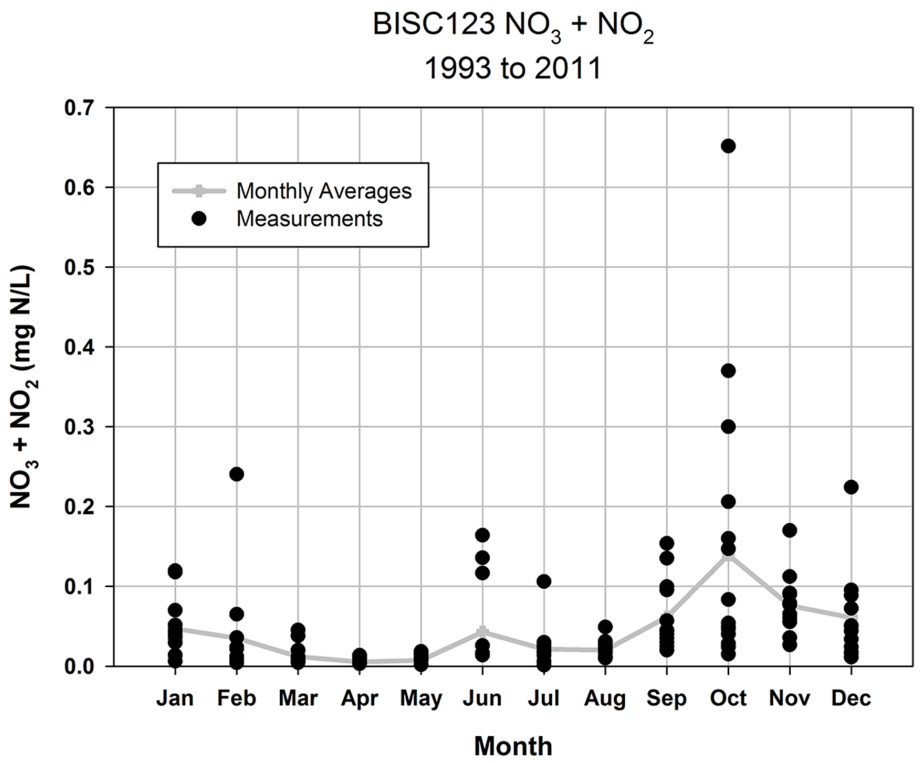


(d)

Figure 2-19. (contd)



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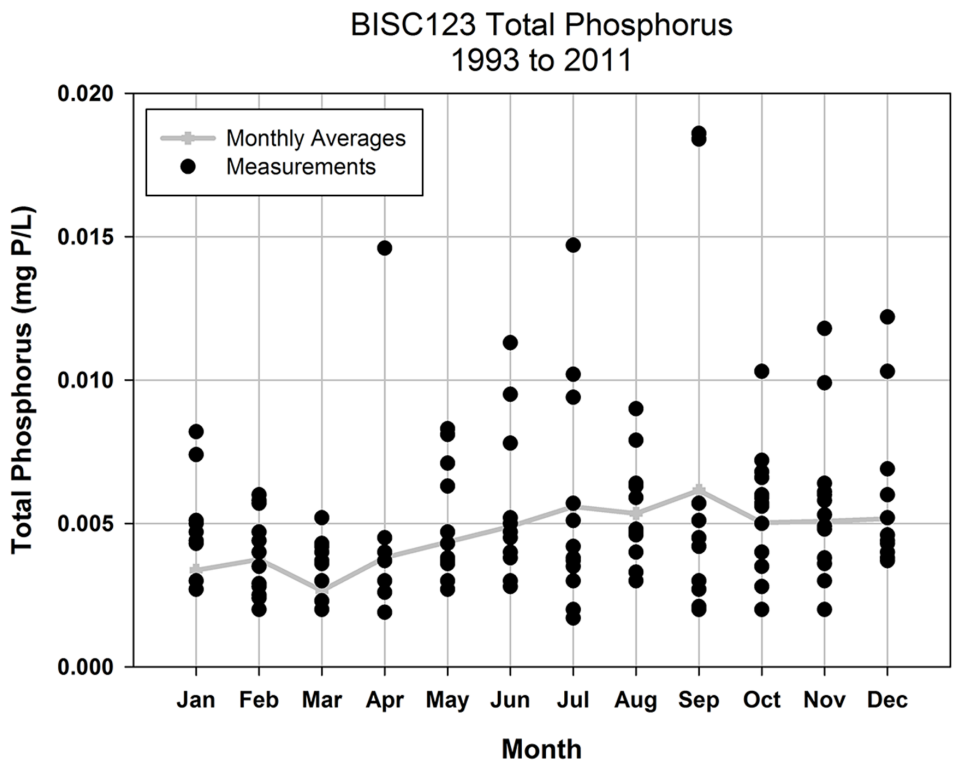
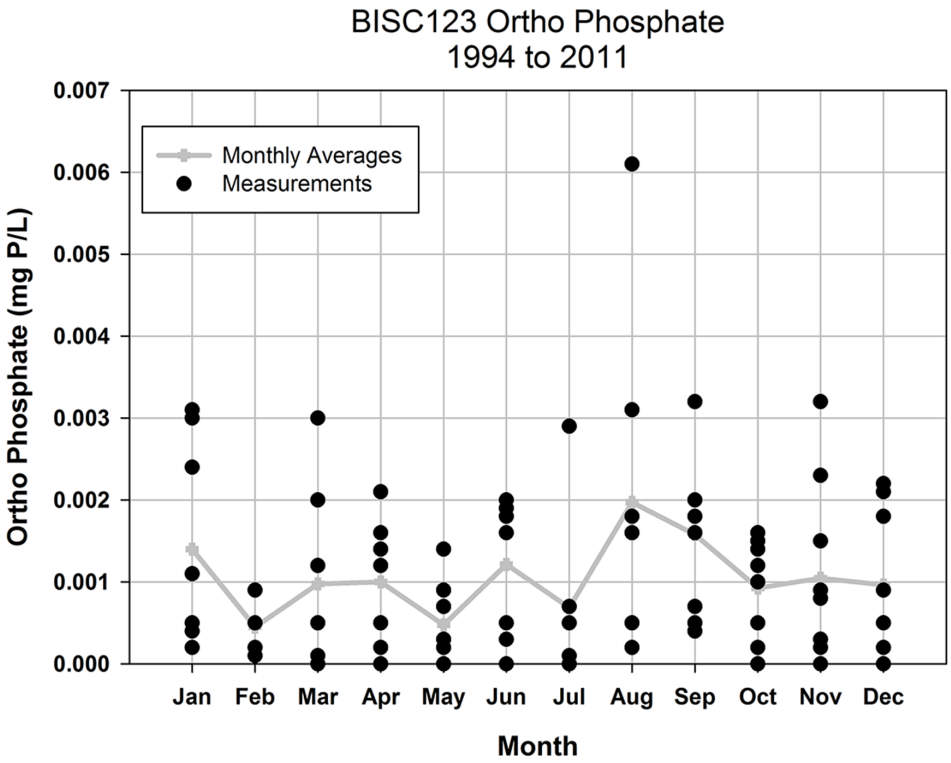
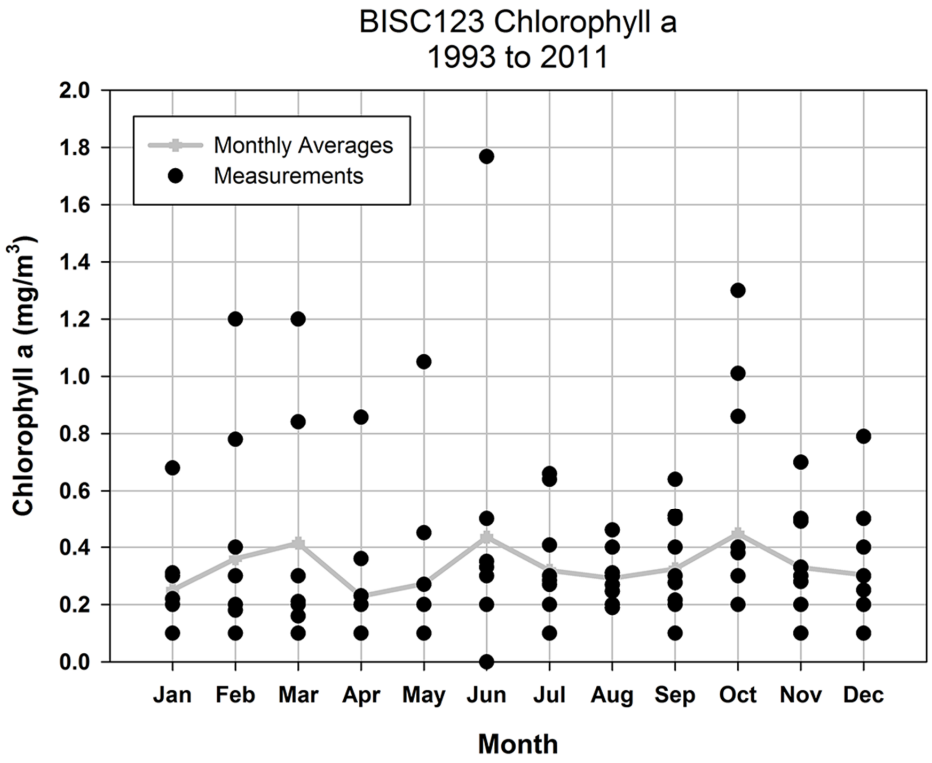


(f)

Figure 2-19. (contd)



(g)



(h)

Figure 2-19. (contd)

maximum and minimum dissolved oxygen concentrations occurred during the winter (9.1 mg O_2/L and 2.7 mg O_2/L). The maximum concentrations tend to be lowest during the summer, while the minimum concentrations exhibit two peaks: one in the late spring and another in late fall/early winter.

Average pH generally varied within a small range of 8.1 to 7.8 throughout the year; the highest pH values occurred during the summer months, likely due to photosynthetic processes (Figure 2-19(c)).

The average concentrations of total nitrogen (TN) were below 0.4 milligrams of nitrate per liter (mg N/L) throughout the year, but the period of record for this constituent is only 2001 to 2008, while most other constituents have measurements from 1993 to 2011 (Figure 2-19(d)). Note that three values included in the plot were from summer 2007 and had concentrations greater than 15 mg N/L. It is unclear why these samples had such large TN values. Other than these sample concentrations the greatest reported concentration is <0.7 mg N/L. The average line in Figure 2-19(d) includes the effect of the large concentration in 2007. TN includes the components organic nitrogen, ammonia nitrogen, and nitrate + nitrite nitrogen. While inclusion of the large concentration values produces a trend in the average concentrations, no general trend can be ascribed. No clear trend is evident in the measured data because of the relatively high monthly variability and the short period of record.

Monthly average concentrations of nitrate+nitrite (NO_3+NO_2) are generally <0.1 mg N/L, although a small increase is seen in October measurements (Figure 2-19(e)). The October measurements also show that nitrate+nitrite reached concentrations of 0.3 mg N/L or greater in three separate years of monitoring (each point of a given month is a separate year). The lowest concentrations occur in the spring, particularly in April and May when measurements are near zero. In many systems this is the time of spring diatom blooms that would reduce inorganic nitrogen concentrations.

For total phosphorus, the monthly average concentrations suggest a slight maximum in summer and a minimum in late winter (Figure 2-19(f)). However, the relatively high variability of the measurements during the spring, summer, and fall may not support this visual analysis of the averages. During the three seasons, measurements tend be around 0.005 mg P/L or lower, but several measurements in each month have higher concentrations. The only months with relatively low variability are February and March.

Ortho phosphate concentrations are generally around 0.003 mg P/L or less. They show no apparent trends in monthly averaged concentrations or in the measurements, although it could be said that the maximum measurements in April, May, and June are the smallest for all the monthly measurements (Figure 2-19(g)).

Chlorophyll a measurements range widely except during the summer and winter months (Figure 2-20(h)). The largest measured values (>0.6 mg/m^3) occurred in late winter through spring and in October, although the monthly average tended to be around 0.3 mg/m^3 without any clear seasonal trend.

As part of the testing program for the radial collector wells, FPL collected a surface sample from Biscayne Bay for analysis of conventional and priority pollutants (FPL 2009-TN1263). The sampling station was located at north latitude 25° 26' 15.2132" and west longitude 80° 19' 35.6518", which is 1 mi north of the proposed location of the radial collector wells. Typical wet chemistry constituents (such as TDS, alkalinity, sodium, potassium, calcium, and magnesium) were analyzed and reported. Other constituents (radiological, metals, chlorinated herbicides, organophosphorus pesticides, volatile organic compounds, organochlorine pesticides, and polychlorinated biphenyls [PCBs]) were analyzed for potential effects from effluents and drift from the cooling towers. Of these other constituents, strontium was measured at 9.84 mg/L, radium 226 was measured at 0.5±0.1 pCi/L, endosulfan I was detected at 0.00247 ug/L, Heptachlor was detected at 0.00691 ug/L 0.00152, and acetone was measured at 18.3 ug/L.[1]

2.3.3.2 Groundwater Quality

The State of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (Renken et al. 2005-TN110). Groundwater quality in the vicinity of the Turkey Point site has also been assessed in support of FPL's Units 3 and 4 Uprate Project (FPL 2012-TN3439). Because of high salinity, groundwater in the vicinity of Turkey Point is not used as a drinking water source (FPL 2014-TN4058). The Biscayne aquifer at Turkey Point extends beneath Biscayne Bay and is in hydraulic communication with the water of the bay. Saltwater has migrated inland along the base of the inland portion of the aquifer in response to the lowering of inland groundwater levels.

Saltwater intrusion into the inland portion of the Biscayne aquifer has occurred over a large area of the Southeast Florida coast including the Turkey Point site. Figure 2-20 shows the estimated extent of saltwater intrusion in the area at different times since 1951. Differences in these estimated extents may be caused by changes in the number of available observation points as well as the degree of saltwater intrusion. The most important factors contributing to the regional intrusion of saltwater from the ocean into the aquifer are rerouting of sheet flow to drainage canals and groundwater pumping (Klein and Hull 1978-TN1351; Renken et al. 2005-TN110). Under natural conditions and with adequate inland recharge of freshwater, the aquifer water table is higher than the average sea-level elevation to balance the higher density of seawater. When the aquifer water table is lowered by pumping or canal drainage, the saltwater begins to move inland, usually at the base of the aquifer because of its higher density. Drainage canals without control structures drain freshwater from inland areas and also provide a conduit for seawater to flow inland at high tide and infiltrate the aquifer. Figure 2-21 shows canals and existing control structures in relation to the estimated extent of saltwater intrusion in 1996. Saltwater movement through the aquifer responds to inland groundwater levels with low groundwater levels resulting in inland and upward migration of saltwater and high groundwater levels resulting in seaward and downward movement of the saltwater plume.

(1) Based on experience with acetone, a laboratory solvent, the review team determined that the acetone measurement may reflect some sample contamination.

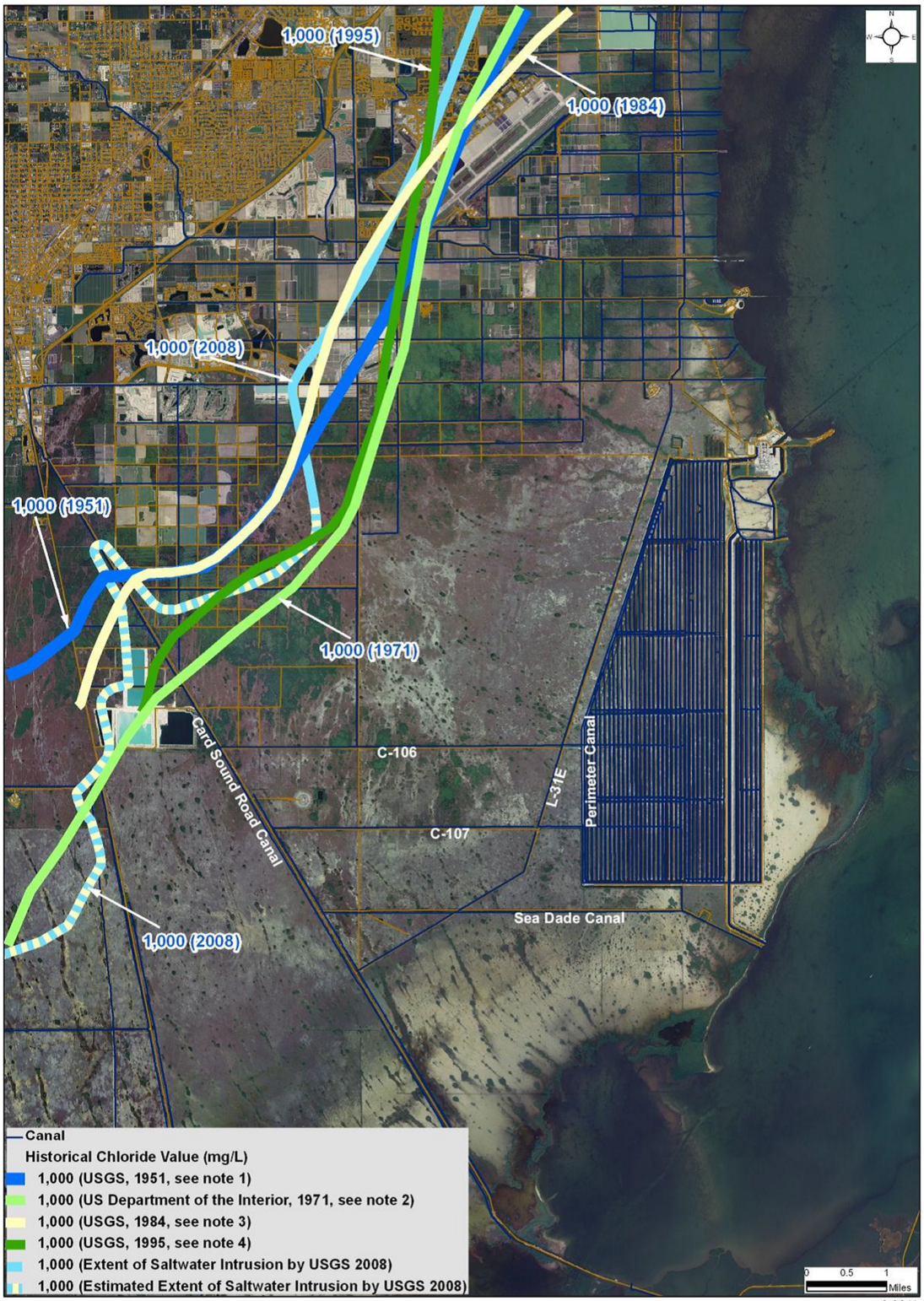


Figure 2-20. USGS Estimated Extent of Saltwater Intrusion from 1951 to 2008 (FPL 2012-TN3439)

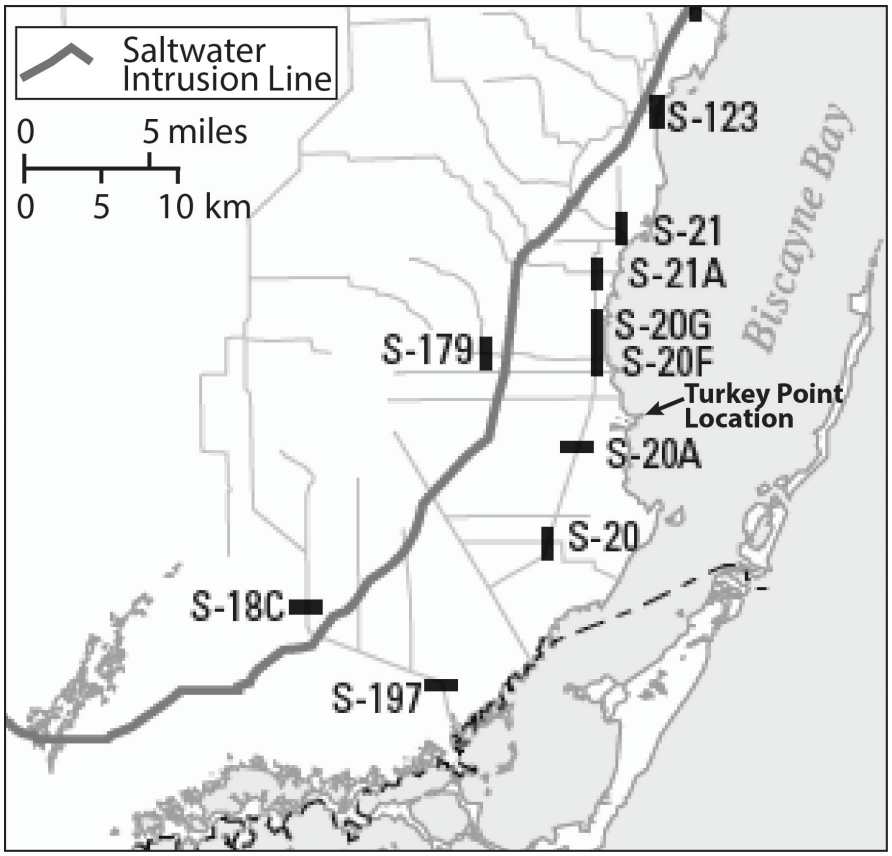


Figure 2-21. Landward Limit of the Saltwater Interface in 1996 and Canal Control Structures (modified from Renken et al. 2005-TN110)

The ER lists groundwater quality indicator parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity, and oxidation-reduction potential) for 12 observation wells completed in the Biscayne aquifer (FPL 2014-TN4058).

The State of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (Renken et al. 2005-TN110). Groundwater quality in the Biscayne aquifer has also recently been assessed to support FPL's Units 3 and 4 Uprate Monitoring Project (FPL 2012-TN3439). The objective of the Uprate Monitoring Project is to better understand the interaction of the cooling canals with Biscayne aquifer and Biscayne Bay. Both tritium and TDS concentrations were found to be elevated in the Biscayne aquifer beneath the cooling canals and in groundwater below the bay adjacent to the cooling canals. Tritium was monitored as a tracer for the cooling canal water, but is not regarded as a health concern at the observed concentrations (FPL 2012-TN3439). These data show that water in the cooling canals has moved into the Biscayne aquifer groundwater. Water can move from the aquifer into the cooling canals and from the cooling canals into the aquifer at different times depending on seasonal variation in the water table and variations in cooling canal water levels caused by precipitation, evaporation, or changes in plant discharge. Hydraulic heads in monitoring wells near Biscayne Bay fluctuated in response to tidal cycles indicating a potential for tide-induced flow between the bay, shallow groundwater and the cooling canals in this area of the IWF.

Water quality in the Floridan aquifer system is affected by the degree of confinement, the length of flowpaths from recharge sources, and the proximity and connection to the ocean (Miller 1990-TN550). The Upper Floridan aquifer in southeastern Florida is generally brackish to saline depending on depth and distance from the coast (Reese 1994-TN1439). An average TDS concentration of 5,451 mg/L was reported for the Upper Floridan aquifer in the SCA for Turkey Point Unit 5 (FPL 2003-TN3437). Water in the Boulder Zone has quality similar to seawater and is likely recharged from the ocean based on the water chemistry and the anomalously low temperature of water in the Boulder Zone (Meyer 1989-TN2255). Water quality in the Boulder Zone and within Lower Floridan aquifer confining units has also been affected in some local areas by wastewater injection.

2.3.4 Water Monitoring

Surface-water and groundwater monitoring at and near the proposed site are described below.

2.3.4.1 Surface-Water Monitoring

The SFWMD maintains an extensive database of monitoring stations (SFWMD 2012-TN1320) that includes water quality for Biscayne Bay and selected canals and stage measurements at some Biscayne Bay and canal stations. Figure 2-22 shows the locations of the surface stations from the SFWMD (2012-TN1320) near the IWF cooling canals and in Biscayne Bay. The SFWMD (2012-TN1318) discusses the purpose of the monitoring program for Biscayne Bay (BISC) and indicates that the Miami-Dade County Department of Environmental Resources Management (DERM) (Miami-Dade County 2014-TN3663) and Florida International University conduct the monitoring of Biscayne Bay.

The National Park Service (NPS) has provided the review team additional monitoring data (Figure 2-22) measured in Biscayne Bay (Bellmund 2012-TN4118). The monitoring data include salinity and water depth time series. The stations are located closer to the shoreline than the stations typically monitored by SFWMD and monitor salinity variations as CERP projects are implemented to increase freshwater inflows to Biscayne Bay.

FPL conducted a study of the CCS to evaluate its functioning with additional cooling-water requirements from uprating of Units 3 and 4 (FPL 2012-TN3439). This required monitoring of surface-water and groundwater elevations and water quality to determine the dynamic exchange processes that influence the CCS's functioning. Figure 2-22 shows the locations of the surface-water monitoring stations used for the uprate study (FPL 2012-TN3439). As part of the site certification process for the State of Florida, FPL is conducting a monitoring study of the IWF to evaluate the horizontal and vertical hydrologic exchanges with the surrounding environment. For the study, FPL installed 20 surface-water monitoring stations at locations surrounding the IWF.

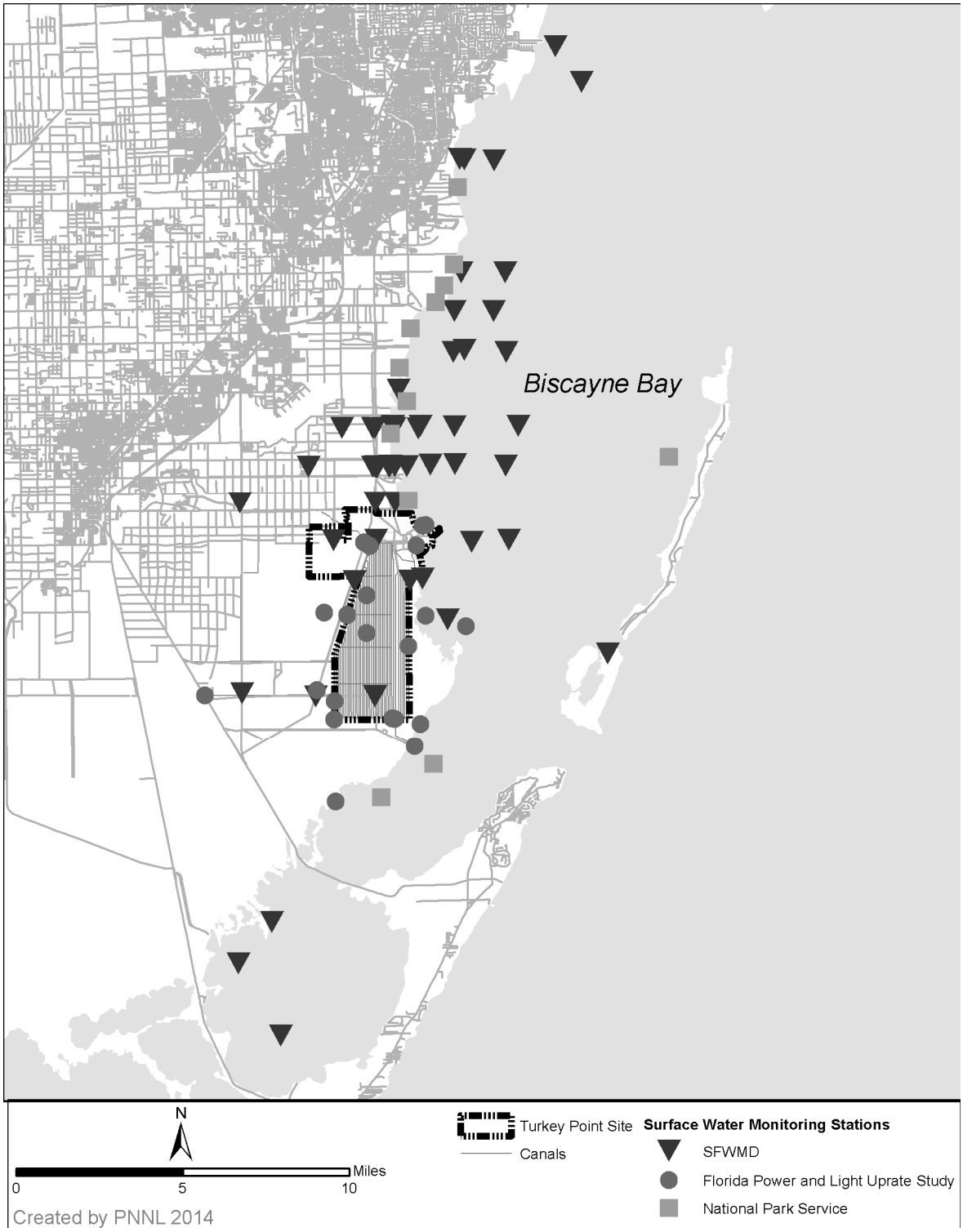


Figure 2-22. Locations of Surface-Water Monitoring Stations from SFWMD (SFWMD 2012-TN1320), the FPL Units 3 and 4 Uprate Project (FPL 2012-TN3439), and USNPS (Bellmund 2012-TN4118)

2.3.4.2 Groundwater Monitoring

Monitoring of groundwater occurs on the Turkey Point site in accordance with existing National Pollutant Discharge Elimination System (NPDES) and industrial stormwater permits associated with existing FPL facilities. Additional groundwater monitoring was performed to support the license application for Units 6 and 7, and to assess the impacts of the IWF cooling canals on groundwater as required by the Florida State Conditions of Certification for FPL's Units 3 and 4 Uprate Project.

Pre-application monitoring of the groundwater system underlying the proposed site for Units 6 and 7 included 10 monitoring well pairs (20 wells) installed in 2008 across the proposed plant area for measuring groundwater levels. Each pair included a well completed in the Miami Limestone/Key Largo Limestone at depths ranging from 14 to 28 ft and a well completed in the Fort Thompson Formation at depths ranging from 85 to 110 ft below ground surface. Water-level data were collected from these wells from June 2008 through June 2010 and are presented in Section 2.3 of the ER (FPL 2014-TN4058).

As discussed in Section 2.3.3.2 above, FPL installed 42 wells in 14 well clusters with monitoring wells completed in the shallow, intermediate, and deep portions of the Biscayne aquifer at each cluster to support FPL's Units 3 and 4 Uprate Monitoring Project (FPL 2012-TN3439). Monitoring well cluster locations are shown in Figure 2-23. Data on water levels and groundwater chemistry have been collected from these wells on an ongoing basis since June 2010 to support the Florida State Conditions of Certification for the proposed uprate of Turkey Point Units 3 and 4. The water quality of Biscayne Bay and the cooling canals and precipitation were also measured. Groundwater level and electrical conductance measurements were collected by an automated system every 15 minutes. And other parameters were measured on a periodic basis. This effort has resulted in automated near-continuous measurements of groundwater electrical conductivity, and periodic measurements of several other parameters, including major ions, nutrients, trace elements, gross alpha, tritium, deuterium, and isotopes of oxygen, strontium, and carbon.

Regional aquifer monitoring data are also routinely collected by the USGS and the SFWMD. Wells currently monitored the within 6 mi of the proposed plant location are shown in Figure 2-24 (USGS 2014-TN3575). Some of these wells are also included in the uprate monitoring well network (Figure 2-23).

Information from the testing of deep-injection Exploration Well 1 (EW-1) showed that the Upper Floridan aquifer within the Suwanee Limestone and upper part of the Avon Park Formation at the Turkey Point site contains brackish water with TDS concentrations less than 10,000 mg/L. The deeper Avon Park Formation below the MCU contained saline water with TDS concentrations higher that 10,000 mg/L. These intervals will be monitored at all of the deep-injection monitoring wells as part of the requirements of the FDEP Underground Injection Control (UIC) program. Boulder Zone injection interval and the deepest overlying USDW aquifer (Upper Floridan) monitoring data are required to be submitted to the FDEP on a monthly basis for permitted injection and monitoring wells at wastewater injection sites.

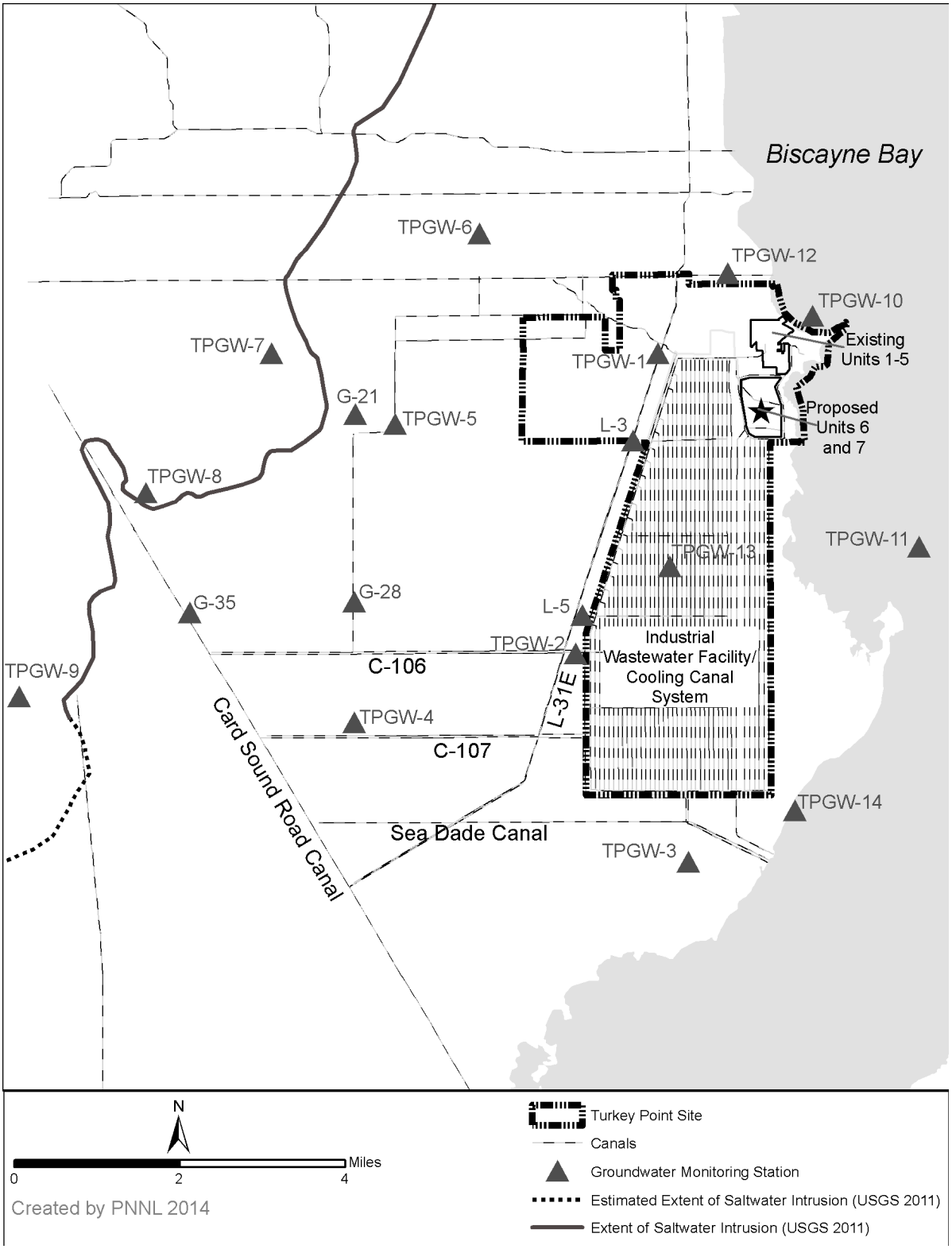


Figure 2-23. Locations of Groundwater Monitoring Well Clusters for the FPL Units 3 and 4 Uprate Project (FPL 2012-TN3439; USGS 2011-TN1801)

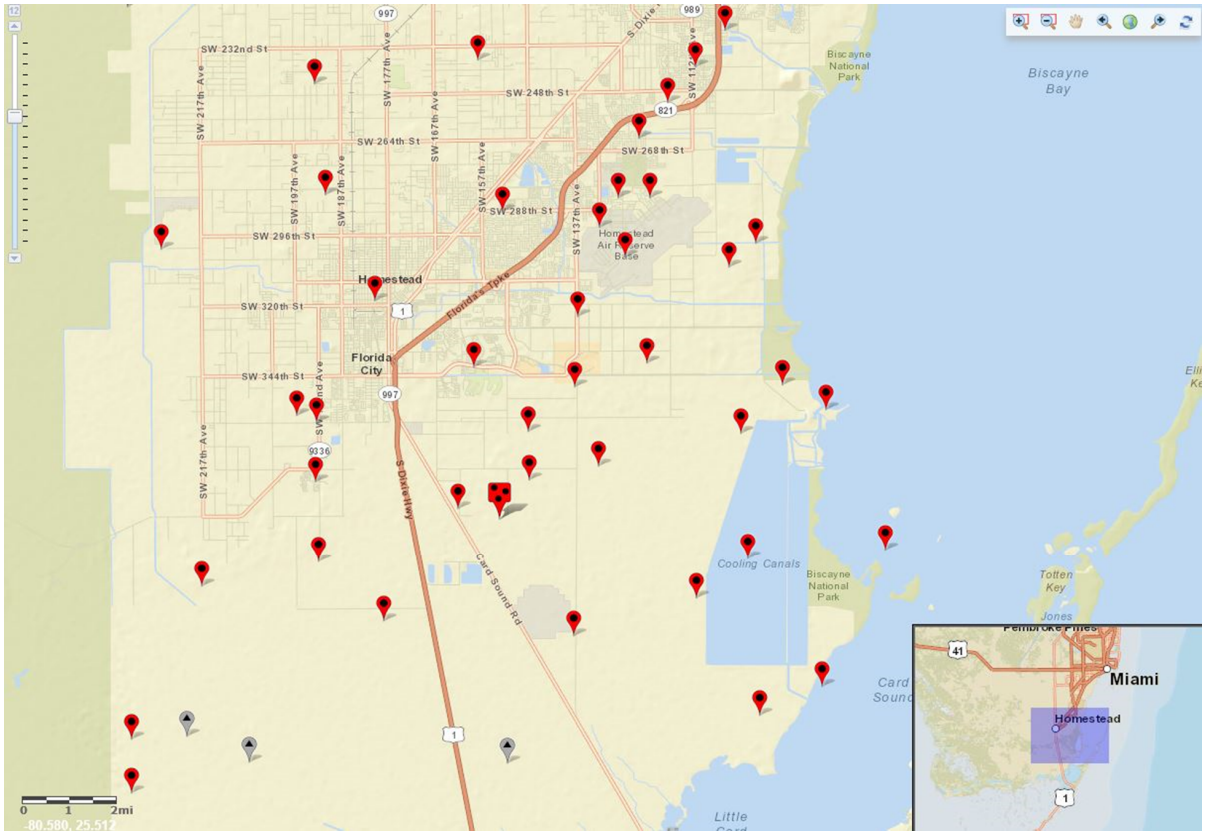


Figure 2-24. USGS Groundwater Monitoring Locations (red markers) within 6 Miles of the Proposed Plant Location (active in April 2014) (USGS 2014-TN3575)

2.4 Ecology

This section describes the terrestrial and aquatic ecology of the site and vicinity that might be affected by the design, siting, building, operation, and maintenance of proposed Turkey Point Units 6 and 7. Detailed descriptions are provided where needed to support the analysis of potential environmental impacts from the building, operation, and maintenance of new nuclear power generating facilities and the new transmission line and pipeline rights-of-way. These descriptions support the evaluation of mitigation activities identified during the EIS analyses to avoid, reduce, minimize, rectify, or compensate for potential impacts. Descriptions are also provided to help compare the alternative sites to the proposed Turkey Point site. Monitoring programs for terrestrial and aquatic environments are also described.

2.4.1 Terrestrial and Wetland Ecology

This section identifies terrestrial and wetland ecological resources and describes species composition and other structural and functional attributes of terrestrial biotic assemblages that could be affected by the building, operation, and maintenance of the proposed Turkey Point Units 6 and 7. It also identifies “important” terrestrial species and resources, such as Federal- and State-listed plants or wildlife, wildlife sanctuaries and natural areas as defined by the NRC in NUREG−1555 (NRC 2000-TN614) that might be affected by the proposed action. The purpose of this section is to describe current ecological communities and existing conditions.

Some of the information presented in this section is based on FLUCFCS codes introduced in Section 2.2. Maps displaying FLUCFCS codes provide useful information about the composition and distribution of terrestrial habitats and wetlands. However, FLUCFCS codes and maps serve primarily to reflect land use and land cover and provide only an approximation of terrestrial habitat. The distribution of FLUCFCS codes indicative of wetlands (the 600-series codes) do not necessarily align with the presence or distribution of jurisdictional wetlands as defined by the USACE.

2.4.1.1 Terrestrial and Wetland Communities of the Site and Vicinity

Turkey Point Site

Turkey Point site is on the western shore of Biscayne Bay, which opens to the Atlantic Ocean. It is in the Mangrove and Coastal Glades physiographic province (McPherson and Halley 1996-TN98). This province occurs along the southern Florida coast in a band that narrows significantly northward from Biscayne Bay. The Mangrove and Coastal Glades province is defined as a broad band of wetlands at or near sea level that is often flooded by tides or freshwater runoff (McPherson and Halley 1996-TN98). The name of this province is derived from its abundance of three species of mangrove trees: black (*Avicennia germinans*), white (*Laguncularia racemosa*), and red (*Rhizophora mangle*). Mangrove forests play a key role in the ecosystems where they occur, because they buffer uplands from storms, filter overland runoff, contribute significant organic material, and provide a nursery to many aquatic and terrestrial animal species (USGS 2003-TN1304). The descriptions of terrestrial habitats provided in this section are derived from different data sources. FLUCFCS maps were used to characterize lands of the Turkey Point property and lands within the 6 mi vicinity. Habitats within the proposed Units 6 and 7 area were characterized during an ecological assessment conducted in 2008 (FPL 2014-TN4058).

The ecology in southern Florida is directly tied to the hydrology and natural seasonal hydrologic fluctuations that occur in this region. Wetlands are the predominant landscape feature of southern Florida. The low and flat elevation, proximity to Biscayne Bay, and high average rainfall result in the predominance of wetlands. Terrestrial land cover on the Turkey Point site is presented in Table 2-2. Land on the Turkey Point site is used primarily for electric power facilities, and facilities for existing Turkey Point Units 1–5 occupy approximately 5,672 ac, composing almost half of the Turkey Point site. Freshwater marsh is the predominant natural land cover on the Turkey Point site.

Wetlands are also the predominant habitat type within the proposed Units 6 and 7 plant area and include mudflats, dwarf mangrove, mangrove heads, open water, canals, and wetland spoil areas (Figure 2-25). Most of the plant area comprises mudflats that are inundated annually for 3 to 4 months and are sparsely vegetated with saltwort (*Batis maritime*), sea-oxeye (*Borrichia frutescens*), wood glasswort (*Salicornia virginica*), and dwarf glasswort (*Salicornia begelovii*) (FPL 2014-TN4058). Dwarf mangrove habitats contain stunted mangroves of the three species present (black, white, and red), but individual plants are stunted due to high salinities and fluctuating water levels. Mangroves that occupy approximately 12 ac of the proposed Units 6 and 7 plant area are remnant mangrove populations found within historical tidal creeks that were disconnected from Biscayne Bay during previous development; they are known as

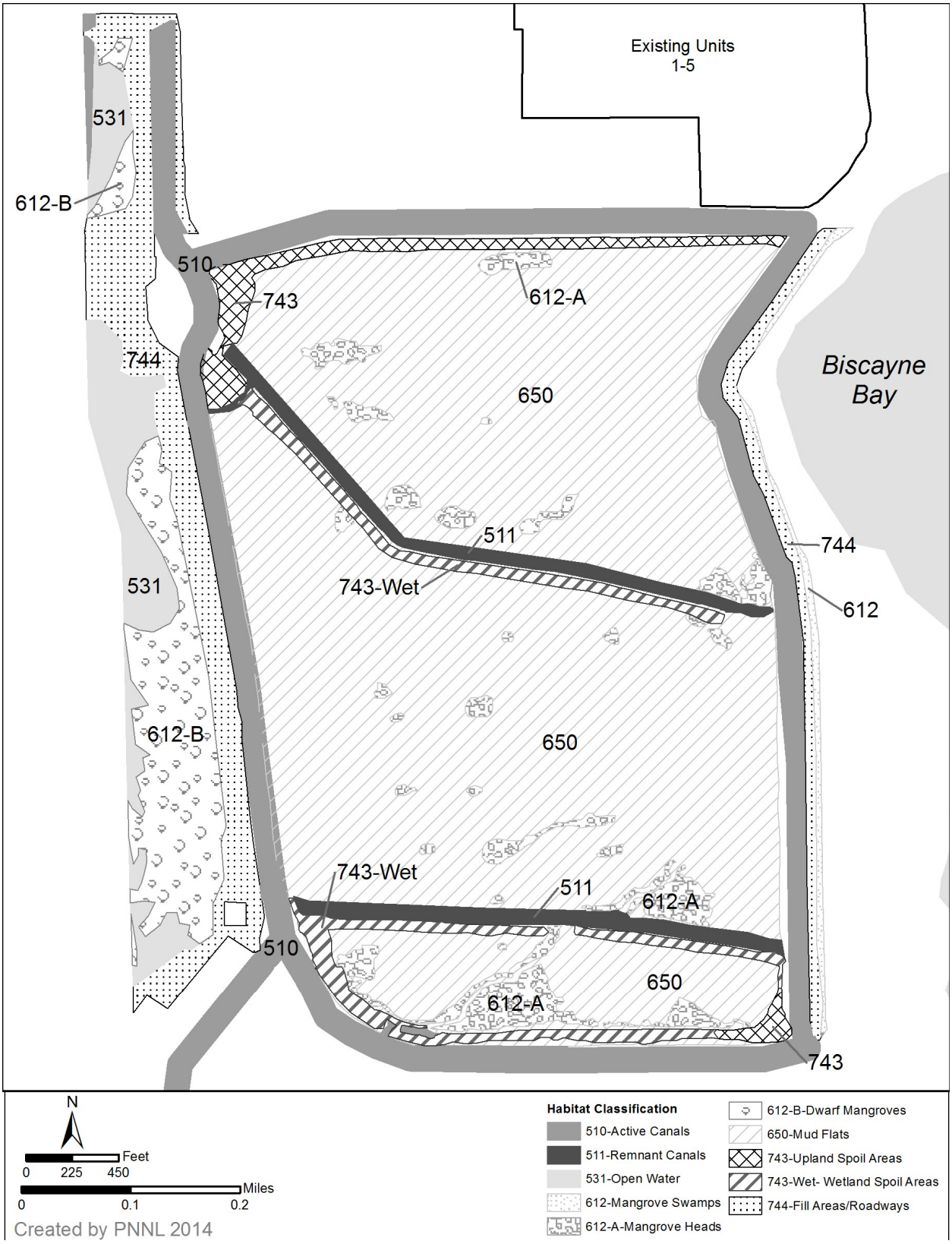


Figure 2-25. Habitat Classification at the Proposed Units 6 and 7 Plant Area (FPL 2014-TN4058)

mangrove heads (FPL 2014-TN4058). Open waters, adjoining cooling canals of the IWF, occupy approximately 8 ac and contain scattered widgeon grass (*Ruppia maritima*) and shoal grass (*Halodule wrightii*) patches (FPL 2014-TN4058). Wetland spoil areas totaling about 9 ac occur adjacent to remnant canals and contain mangrove species as well as buttonwood (*Conocarpus erectus*) and non-native Australian pine (*Casuarina equisetifolia*) (FPL 2014-TN4058).

The proposed project area also contains highly disturbed upland habitats including roadways raised with fill and spoil piles (FPL 2010-TN272). The raised fill areas contain maintained grasses as well as poisonwood (*Metopium toxiferum*), buttonwood, wild sage (*Lantana involucrata*), ground orchid (*Bletia* species), sea grape (*Coccoloba uvifera*), and the exotics Brazilian pepper (*Schinus terebinthifolius*), Australian pine, and melaleuca (*Melaleuca quinquinervia*) (FPL 2014-TN4058). Miami-Dade County Code (Part III, Chapter 24, Section 24.49) (Miami-Dade Code of Ordinances 24-49-TN1168) mandates protection of specific native tree species and protections do not include poisonwood, Brazilian pepper, Australian pine, or Melaleuca. Results of a tree survey, that documented all trees with either a diameter greater than 3 in. or a total height greater than 12 ft, indicate over 1,300 individual stems of 43 species of trees occur in survey areas encompassing the project area (FPL 2011-TN1312). Trees generally occur on artificial raised fill areas created by past construction activities that constitute most uplands areas on the site, such as raised roadsides, canal berms, and undeveloped portions of raised areas (FPL 2011-TN1312). Tree survey results do not include wetland trees such as buttonwood or the three mangrove species (FPL 2011-TN1312).

Land-cover classes in the vicinity of the Turkey Point site are presented in Table 2-3. Most lands within 6 mi are classified as wetlands. Most of the uplands support forest, occupying 23 percent of the nearby landscape. Although much of the forested habitat in the vicinity is dominated by non-native tree species, even these trees provide valuable habitat to local wildlife. Previously disturbed or developed land-use classes within the Turkey Point site vicinity include agriculture and urban development as well as lands classified as “other” that includes open water and barren land. Although considerable industrial and residential development has occurred within Miami-Dade County, the Turkey Point site is in a relatively undeveloped and rural area where most lands within 6 mi have not been developed into agriculture or urbanized.

Wildlife

Surveys to characterize wildlife on the Turkey Point site and in the vicinity were conducted in 1972 and in 2005 through 2009 (FPL 2014-TN4058). The most recent surveys included limited pedestrian and vehicular surveys to determine the relative abundance of migratory and resident bird species. Most of the project area was surveyed, including the IWF, the plant area, two mangrove areas immediately north of the plant area, the radial collector well site, the originally proposed reclaimed water-treatment site, and a small portion of the proposed access road west of the IWF (FPL 2009-TN1334).

Wildlife species observed during these surveys were those expected to occur in the types of habitats present in South Florida. Most of the site comprises wetlands, and wetland birds are the predominant fauna. Forty-six species of birds within 11 bird families were observed, 35 of which are commonly associated with wetlands (FPL 2010-TN272). Wading birds

(*Pelicaniformes*) are common and abundant on the mudflats and along the canals on the site and include various herons, egrets, and ibis. Shorebirds (*Charadriiformes*) are also strongly represented by sandpipers, plovers, and numerous others (FPL 2010-TN272). Historical data and other observations indicate at least 38 additional bird species have been observed on the site (FPL 2014-TN4058).

During April 2009, surveys were also conducted to determine small mammal, amphibian, and reptile presence and relative abundance within areas that would be disturbed by building proposed Units 6 and 7 (FPL 2009-TN1444). Small mammals were trapped and identified using baited live traps. Reptiles and amphibians were captured using coverboards, minnow traps, and dip nets, and were also recorded during pedestrian searches. Habitats surveyed included marsh, mangrove, and ditches. Reptiles were observed, including the American alligator (*Alligator mississippiensis*), American crocodile (*Crocodylus acutus*), eastern diamondback rattlesnake (*Crotalus adamanteus*), the non-native green iguana (*Iguana iguana*), and an unidentified gecko (*Hemidactylus* sp.). In addition, three species of anole lizards (*Anolis* sp.), the Florida softshell turtle (*Apalone ferox*), and five snake species were observed. Amphibians were also observed, including nine frog species (FPL 2014-TN4058). An eastern narrow-mouthed toad (*Grastrophryne carolinensis*) was found in April 2009 and the southern toad (*Bufo terrestris*) was also observed (FPL 2009-TN1334).

Four mammal species, the cotton rat (*Sigmodon hispidus*), black rat (*Rattus rattus*), raccoon (*Procyon lotor*), and marsh rabbit (*Sylvilagus palustris*), were observed. White-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), and eastern cottontail (*Sylvilagus floridanus*) have also been observed on the Turkey Point site. Although numerous bat species occur in South Florida, no bats were observed in 2009 during a single 2-hour bat survey conducted between mangrove habitat and the existing facilities, and bat distribution and abundance is unknown (FPL 2014-TN4058). As in most areas of South Florida, bats presumably occur within the 6-mi vicinity of Turkey Point.

Immediately to the east and adjoining the boundary of the Turkey Point site is Biscayne National Park, which encompasses approximately 270 mi^2 and includes the mangrove forests along the mainland shoreline, the southern portion of Biscayne Bay, barrier island keys, and the nearshore waters out to approximately 14 mi from the shoreline (NPS 2011-TN103). Biscayne National Park is recognized for both terrestrial and aquatic resources as well as cultural history, and management of the park is focused on preservation of natural and cultural resources while providing recreation (NPS 2011-TN103). The Everglades National Park, the largest subtropical wilderness in the United States, is approximately 12 mi west of the Turkey Point site. The Everglades National Park encompasses almost 1.5 million ac and is recognized for its rich biological diversity. It has been designated an International Biosphere Reserve, World Heritage Site, and Wetland of International Significance. Management of the Everglades National Park balances the preservation of these resources while providing recreation (NPS 1979-TN104). Extensive canal and levee systems constructed for agricultural purposes have altered surface-water flow and have changed the ecology of South Florida, including Biscayne National Park and Everglades National Park. Goals of the CERP include restoration of the Everglades ecosystem (CEPP 2011-TN107).

2.4.1.2 Terrestrial Resources – Associated Offsite Facilities

Potable Water Pipeline Corridor

A potable water pipeline would also be built within a 9 mi long corridor from the MDWASD facility to support the proposed units. Approximately 2.5 mi of this pipeline would require establishing a new corridor, and the remaining 7.5 mi would be built along improved roadways. About half of the land cover within the potable water pipeline is classified as wetlands consisting of mostly freshwater marsh along with mixed wetland and exotic wetland hardwoods, dwarf mangroves, and minor amounts of sawgrass marsh and other wetland types (Table 2-12).

Reclaimed Water Pipeline Corridor

In addition to transmission facilities, proposed Units 6 and 7 would use reclaimed water for cooling purposes and require a reclaimed water pipeline. The 9 mi long corridor for this pipeline would include a 6.5 mi section that would be installed within the Clear Sky to Davis transmission line corridor. The remaining 2.5 mi would be installed within a new corridor. Land cover within the entire 9 mi corridor is typical of the region, predominantly agriculture and wetlands, but also includes upland prairie, shrub and brushland, mixed rangeland, and a small amount of exotic invasive Brazilian pepper forest, as well as developed land and open waters (Table 2-12).

Table 2-12. Classifications of Land Cover Within the Proposed Units 6 and 7 Offsite Pipeline Corridors

Facility	Agriculture (ac)	Developed (ac)	Disturbed (ac)	Forest (ac)	Uplands (ac)	Open Water (ac)	Wetlands[(a)] (ac)	Infra-structure (ac)	Total Acres
Potable Water Pipeline Corridor	69.92	58.9	4.05	7.69	1.63	24.75	159.95	39.21	**326.87**
Reclaimed Water Pipeline Corridor	496.65	720.7	31.27	2.06	101.34	78.06	457.8	669.29	**1,885.7**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Source: FPL 2014-TN4058, Table 2.2-6

Transmission-Line Corridors

FPL has proposed East and west corridors to service proposed Units 6 and 7. Two different routes for the western corridor, the Preferred and the Consensus, have also been proposed. Both the Preferred and Consensus routes are redundant over a substantial portion of their lengths. However, the routes diverge for a portion of the distance between the Clear Sky and Levee substations (Figure 2-5).

The West Preferred corridor between the Clear Sky and Levee substations traverses a landscape of mostly agriculture, wetlands, and open water (Table 2-4) and includes a segment along the eastern boundary of Everglades National Park. Wetland cover types include mostly freshwater marshes, dwarf mangroves, mixed wetland hardwoods, exotic wetland hardwoods, wet prairies, mangrove swamps, and sawgrass. Uplands include shrub and brushland along with dry prairie. Two access roads would also be required to access the West Preferred

corridor. The route for the Krome Avenue access road traverses freshwater marsh, exotic wetland hardwoods, streams and waterways, and existing roads. Land within the proposed Tamiami Trail access road consists of wetlands and existing roads.

Lands within the West Consensus corridor consists mostly of wetlands and includes sawgrass, exotic wetland hardwoods, wet prairie, freshwater marsh, and mixed wetland shrubs. The West Consensus corridor also contains uplands including dry prairie. Four new access roads would be needed if the west transmission line is built within this corridor. An access near NW 12th Street would occupy rock quarry and agricultural lands. Access to the West Consensus corridor from Tamiami Trail would occur through wetlands comprised mostly of exotic wetland hardwoods. Access near the L-31 Canal would occur over or through dikes, levees, and canals as well as 5 ac of wetlands. An access road near NW 88th Street would occupy Australian pine cover, freshwater marsh, and exotic wetland hardwoods in addition to small amounts of other land cover. The Levee to Pennsuco segment of both proposed west transmission line corridors is mostly wetlands and previously developed land.

The Clear Sky to Davis leg of the East corridor occupies mostly agriculture land cover. Wetland types are almost exclusively mangrove swamp. Dry prairie is the predominant upland cover. The Davis to Miami segment lies within an urban landscape. No wetlands are present and very little natural cover remains.

In addition to transmission lines, four substations would be modified in support of proposed Units 6 and 7. A new substation, the Clear Sky substation, is also proposed to be constructed on the Units 6 and 7 project area. All existing and proposed transmission facilities are or would be within Miami-Dade County.

2.4.1.3 Important Terrestrial Species and Habitats – Site and Vicinity

This section describes Federally and State-listed, proposed threatened and endangered terrestrial species, candidate species for listing, commercially and recreationally valuable species, species critical for ecological structure and function, and biological indicatory species as defined as important by the NRC in NUREG−1555 (NRC 2000-TN614). Designated and proposed critical habitat that may occur in the vicinity of the site is also discussed. Only species with recorded occurrences in Miami-Dade County (FFWCC 2011-TN158; FNAI 2014-TN3668) and species having the potential to occur in Miami-Dade County are discussed (FWS 2012-TN117). Species identified by FPL as being commercially or recreationally valuable are also included in this section (FPL 2014-TN4058).

Federally Listed Species

Thirty-nine terrestrial species listed or proposed to be listed by the U.S. Fish and Wildlife Service (FWS) as Federally threatened, endangered, or candidates for listing as threatened or endangered are known to occur in Miami-Dade County (FWS 2012-TN117). Almost half (18) of this list consists of plants, and the rest of the list includes 12 birds, 2 mammals, a single reptile, and 5 invertebrates (Table 2-13). Other listed species that occur in the aquatic environment, including the American crocodile, are discussed in the aquatic ecology sections.

Table 2-13. Federally Listed Species Known to Occur Within Terrestrial Habitats of Miami-Dade County or in the Vicinity of the Turkey Point Site

Common Name	Scientific Name	Federal Status[a, b]	State Status[c]
Plants			
Crenulate lead-plant	*Amorpha herbacea var. crenulata*	LE	SE
Blodgett's wild-mercury	*Argythamnia blodgettii*	C	SE
Florida brickell-bush[d]	*Brickellia eupatorioides (mosieri) var. floridana*	LE	SE
Deltoid spurge	*Chamaesyce deltoidea ssp. deltoidea*	LE	SE
Pinelands (spurge) sandmat[d]	*Chamaesyce deltoidea ssp. pinetorum*	C	SE
Garber's spurge	*Chamaesyce garberi*	LT	SE
Cape Sable thoroughwort	*Chromolaena frustrata*	LE	SE
Small semaphore pricklypear	*Consolea (Opuntia) corallicola*	LE	SE
Okeechobee gourd	*Cucurbita okeechobeensis ssp. okeechobeensis*	LE	
Florida prairie-clover	*Dalea carthagenensis floridana*	C	SE
Florida pineland crabgrass	*Digitaria pauciflora*	C	SE
Small's milkpea	*Galactia smallii*	LE	SE
Beach jacquemontia	*Jacquemontia reclinata*	LE	SE
Sand flax[d]	*Linum arenicola*	C	SE
Carter's small-flowered flax	*Linum carteri carteri*	LE	SE
Tiny polygala	*Polygala smallii*	LE	SE
Everglades bully	*Sideroxylon reclinatum ssp. austrofloridense*	C	
Florida filmy or bristle fern	*Trichomanes punctatum ssp. floridanum*	C	SE
Invertebrates			
Florida leafwing butterfly	*Anaea troglodyte floridalis*	LE	
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	LE	ST
Schaus swallowtail butterfly	*Heraclides [Papilio] aristodemus ponceanus*	LE	SE
Bartram's scrub-hairstreak butterfly	*Strymon acis bartrami*	LE	
Stock Island tree snail	*Orthalicus reses reses*	LT	ST
Reptiles			
Eastern indigo snake	*Drymarchon corais couperi*	LT	ST
Birds			
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	LE	SE
Florida grasshopper sparrow	*Ammodramus savannarum floridanus*	LE	SE
Florida scrub jay	*Aphelocoma coerulescens*	LT	ST
Rufa red knot	*Calidris canutus rufa*	PT	
Ivory-billed woodpecker	*Campephilus principalis*	LE	SE
Piping plover	*Charadrius melodus*	LT	ST
Kirtland's warbler	*Dendroica kirtlandii*	LE	SE
Wood stork	*Mycteria americana*	LT	SE
Red-cockaded woodpecker	*Picoides borealis*	LE	SE

Table 2-13. (contd)

Common Name	Scientific Name	Federal Status[a, b]	State Status[c]
Audubon's crested caracara	*Polyborus plancus audubonii*	LT	ST
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	LE	SE
Bachman's warbler	*Vermivora bachmanii*	LE	SE
Mammals			
Florida bonneted bat	*Eumops floridanus*	LE	ST
Florida panther	*Puma (=Felis) concolor coryi*	LE	SE

(a) Federal status: confirmed 1/14/2014; (FWS 2014-TN2918). State status confirmed 1/14/2014; FNAI 2014-TN3668).
(b) Federal Status: LE = Federal endangered; LT = Federal threatened; C = Federal candidate.
(c) State status: FE = Federally designated and endangered; PE = Federally proposed endangered; FT = Federally designated threatened; PT = Federally proposed threatened; SE = State endangered; ST = State Threatened; blank = no status. All Federally listed species that occur in Florida are not included on the State of Florida's list as Federally designated species in addition to the State listing process (FFWCC 2011-TN158)
(d) Species detected in surveys of plant site and/or transmission line corridor right-of-way (Tables 2.4-1 and 2.4-4 in the ER) (FPL 2014-TN4058)

Source: FWS 2014-TN2918

Terrestrial species listed as endangered or threatened under the Federal Endangered Species Act of 1973, as amended (ESA) (16 USC 1531 et seq.) (TN1010) are under the jurisdiction of the FWS. The staff has prepared a biological assessment of the Federally listed threatened and endangered terrestrial plant and animal species that potentially could occur at or near Turkey Point site (Appendix F).

Plants

Crenulate Lead-Plant (*Amorpha herbacea var. crenulata*). This Federally and State-listed endangered species is found in eight sites within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The plant is a deciduous shrub that occurs in seasonally hydrated soils and in areas subject to frequent burning. It is found specifically in marl prairies (flatlands with marl over limestone substrate that are seasonally inundated) and wet pine rocklands (flatlands with exposed limestone substrate) (FWS 1999-TN136). FPL indicated this species was observed within the vicinity of the Turkey Point Property (FPL 2011-TN1374) and it is known to occur in six conservation areas near the Turkey Point site, although none occur within 6 mi of the site (Gann et al. 2012-TN137). It was not observed during survey of the transmission line corridors. Plant surveys were not conducted offsite within the potable water corridor or reclaimed water corridor. Land-cover classification indicates suitable habitat may not be present at these locations.

Blodgett's Silverbush (*Argythamnia blodgettii*). This Federally listed candidate species and State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668) is a forb that occurs in sunny gaps and edges in pine rockland, rockland hammock, and coastal berm habitats (FNAI 2000-TN139). This spurge is found in 18 conservation areas in Miami-Dade and Monroe counties (Gann et al. 2012-TN137), including Biscayne National Park and Everglades National Park, which are adjacent to the Turkey Point site (FNAI 2012-TN1445). FPL acknowledged this species has been observed in the vicinity of the Turkey Point

property (FPL 2011-TN1374) although it was not observed within the transmission line corridors during a ground survey, conducted following freezing weather, of a pine rockland between SW 300 and 304 Streets. Ground surveyors acknowledged this species has the potential to occur within this rockland (FPL 2009-TN657). It is unknown if it occurs at other offsite facilities as plant surveys were not conducted within the potable water corridor or reclaimed water corridor but land-cover classification information indicates suitable habitat may not be present at these locations.

Florida Brickell-Bush (*Brickellia eupatorioides [mosieri] var. floridana*). This plant is a Federally and State-listed endangered species found within Miami-Dade County (79 FR 52567 [TN4068]; FNAI 2014-TN3668). The Florida brickell-bush is a forb that inhabits pine rocklands with an open shrub layer, exposed limestone, and minimal leaf litter (FNAI 2000-TN139). It is endemic to the Miami Rock Ridge and has been observed in the vicinity of the Turkey Point property (FPL 2011-TN1374) and within transmission line corridor rights-of-way associated with proposed Turkey Point Units 6 and 7 (FPL 2014-TN4058). Critical habitat for this species has been designated within and adjacent to proposed transmission line corridors for Units 6 and 7 (79 FR 41211) (TN3725). Occurrence within the potable water corridor or reclaimed water corridor is unknown because there were no surveys conducted at these locations. Land-cover classification information indicates habitat suitable for this species may not be present at these locations.

Deltoid Spurge (*Chamaesyce deltoidea ssp. deltoidea*). This Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668) is a perennial forb endemic to Miami-Dade County and occurs in areas with open shrub canopy, exposed limestone, and minimal litter. It is most often associated with the edges of sand pockets; the plants grow both in sand and on oolitic limestone (Gann et al. 2012-TN137). Deltoid spurge is found in 10 conservation areas in Miami-Dade County north and west of the Turkey Point site (Gann et al. 2012-TN1322). FPL indicated deltoid spurge has been observed in the Turkey Point property vicinity, and habitat preferences indicate berms within the IWF created with limestone fill may provide suitable habitat. However, plant surveys were not conducted within the IWF. Surveys were also not conducted within the potable water corridor or reclaimed water corridor so occurrence at these locations is unknown. This species was not observed within the transmission line corridors.

Pineland Sandmat (*Chamaesyce deltoidea ssp. pinetorum*). This plant is a Federally listed candidate species and a State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). It is a perennial forb found in pine rocklands with scattered shrubs and exposed limestone (FNAI 2000-TN139). It is endemic to South Florida and has been observed in the vicinity of the Turkey Point property (FPL 2011-TN1374) as well as in the transmission line corridor rights-of-way associated with proposed Turkey Point Units 6 and 7 (FPL 2014-TN4058). It has not been observed within any of the other offsite facility locations, but no surveys were conducted within the other offsite facilities. Land-cover classification information indicates suitable habitat may not be present at the other offsite facility locations.

Garber's Spurge (*Chamaesyce garberi*). This plant is a Federally listed threatened species and a State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The plant is a short-lived, perennial forb. It requires open sunny areas where frequent fires have maintained an open canopy. It has been found in the following four habitats: beach dune, coastal rock barren, hammock edge, and pine rockland (FWS 2007-TN3529). Garber's spurge is present in Everglades National Park west of the Turkey Point site (Gann et al. 2012-TN137). It is not known to occur within the proposed Units 6 and 7 plant area, the vicinity of the Turkey Point property, the transmission line corridors, and potable and reclaimed water corridors. However, a ground survey of a pine rockland between SW 300 and 304 Streets along the west transmission line corridor was done following freezing weather and ground surveyors acknowledged Garber's spurge has the potential to occur along the west transmission line corridor (FPL 2009-TN657). Disturbed upland habitats can be found at many proposed facility locations. Suitability of these uplands as habitat for Garber's spurge is unknown.

Cape Sable Thoroughwort (*Chromolaena frustrata*). This plant is a Federally listed candidate species that is found at rockland hammock edges, in coastal rock barrens, and in the ecotone between buttonwood hammock and coastal hardwood hammock. It does not occur in disturbed habitats (FWS 2010-TN1323). The Cape Sable thoroughwort is not known to occur within any of the proposed onsite or offsite project locations. Land-cover information does indicate hammock habitats are not present within any of the proposed locations, so the thoroughwort's unique habitat requirements likely preclude its occurrence within project areas.

Florida Semaphore Cactus (*Consolea [Opuntia] corallicola*). This cactus is a Federally listed endangered species and a State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). It is found in the buttonwood zone between rockland hammocks and coastal swamps (FNAI 2000-TN139). It was historically known to occur on coastal berms. It is not known to occur within the proposed Units 6 and 7 plant area but it has been recorded in Biscayne National Park (Gann et al. 2012-TN137). It also has not been observed at any offsite facilities, although surveys were limited to proposed transmission line corridors.

Okeechobee Gourd (*Cucurbita okeechobeensis ssp. okeechobeensis*). A Federally listed endangered species in Miami-Dade County (FWS 2012-TN117), this vine was locally common in pond apple (*Annona glabra*) forests that were formerly present within the region. The plant grows in swamps and wet soils along rivers and lakes; it appears to require fluctuating water levels where high water allows for seed dispersal and seeds germinate when water levels decline. Plants were seen north of Homestead in an agricultural area in 1965 (FWS 1999-TN136), but more recently the species appears to be restricted to nine sites in Glades and Palm Beach Counties (Gann et al. 2012-TN137). Okeechobee gourds have not been observed within any of the proposed project areas, on- or offsite. They have been observed growing in mowed power-line rights-of-way (FWS 1999-TN136), and land-cover information indicates the proposed transmission lines will cross through extensive wetland habitats. Wetland habitats also exist within the proposed potable water pipeline corridor and reclaimed water pipeline corridor (FPL 2014-TN4058). The occurrence of the Okeechobee gourd at any of these sites is unknown.

Florida Prairie-Clover (*Dalea carthagenensis floridana*). This plant is a Federally listed candidate species and a State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). It is a shrub that inhabits pine rocklands, edges of rockland hammocks, coastal uplands, and marl prairies (FNAI 2000-TN139). Currently, there are only nine known populations (76 FR 66370) (TN1011), many of which are found on conservation lands north and west of the Turkey Point site, including Everglades National Park (Gann et al. 2012-TN137). The Florida prairie-clover was not observed within any of the proposed project sites. Suitable habitat is likely not present within the project sites within the Turkey Point property, and FPL determined the probability that this plant would occur within the Turkey Point vicinity was low (FPL 2011-TN1374). Offsite plant surveys were conducted within pine rocklands within proposed transmission line corridors, and those sites selected were remnant pine rocklands that would likely represent the most suitable habitats for the Florida prairie-clover.

Florida Pineland Crabgrass (*Digitaria pauciflora*). This plant is a Federally listed candidate species and a State-listed endangered species within Miami-Dade County. This grass species is endemic to South Florida where it is found in marl prairie and pine rockland habitats. Currently, it is found only in the Big Cypress National Preserve and Everglades National Park (Gann et al. 2012-TN137). FPL reported Florida pineland crabgrass was observed in the vicinity of the Turkey Point property (FPL 2011-TN1374). It has not been reported to occur within any of the offsite project areas including within selected pine rockland habitats along proposed transmission line corridors. Land-cover classification information indicates suitable habitat may not be present within the proposed Units 6 and 7 plant area and potable and reclaimed water pipeline corridors.

Small's Milkpea (*Galactia smallii*). This plant is a Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). Small's milkpea is a small, perennial legume with small purple flowers and a prostrate habit. The plant occurs in the pine rocklands of southern Miami-Dade County, and in 2007 it was only known at two sites near Homestead (FWS 1999-TN136). A 1994 survey found the plant at seven conservation areas, and it may occur in two additional conservation areas (Gann et al. 2012-TN137). None of these areas are within 6 mi of the Turkey Point site. Small's milkpea was not observed within the proposed Units 6 and 7 plant area as well as at any of the proposed offsite project areas. However, conditions during ground survey of a pine rockland between SW 300 and 304 Streets within the west transmission line corridor was done following freezing weather. Ground surveyors acknowledged Small's milkpea has the potential to occur within a pine rockland between SW 300 and 304 Streets within the west transmission line corridor (FPL 2009-TN657).

Beach jacquemontia (*Jacquemontia reclinata*). This Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668) is a member of the morning glory family. It is restricted to beach coastal strand and maritime hammock habitats (FWS 1999-TN136) and requires open areas generally found on the crest and lee side of stable dunes. It is also found in disturbed openings in maritime hammocks, coastal strand, and coastal scrub habitat (FWS 1999-TN136). Fewer than 500 plants are known from nine sites, all of which are more than 6 mi from the Turkey Point site (FNAI 2000-TN139). Beach jacquemontia was not observed within any of the proposed project areas, although only limited surveys were

conducted in selected habitats along the transmission line corridors. Land-cover classification information indicates suitable habitat is likely not present within any of the project areas.

Sand flax (*Linum arenicola*). A Federal candidate species and a Florida State endangered species found in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668), this forb is found in pine rockland, marl prairie, and adjacent disturbed areas (FNAI 2000-TN139). Sand flax occurs in Homestead Bayfront Park, which is less than 1 mi north of the Turkey Point site boundary (FNAI 2000-TN139). FPL also noted sand flax was observed in the vicinity of the Turkey Point site (FPL 2011-TN1374). Sand flax was also observed during survey of selected rockland habitats associated with the proposed transmission line corridors, and suspected as occurring within a pine rockland between SW 300 and 304 Streets along the west transmission line corridor (FPL 2009-TN657). It was not observed within any of the other proposed project areas offsite, but ground surveys for plants were not conducted at these locations.

Carter's Small-Flowered Flax (*Linum carteri* var. *carteri*). This Federal and Florida State endangered species in Miami-Dade County (79 FR 52567 [TN4068]; FNAI 2014-TN3668) is an annual herb found in pine rockland habitat. It is found in several conservation areas north of the Turkey Point site (Camp Owaissa Bauer, Deering Estate at Cutler, R. Hardy Matheson Preserve, and Rockdale Pineland) (Gann et al. 2012-TN137). Although it was not observed during ground surveys of the proposed transmission lines (FPL 2009-TN657), ground surveyors acknowledged it has the potential to occur within a pine rockland between SW 300 and 304 Streets within the west transmission line corridor. Critical habitat for this species has been designated within and adjacent to proposed transmission line corridors for proposed Units 6 and 7 and includes 11.2 ac within an FPL utility corridor (79 FR 41211) (TN3725). FPL also confirmed it was observed in the vicinity of the Turkey Point site (FPL 2011-TN1374). The occurrence, distribution, and abundance of Carter's small-flowered flax within the potable and reclaimed water pipeline corridors are unknown.

Tiny Polygala (*Polygala smallii*). The tiny polygala is a short-lived forb that is a Federally and State-listed endangered species found in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The only known populations occur in sand pockets of pine rocklands, open sand pine scrub, slash pine, high pines, and well-drained coastal spoil. Within these habitats it requires high light levels and open sand with little to no organic litter. As of 2007, there were only 11 known populations of tiny polygala all of which are found within about 6 mi of the Atlantic Coast (FWS 1999-TN136). FPL noted this species has been observed in the vicinity of the Turkey Point property (FPL 2011-TN1374). It was not observed growing within the proposed transmission line corridors (FPL 2009-TN657). The occurrence of the tiny polygala at any of the other proposed offsite facility locations is unknown.

Everglades Bully (*Sideroxylon reclinatum ssp. austrofloridense*). A Federally listed candidate species within Miami-Dade County (FWS 2012-TN117), the Everglades bully is a thorny shrub that is endemic to Miami-Dade County. It is found in marl prairie and pine rockland habitats, and in several conservation areas to the west of the Turkey Point site (Lucille Hammock and Frog Pond/L-31 N Transition Lands) as well as in Everglades National Park (Gann et al. 2012-TN137). The Everglades bully was not observed growing in the Turkey Point property vicinity or within selected pine rockland habitats within the proposed transmission line corridors. Occurrence of this species at other proposed facility locations is unknown.

Florida Bristle Fern (*Trichomanes punctatum ssp. floridanum*). This fern is a Federally listed candidate species and a State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). It is found in rockland hammocks, sinkhole habitats (Gann et al. 2012-TN137), and on tree trunks that are in deep shade (NatureServe 2010-TN140). It has been documented in eight conservation areas in Miami-Dade County and it historically occurred in Everglades National Park (Gann et al. 2012-TN137). The Florida bristle fern has not been observed within the proposed transmission line corridors and its occurrence at other proposed facility locations is unknown.

Invertebrates

Florida Leafwing Butterfly (*Anaea troglodyta floridalis*). A Federally listed endangered species in Miami-Dade County (79 FR 47222) (TN3726), the Florida leafwing butterfly lives in pine rocklands of Long Pine Key in the Everglades National Park that contain the larval host plant, pineland croton (*Croton linearis*) (78 FR 49878) (TN2844). A single adult Florida leafwing was observed in the Navy Wells Pine Rockland that lies in the vicinity of the west transmission line corridors as recently as 2008 (78 FR 49878) (TN2844) and major portions of this land parcel has been designated as critical habitat for this species (79 FR 47180) (TN3727). However, it is only known to occur in Long Pine Key in Everglades National Park and is not known to occur within any of the proposed project areas. The proposed East transmission line corridor borders another rockland fragment located on SW 152nd Street that has been proposed as Florida leafwing critical habitat for almost one-half mile. In addition, the pineland croton was observed growing in a pine rockland fragment (King's Highway rockland) found within a segment of all proposed west transmission line corridors between SW 300 and 304 Streets, and SW 202 and 204 Avenues (FPL 2009-TN657).This land parcel was originally proposed as critical habitat but was ultimately not designated as such (79 FR 47180) (TN3727).

Miami Blue Butterfly (*Cyclargus thomasi bethunebakeri*). This butterfly is a Federally listed endangered species and a State-listed endangered species within Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). Primarily a coastal species, the Miami blue inhabits tropical coastal hammocks, scrub, and pine rocklands (Daniels 2005-TN141). The butterfly relies on the pods of balloonvine (*Cardiospermum corindum*) and yellow nicker (*Caesalpinia bonduc*) as its primary larval hosts, and also possibly love-in-a-puff (*Cardiospermum halicacabum*). The butterfly now only occurs within the boundaries of Bahia Honda State Park on Bahia Honda Key in the Lower Florida Keys (Daniels 2005-TN141). Invertebrate surveys have not been conducted at any proposed project locations, so the occurrence of this butterfly at those locations is unknown. Pine rockland habitats exist within the proposed transmission line corridors.

Schaus Swallowtail Butterfly (*Heraclides aristodemus ponceanus*). This butterfly is a Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). Schaus swallowtail butterflies historically occurred in hardwood hammocks from South Miami to Lower Matecumbe Key, Florida (FWS 1999-TN136). The species is currently known to occur in 13 areas on the mainland and the Upper and Middle Keys since reintroduction efforts between 1995 and 1997. The males prefer trails and hammock edges while the females more often fly within the hammock, occasionally venturing out to feed on flowers but typically staying within the hammocks proper. The species rarely feeds in areas

open to direct sunlight. Schaus swallowtail butterfly uses torchwood (*Amyris elemifera*) and wild lime (*Zanthoxylum fagara*) to deposit its eggs. Torchwood is also the primary source of food for the Schaus butterfly (FWS 1999-TN136). Invertebrate surveys have not been conducted at any proposed project locations, so the occurrence of this butterfly at those locations is unknown. Hammock habitats can still be found in the vicinity of Turkey Point and the proposed transmission line corridors, but they are small remnants in widely scattered in a highly fragmented landscape.

Bartram's Scrub-hairstreak Butterfly (*Strymon acis bartrami*). A Federally listed endangered species in Miami-Dade County (79 FR 47222) (TN3726), the hairstreak is found in pine rockland habitats (NatureServe 2010-TN140) in forest openings (Opler et al. 2012-TN142). Bartam's hairstreak is known to occur on Long Pine Key in the Everglades National Park and is sporadically observed within pine rockland fragments near the Everglades National Park border including the Navy Wells and Richmond Pine Rocklands (78 FR 49878) (TN2844). The larval host plant is the pineland croton (*Croton linearis*); adults feed on nectar from the flowers of the narrow-leafed croton and shepherd's needle (*Scandix pectenveneris*) (Opler et al. 2012-TN142). Pineland croton was observed within a pine rockland known as the King's Highway Pineland along the west transmission line corridor (FPL 2009-TN657), and this pine rockland fragment has been designated as critical habitat for Bartam's scrub-hairstreak (79 FR 47180) (TN3727). The proposed East transmission line corridor also borders designated critical habitat for this species. A rockland fragment located on SW 152nd Street borders an existing transmission route that would be expanded for almost one-half mile. Another rockland fragment designated as critical habitat lies immediately adjacent another existing transmission line corridor northeast of the Davis substation. The occurrence of Bartram's scrub-hairstreak at this location or any other proposed location is unknown, as invertebrate surveys have not been conducted at this or other proposed project locations.

Stock Island Tree Snail (*Orthalicus reses reses*). This snail is a Federally listed threatened species and a State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). This species has two subspecies, *O. r. reses* is listed and *O. r. nesodryas* is not. This arboreal snail inhabits the hardwood hammocks of the Florida Keys (FWS 1999-TN136). The snails historically occurred on Stock Island and Key West, but appear to have been extirpated from their historic range. Snails have been introduced by snail collectors to areas outside of their historic range including Key Largo and the southernmost parts of the mainland. The Stock Island tree snail survives best in hammocks with smooth-barked native trees that support relatively large amounts of lichens and algae. The snails lay their eggs in a cavity dug into the soil humus, usually at the base of a tree (FWS 1999-TN136). Invertebrate surveys have not been conducted at any proposed project locations, so the occurrence of the Stock Island tree snail at any of the proposed project locations is unknown. Hammock habitats can still be found in the vicinity of Turkey Point and the proposed transmission line corridors, but they are small remnants widely scattered in a highly fragmented landscape.

Reptiles

Eastern Indigo Snake (*Drymarchon corais couperi*). A Federally and State-listed threatened species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668), the eastern indigo snake is a large, black, non-venomous snake found primarily in upland habitats (FWS 1999-

TN136). They have also been found in pinelands, tropical hardwood hammocks, and mangrove forests. The eastern indigo snake needs a mosaic of habitats to complete its annual cycle. In extreme South Florida (the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (FWS 1999-TN136). Although the snake was previously observed within the EMB south of the IWF in 2004 and just south of SW 344th Street/Palm Drive in 1982 (FPL 2014-TN4058), it was not observed during recent surveys of the Turkey Point site (FPL 2011-TN94). Eastern indigo snakes were also observed at two locations within the eastern transmission line corridor in 2011 (FPL 2012-TN1446). Occurrence of this snake within the potable water pipeline corridor and reclaimed water pipeline corridor is unknown. Use of a wide range of habitats by this species would make it likely they occur at these offsite locations.

American crocodile (*Crocodylus acutus*). See Section 2.4.2 for information about the American crocodile and the American alligator.

Birds

Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis*). A Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668), this medium-sized sparrow has a range that is restricted to the southern Florida peninsula (FWS 1999-TN136; FWS 2010-TN256). They are non-migratory residents of freshwater to brackish marshes of the Everglades region of Miami-Dade and Monroe counties. Their preferred nesting habitat appears to be a mixed marl prairie community that often includes muhly grass (*Muhlenbergia filipes*). The birds tend to avoid tall, dense, sawgrass-dominated communities and sites with permanent water cover (FWS 1999-TN136).

The species includes six subpopulations and the total estimated population is approximately 2,900 individuals (FWS 2010-TN256). Critical habitat designated for this species includes suitable habitat contained within five polygons that range in size from 4,800 to 39,000 ac that are south and west of the Turkey Point site. No Cape Sable seaside sparrows were observed during surveys at the Turkey Point site or the transmission line rights-of-way (FPL 2014-TN4058). Their well-known distribution and ecologically narrow habitat preference of this species very likely excludes the potential for this species to occur at any of the proposed project areas, as land-cover classification information indicates suitable habitat is not present.

Florida Grasshopper Sparrow (*Ammodramus savannarum floridanus*). This bird is a Federally and State-listed endangered species. Although listed by the FWS as occurring in Miami-Dade County, this species appears to be restricted to inland counties on the Florida peninsula and would not be expected to be found in Miami-Dade County (FWS 2012-TN284; FNAI 2000-TN139). Therefore, it is not expected to occur onsite or at any of the proposed offsite project locations.

Florida Scrub Jay (*Aphelocoma coerulescens*). This bird is a Federally and State-listed threatened species. Although listed by the FWS as occurring in Miami-Dade County, distribution information indicates the Florida scrub jay occurs in peninsular Florida, but only in

counties north of Miami-Dade (FWS 2012-TN285). Therefore, it is also not expected to occur onsite or at any of the proposed offsite project locations.

Red Knot (*Calidris canutus rufa*). The red knot is proposed as a Federally threatened species (78 FR 60024) (TN3199). As of 2008, the *rufa* subspecies is thought to have three biogeographically distinct populations, one of which winters in the Southeast United States including Georgia, South Carolina, and Florida (FWS 2013-TN3202). During the winter of 1993-1994 the Florida Fish and Wildlife Conservation Commission (FFWCC) evaluated wintering shorebird distribution and abundance along the entire coast of Florida. It determined the most important shorebird wintering areas in Florida are along the Gulf Coast and there are no important sites for wintering shorebirds along the Atlantic Coast of Miami-Dade County (Sprandel et al. 2000-TN3203). Like other shorebirds, red knots winter in Florida primarily along the central Gulf Coast and that is where survey efforts are focused (FWS 2013-TN3202; FWS 2012-TN146; Niles et al. 2008-TN143). Although approximately 550 red knots were observed during the winter of 2007-2008 along a portion of the west coast of Florida between Anclote Key and Cape Romano (Niles et al. 2008-TN143), more than 3,000 red knots were counted in Florida in 2006, and more than 1,000 were counted again in 2011 (FWS 2013-TN3202), red knots have not been observed and are not known to occur on the Turkey Point property or along the Atlantic Coast of Miami-Dade County. Red knot migration flight has been observed to be very long, and includes flight over the open ocean directly to South America from coastal Massachusetts. However, during migration red knots can occur at suitable habitats all along the coast (FWS 2013-TN3202) and could be expected to occasionally occur in small numbers at the Turkey Point site.

Habitats used by red knots in winter include coastal beaches, tidal mudflats, salt marshes, and peat banks; they also use mangrove and brackish-water lagoons (FWS 2012-TN146). Roosting habitat that provides areas above the highest tides that is free from excessive human disturbance may also be important. Beach habitat along the east border of the Turkey Point property could be suitable for wintering red knots, and the proposed Units 6 and 7 plant area could also provide mudflat habitat suitable for foraging or roosting. Suitable habitat is not present at any of the offsite locations.

Ivory-Billed Woodpecker (*Campephilus principalis*). Although this species was once believed to be extinct, its status has been revised to a Federally endangered species and would therefore be considered a Florida State-listed endangered species (see footnote “c” of Table 2-13). Although listed by the FWS as occurring in Miami-Dade County, distribution information indicates these woodpeckers do not occur in Florida (FWS 2012-TN286). Therefore, ivory-billed woodpeckers are not expected to occur onsite or at any of the proposed offsite project locations.

Piping Plover (*Charadrius melodus*). A Federally and State-listed threatened species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668), the plover is a small, migratory shorebird that breeds only in three geographic regions of North American (FWS 1999-TN136). Piping plovers do not breed in Florida, but individuals from all three breeding populations do winter there and have been observed in Miami-Dade County. Their winter habitats include beaches, mudflats, and sandflats as well as barrier island beaches and spoil islands. Piping plovers seem to prefer landforms that provide tidal flats for foraging and open beaches for roosting within close proximity of each other. The migration pattern of piping plovers is not well

documented, but birds should appear in Florida any time after late July through September and leave from late February to early April (FWS 1999-TN136). The piping plover is not known to occur on the Turkey Point property, and no piping plovers were seen during surveys of the Turkey Point site or the transmission line rights-of-way (FPL 2014-TN4058). Although the piping plover has not been observed on the Turkey Point property, FPL acknowledged the probability of occurrence in the vicinity is moderate (FPL 2011-TN1374). The FFWCC has determined that piping plovers may occur within the proposed project area and have the potential to be affected (FFWCC 2012-TN520), and the proposed Units 6 and 7 plant area could provide suitable mudflat habitats for wintering piping plovers. Land-cover classification information indicates it is unlikely suitable habitat for the piping plover exists within the potable and reclaimed water pipeline corridors.

Kirtland's Warbler (*Dendroica kirtlandii*). This bird is a Federally listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The warbler nests in a relatively small area of central Michigan and migrates south to the Bahamas in winter. Its migratory pattern brings it to the east coast of Florida in spring and fall. Migrating Kirtland's have been observed in a variety of habitats including woodlands, scrub, fencerows, and vegetated yards. They appear to prefer dense vegetation less than 1.5 m in height (FWS 1999-TN136). Sightings in Florida have occurred between late April and early May, and early September and late November. No Kirtland's warblers were observed on surveys of Turkey Point site or the transmission line rights-of-way and this species is not known to occur on any of the onsite of offsite project areas (FPL 2014-TN4058). Preference of a range of low shrub habitats including landscaping in urbanized areas indicates suitable habitat may exist at offsite facilities but is not present within proposed onsite locations.

Wood Stork (*Mycteria americana*). This large, long-legged wading bird is a Federally and State-listed threatened species in Miami-Dade County (79 FR 37077 [TN4039]; FNAI 2014-TN3668). It breeds in South Florida (FWS 1999-TN136) using a variety of wetlands including freshwater and estuarine habitats for nesting, roosting, and foraging (FWS 1997-TN225). Wood storks typically construct their nests in medium to tall trees that occur in stands either in swamps or on islands surrounded by relatively broad expanses of open water and often reuse colony sites many years. Wood storks have abandoned colony locations when water-management practices removed surface water from beneath nesting trees that afforded protection from land-based predators. During the non-breeding season, wood storks occur in a wide variety of wetland habitats including freshwater marshes, stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks, or shallow tidal pools (FWS 1999-TN136). Foraging occurs in almost any shallow, open water where prey items become concentrated (FWS 1997-TN225).

Wood storks do not nest at the Turkey Point site but have been observed there as recently as June 2008 using shallow portions of the IWF to forage and roost during winter (FPL 2014-TN4058). Three storks were also observed using shallow wetlands of the mangrove area immediately west of the proposed Units 6 and 7 plant area. Wood storks nest in four colonies within 5 mi of the proposed Turkey Point-Levee transmission line corridors including a major colony within Everglades National Park (FPL 2012-TN2043). Although there is no designated critical habitat for the wood stork, the FWS Southeast Florida Ecological Services Office recognizes a 0.47 mi nest colony buffer and an 18.6 mi (29.9 km) core foraging area buffer

around all known wood stork colonies that have had active nests within the last 10 years in South Florida (FWS 2010-TN226). Portions of both the east and west transmission lines intersect the core foraging areas of nine wood stork colonies (FPL 2012-TN2043). Impacts on suitable habitats within either of these buffer zones would require mitigation depending on the impact level (FWS 2010-TN226).

Red-Cockaded Woodpecker (*Picoides borealis*). This woodpecker is a Federally and State-listed threatened species. Although listed by the FWS as occurring in Miami-Dade County, distribution information indicates this species is not known to occur in Miami-Dade County and would not be expected to occur at or in the vicinity of any of the proposed project locations (FWS 2012-TN287).

Audubon's Crested Caracara (*Polyborus plancus audubonii*). A Federally and State-listed threatened species in Miami-Dade County (FWS 2012-TN117), the caracara is a resident, diurnal, and non-migratory species that occurs in Florida and parts of the southwestern United States. The Florida population commonly occurs in dry or wet prairie areas with scattered cabbage palms (*Sabal palmetto*) or in lightly wooded areas. Caracaras prefer to nest in cabbage palms surrounded by open habitats with low ground cover and a low density of tall or shrubby vegetation. Observation and radio-telemetry suggest there are three congregation areas in south-central Florida: one along the Kissimmee River north of SR-98, one north of US-27 in Glades County, and one in the vicinity of Eagle Island Road in northern Okeechobee County (FWS 1999-TN136). This species is not known to occur at any of the proposed project locations and no caracaras were observed during surveys of the Turkey Point site or along transmission line rights-of-way (FPL 2014-TN4058). Suitable habitat is not present within the proposed Units 6 and 7 plant area or within the Turkey Point property. It is unknown if suitable habitat is present at any of the proposed offsite locations.

Everglades Snail Kite (*Rostrhamus sociabilis plumbeus*). This Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668) is a subspecies of a wide-ranging New World raptor found primarily in lowland tropical freshwater marshes in Central and South America. In the United States it is restricted to peninsular Florida in the watersheds of the Everglades, lakes Okeechobee and Kissimmee, and the upper St. Johns River. The Everglade snail kite was first listed as endangered in 1967 when the entire population was estimated to number in the dozens. Populations estimates approached 300 individuals in the late 1970s (Sykes 1979-TN4040), and 1,000 individuals in 1994 (FWS 1999-TN136). Recent Everglade snail kite population modeling indicates the population may have peaked at approximately 3,500 individuals in the late 1990s (Martin 2007-TN4041). More recently the entire Florida population was dramatically decreasing in size and last estimated to number fewer than 1,000 individuals in 2011 (Reichert et al. 2011-TN2467). Most of the Florida lands occupied by Everglade snail kites are located north and west of the proposed project areas. Everglade snail kite nesting has also been previously observed along the section of the West Preferred corridor that lies along the east Everglades. During 2010–2012, at least 14 snail kites were observed by the FFWCC from the L-31 Levee where the preferred transmission line corridor would be built (FFWCC 2013-TN2339). Lowland freshwater marsh habitat is present within most legs of the West Preferred corridor. The FFWCC observed 31 snail kite nests during this same time frame immediately north in Water Conservation Area 3B that is bordered by the West Preferred route. Snail kite nests within Water Conservation Area 3B tend to be

located along existing canals and kites forage across the local landscape (Reichert et al. 2011-TN2467). Snail kite nesting here represents one of few areas where successful nesting has occurred within the southern portion of the snail kites range (FFWCC 2013-TN2339). A snail kite was also observed within the EMB adjacent to the Turkey Point site (FPL 2014-TN4058). FWS-designated critical habitat for the snail kite exists in western Miami-Dade County beginning about 22 mi west of the Turkey Point site. None of the proposed project areas occurs within FWS-designated critical habitat. The FWS has also established a snail kite consultation area that includes much of southern Florida. Although Turkey Point site is excluded from this consultation area, major portions of the west transmission route lie within this designated area (FWS 2003-TN227). Land-cover classification information indicates freshwater marsh habitat exists within the potable water pipeline corridor, and reclaimed water pipeline corridor. Suitability of these habitats for the Everglades snail kite is unknown.

Bachman's Warbler (*Vermivora bachmanii*). This bird is a Federally listed endangered species in Miami-Dade County (FWS 2012-TN117). Bachman's warbler breeds in the southeastern United States and winters in western Cuba and the Isle of Pines (FWS 1999-TN136). There are no breeding records for Florida where this species is an early spring and fall transient. Bachman's warbler has not been observed in Florida since 1977 and not anywhere in the United States since 1988 (FWS 1999-TN136). Migratory records of this species are scarce, especially since their rapid decline in the early 1990s; as a result, habitat information is almost nonexistent. It is not expected to occur at any of the proposed project locations due to its apparent extirpation from the U.S.

Mammals

Florida Bonneted Bat (*Eumops floridanus*). This bat is a Federally listed endangered species that was originally proposed for listing as an endangered species in 2012 (77 FR 60750 [TN2276]; FWS 2012-TN117) and subsequently listed in October 2013. It is also a Florida State-listed endangered species within Miami-Dade County (FNAI 2014-TN3668). The bat is a year-round resident and roosts in palms and hollow trees, and may also use building roofs covered with Spanish tiles (FNAI 2000-TN139). They forage high in the air over natural and man-made landscapes (FNAI 2000-TN139). A 2006–2008 acoustic survey found three calls recorded near Homestead, Florida (FWS 2011-TN147), along the L-31 Canal in the vicinity of the west preferred corridor, and at Zoo Miami located in the vicinity of the East preferred corridor (78 FR 61004) (TN2659). Almost nothing is known about the distribution, and abundance of this bat at any of the proposed project locations but FPL acknowledged the Florida bonneted bat has been observed in the Turkey Point vicinity (FPL 2011-TN1374). Palms, hollow trees, and buildings roofed with Spanish tiles do not appear to be abundant in the landscape around much of the project areas. Palms planted for landscaping are present around existing facilities within the Turkey Point site and may be more abundant where transmission line corridors, such as the Davis to Miami section of the East corridor, pass through previously developed residential and industrial areas.

Florida Panther (*Puma concolor coryi*). This subspecies of the mountain lion is a Federally and State-listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). A small population of 100 to 160 individuals in South Florida represents the only known remaining wild population of this subspecies (FFWCC 2010-TN3438). The panther

presently occupies one of the least-developed areas in the eastern United States; a contiguous system of large private ranches and public conservation lands in Broward, Collier, Glades, Hendry, Lee, Miami-Dade, Monroe, and Palm Beach Counties totaling more than 809,400 ha. Radio-telemetry surveys indicated panthers prefer native, upland forests, especially hardwood hammocks and pine flatwoods, over wetlands and disturbed habitats. Understory thickets of tall, almost impenetrable, saw palmetto (*Serenoa repens*) have been identified as important denning cover for panthers. The largest contiguous tract of panther habitat is in the Big Cypress Swamp/Everglades physiographic regions south and west of the proposed project areas. The FWS recognizes much of Miami-Dade County and South Florida as a Florida Panther Focus Area (FWS 1999-TN136). Although most of the FPL Turkey Point site lies outside of the focus area, lands immediately adjacent to the south and west are contained within the focus area and are also considered to be within the panther's primary zone (FWS 2007-TN230). No confirmed panther occurrences have been recorded on the Turkey Point property, within the proposed reclaimed and potable water corridors (FPL 2014-TN4058). Radio-collared panthers have been recorded near both routes of the proposed west transmission line corridor between the Clear Sky and Levee substation locations, and in October 2013 an adult and kitten were observed traveling east along the corridor approximately 2 mi west of the Turkey Point site boundary in the Model Lands Area (SFWMD 2013-TN2917). A historical Florida panther den was also located near the proposed west transmission line corridor. The FFWCC has determined that the Florida panther may occur within the proposed project area and could potentially be affected (FFWCC 2012-TN520).

Puma (or mountain lion) (*Puma concolor*, all subspecies except *coryi*). This species is a Federally listed threatened species based on its similarity in appearance to the Florida panther (FWS 2012-TN117). The mountain lion occupies a wide variety of habitats including swamps, riparian woodlands, and broken country with good cover of brush or woodland (NatureServe 2010-TN140). The mountain lion is widely distributed throughout the United States but is not known to occur in Florida. This species will not be considered in further discussion.

Red wolf (*Canis rufus*). This species is a Federally listed endangered species in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The red wolf has been extirpated from its former range throughout the southeastern United States; it is not known to exist in Florida and now only exists in one major population in northeastern North Carolina, plus a couple of islands used for propagation (NatureServe 2010-TN140). This species will not be considered in further discussion.

State-Listed Species

The FFWCC is responsible for maintaining lists of rare species in Florida. Southern Florida is a biologically rich area with many endemic species (species naturally occurring nowhere else). In addition to Federally listed species there are 110 plant species (Table 2-14) and 23 animal species (Table 2-15) in Miami-Dade County that the FFWCC has listed as endangered, threatened, or as Species of Concern in addition to those that are also listed as endangered or threatened under the Federal ESA. Of these, FPL acknowledged one reptile, nine birds, a mammal, and 60 plant species were observed within the vicinity of the Turkey Point property (FPL 2011-TN1374). The least tern (*Sterna antillarum*), white-crowned pigeon (*Patagioenas*

leucocephala), little blue heron (*Egretta caerulea*), roseate spoonbill (*Platalea ajaja*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), reddish egret (*Egretta rufescens*), and white ibis (*Eudocimus albus*) were previously observed on or adjacent to the proposed Units 6 and 7 plant area at the Turkey Point site (FPL 2014-TN4058). A single Florida burrowing owl (*Athene cunicularia floridana*) was observed once in 2010 along a road within the IWF (FPL 2012-TN1468).

Individuals or populations of 17 plant species listed by the State of Florida were observed within proposed transmission line corridors (FPL 2009-TN1449). Occurrences of both State threatened and State endangered species were common within the first 8 mi segment of the West corridors and the first 6 mi segment of the East corridor originating at Units 6 and 7. Numerous State endangered species were also observed within the final 3 mi segment of the West corridors nearest the Pennsuco substation. Scattered occurrences were also observed in other segments of the corridors. The Davis-Miami segment of the East corridor was not surveyed so the occurrence, distribution, or abundance of State-listed species is unknown (FPL 2009-TN1449). This portion lies within a mostly urbanized landscape, so occurrence of State-listed species would be expected to occur within scattered remnants of native vegetation.

Although many of the State-listed plants are found in either pine rockland or marl prairie habitats, neither of which occurs on the Turkey Point site, the range of habitats in which they occur indicates unreported species and populations likely occur within other proposed project areas. For instance Small's flax (*Linum carteri var. smallii*) and the Bahama ladder brake (*Pteris bahamaensis*) are known to occur in disturbed habitat, much of which has not been surveyed. Also the banded wildpine (*Tillandsia flexuosa*) is an epiphyte that grows on a variety of other plants that occur in a wide range of habitat conditions. The full extent of which State-listed plant species occur within all proposed project areas is undetermined.

Table 2-14. State-Listed Terrestrial or Wetland Plant Species Occurring in the Vicinity of the Turkey Point Site not Previously Discussed as a Federal Listed Species

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Acrostichum aureum	Golden leather fern	ST	X	Brackish and freshwater marshes[b]
Adiantum melanoleucum	Fragrant maidenhair fern	SE		Sides of limestone sinks[b]
Adiantum tenerum	Brittle maidenhair fern	SE		Moist limestone in rockland hammocks[b]
Aeschynomene pratensis	Meadow jointvetch	SE		Marl prairie; cypress domes; swales[c]
Aletris bracteata	Bracted colic-root	SE		Marl prairie; pine rockland[b]
Alvaradoa amorphoides	Everglades leaf lace	SE		Pine rocklands and transition zones with rockland hammocks
Anemia wrightii	Wright's anemia	SE		Limestone pinnacles; walls of solution holes; pine rockland; rockland hammocks[c])
Argusia gnaphalodes	Sea lavender	SE		Beach dunes; coastal thickets[b]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Aristolochia pentandra	Marsh's dutchman's pipe	SE		Rockland hammock[b]
Asplenium trichomanes-dentatum	American toothed spleenwort	SE		Tropical hardwood hammocks; limestone outcrops; walls of limesinks[c]
Asplenium serratum	American bird's nest fern	SE		Cypress swamps; tropical rockland hammocks[c]
Asplenium verecundum	Modest spleenwort	SE		Rockland hammock; limestone outcrops, grottoes, and sinkholes
Basiphyllaea corallicola	Rockland orchid	SE		Pine rocklands and rockland hammock[c]
Beloglottis costaricensis	Costa Rican ladies'-tresses	SE		Rockland hammock[b]
Bourreria cassinifolia	Smooth strongbark	SE		Pine rocklands[c]
Brassia caudata[a]	Spider orchid	SE		Rockland hammock[b]
Byrsonima lucida	Locustberry	ST	X	Pine rocklands and rockland hammock[b]
Calyptranthes zuzygium	Myrtle-of-the-river	SE		Rockland hammocks; coastal berm[c]
Catopsis berteroniana	Powdery catopsis	SE		Tropical hammocks; cypress swamps[c]
Catopsis floribunda	Many-flowered catopsis	SE		Tropical hammocks; cypress swamps[c]
Chamaesyce deltoidea ssp. adhaerens	Hairy deltoid spurge	SE		Pine rockland[c]
Chamaesyce porteriana	Porter's broad-leaved spurge	SE		Pine rocklands, rockland hammock, coastal rock barrens, marl prairie[c]
Coccothrinax argentata	Florida silver palm	ST	X	Five habitats: coastal berm, coastal strand, maritime hammock, marl prairie, and pine rockland[b]
Colubrina cubensis var. floridana	Cuban snake-bark	SE		Rockland hammocks and pine rocklands[c]
Crossopetalum ilicifolium	Quailberry (Christmas berry)	ST	X	Marl prairie, pine rockland, rockland hammock[b]
Crossopetalum rhacoma	Rhacoma	ST		Coastal berm, coastal strand, pine rockland, rockland hammock[b]
Ctenitis sloanei	Florida tree fern	SE		Rockland hammocks and strand swamp[b]
Cyclopogon elatus	Tall neottia	SE		Rockland hammocks[b]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Cyrtopodium punctatum	Cowhorn orchid	SE		Cypress swamps, coastal hammocks, occasionally pinerocks and marl prairies[c])
Drypetes diversifolia	Milkbark	SE		Rockland hammocks[b]
Eltroplectris calcarata	Spurred neottia	SE		Mesic hammock, rockland hammock[c]
Prosthechea boothiana var. erythronioides	Dollar orchid	SE		Disturbed upland, rockland hammock, tidal swamp[b]
Encyclia cochleata var. triandra	Clamshell orchid	SE		Trunks and branches of pond apple, cypress, live oak, and buttonwood trees in swamps and hammocks[c]
Epidendrum nocturnum	Night-scented orchid	SE		Tree trunks, branches, and stumps in hammocks, swamps, and sloughs[c]
Ernodea cokeri	Coker's beach creeper	SE		Pine rocklands[c]
Eugenia confusa	Tropical ironwood	SE		Rockland hammocks[c]
Eugenia rhombea	Red stopper	SE		Rockland hammocks[c]
Eupatorium villosum	Villose fennel	SE		Pine rocklands, rockland hammocks[c]
Euphorbia pinetorum	Rockland painted-leaf	SE		Pine rocklands[b]
Galeandra bicarinata	Two-keeled helmet orchid	SE		Hammocks[b])
Glandularia maritima	Coastal vervain	SE		Back dunes, dune swales, coastal hammocks; disturbed, sandy areas[c]
Govenia floridana	Sheathing govenia	SE		Rockland hammocks[b]
Guaiacum sanctum	Lignumvitae	SE		Rockland hammocks[c]
Guzmania monostachia	Fakahatchee guzmania	SE		Swamps and wet hammocks[c]
Harrisia simpsonii	Simpson's prickly apple	SE		Scrubby flatwoods and xeric hammocks on the Atlantic Coastal Ridge[c]
Hippomane mancinella	Manchineel	SE		Coastal berms and hammocks in brackish areas just inland of the mangrove zone[c]
Hypelate trifoliata	White ironwood	SE		Rockland hammocks[c]
Ilex krugiana	Krug's holly	ST	X	Pine rockland, rockland hammock[b]
Ipomoea microdactyla	Wild potato morning glory	SE		Pine rocklands[c]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Ipomoea tenuissima	Rocklands morning glory	SE	X	Pine rocklands[c]
Jacquemontia curtissii	Pineland jacquemontia	ST	X	Disturbed upland, marl prairie, mesic flatwoods, pine rockland[b]
Jacquemontia pentanthos	Skyblue clustervine	SE	X	Bayhead, coastal rock barren, disturbed upland, marl prairie, pine rockland, rockland hammock[b]
Jacquinia keyensis	Joewood	ST		Coastal rock barren, coastal strand, disturbed upland, maritime hammock, pine rockland[b]
Lantana canescens	Small-headed lantana	SE		Transition zones between rockland hammock and pine rockland[c]
Lantana depressa var. depressa	Florida lantana	SE	X	Pine rocklands[b]
Lantana depressa var. floridana	Atlantic Coast Florida lantana	SE		Stabilized dunes of the Atlantic Coast barrier islands and relictual dunes of central Florida[b]
Voyria parasitica	Ghost plant	SE	X	Rockland hammocks, sinkholes[b]
Licaria triandra	Gulf licaria	SE		Rockland hammocks[c]
Linum carteri var. smallii	Small's flax	SE	X	Pine rocklands, pine flatwoods, adjacent disturbed areas[c]
Lomariopsis kunzeana	Holly vine fern	SE		Rockland hammocks, sinkholes[b]
Microgramma heterophylla	Climbing vine fern	SE		Rockland hammocks[b]
Odontosoria clavata	Wedgelet fern	SE		Pine rocklands, sinkholes, limestone ledges, rocky glades[c]
Okenia hypogaea	Burrowing four-o'clock	SE		Beach dune, disturbed upland[b]
Oncidium floridanum	Florida dancing lady orchid	SE		Rockland hammocks, cypress swamps[c]
Ophioglossum palmatum	Hand fern	SE		“Boots,” or old leaf bases, of cabbage palms in maritime hammocks and wet hammocks[c]
Passiflora multiflora	White passion flower	SE		Tropical hammocks[c]
Passiflora sexflora	Everglades Key passion flower	SE		Tropical hammocks[c]
Pavonia paludicola	Mangrove mallow	SE		Disturbed wetland, tidal marsh, tidal swamp[b]
Peperomia obtusifolia	Blunt-leaved peperomia	SE		Rockland hammocks, hydric hammocks, strand swamps[c]
Phoradendron rubrum	Mahogany mistletoe	SE		Rockland hammock[b]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Picramnia pentandra	Bitter bush	SE		Rockland hammocks[c]
Dendrophylax lindenii	Ghost orchid	SE		Dense, wet subtropical to tropical forests and hammocks
Prescotia oligantha	Small-flowered prescotia	SE		Rockland hammock[b]
Prunus myrtifolia	West Indian cherry	ST		Rockland hammock[b]
Pseudophoenix sargentii	Florida cherry-palm	SE		Coastal berm, rockland hammock[b]
Psidium longipes	Mangrove berry	ST		Pine rockland, rockland hammocks[c]
Psychotria ligustrifolia	Bahama wild coffee	SE		Rockland hammock[c]
Pteris bahamensis	Bahama brake	ST	X	Disturbed upland, marl prairie, pine rockland, rockland hammock, sinkholes[b]
Pteroglossaspis ecristata	Giant orchid	ST		Sandhill, scrub, pine flatwoods, pine rocklands[c]
Roystonea elata	Florida royal palm	SE		Rocklands.
Sachsia polycephala	Bahama sachsia	ST	X	Disturbed upland, pine rockland[b]
Sacoila lanceolata var. paludicola	Fahkahatchee ladies'-tresses	ST		Swamps and hydric hammocks[c]
Schaefferia frutescens	Yellowwood	SE		Rockland hammock[b]
Actinostachys pennula	Ray fern	SE		Bayhead, floodplain forest, mesic flatwoods, rockland hammock[b]
Scutellaria havanensis	Havana skullcap	SE		Disturbed upland, pine rockland[b]
Selaginella eatonii	Eaton's spike moss	SE		Rockland hammocks and pine rocklands[b]
Spiranthes polyantha	Green ladies'-tresses	SE		Rock outcrops in mesic hammock, rockland hammock, maritime hammock[c]
Spiranthes torta	Southern ladies'-tresses	SE		Pine rockland, marl prairie, edges of rockland hammock[c]
Stylosanthes calcicola	Pineland pencil flower	SE		Pine rocklands and marl prairies, especially the transition zones between these two communities[c]
Swietenia mahagoni	West Indies mahogany	ST		Between pine rockland and marl prairie communities[c]
Tectaria fimbriata	Least Halberd fern	SE		Solution holes in limestone in rockland hammocks[c]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[(a)]	Habitat
Tephrosia angustissima var. angustissima[a]	Devil's shoestring	SE		Pine rocklands[(c)]
Tephrosia angustissima var. corallicola	Rockland hoary-pea	SE		Pine rocklands[(c)]
Tephrosia angustissima var. curtissii	Coastal hoary-pea	SE		Scrub and sandy areas[(c)]
Thelypteris reptans	Creeping maiden fern	SE		Limestone grottoes and sinkholes[(c)]
Thelypteris sclerophylla	Stiff-leaved maiden fern	SE		Rockland hammock and sinkholes[(b)]
Thelypteris serrata	Toothed maiden fern	SE		Cypress swamps, sloughs, floodplains[(c)]
Thrinax morrisii	Brittle thatch palm	SE		Coastal berm, rockland hammock, pine rockland, maritime hammock, disturbed upland[(b)]
Thrinax radiata	Florida thatch palm	SE		Coastal berm, rockland hammock, pine rockland[(b)]
Tillandsia flexuosa	Banded wildpine	ST	X	17 habitats: coastal berm, coastal grassland, coastal rock barren, disturbed upland, dome swamp, freshwater tidal swamp, maritime hammock, marl prairie, pine rockland, rockland hammock, sandhill, scrub, shell mound, strand swamp, tidal marsh, tidal swamp, xeric hammock[(b)]
Tragia saxicola	Pineland noseburn	ST	X	Disturbed upland, pine rockland[(b)]
Trema lamarckianum	Lamarck's trema	SE	X	Disturbed upland, pine rockland, marl prairie, rockland hammock[(b)]
Trichomanes krausii	Kraus' bristle fern	SE		Buttressed roots and tree bases in rockland hammocks[(c)]
Trichomanes punctatum ssp. floridanum	Florida filmy fern	SE		Pine rockland[(c)]
Tripsacum floridanum	Florida gamagrass	ST	X	Pine rockland, marl prairie[(b)]
Tropidia polystachya	Young-palm orchid	SE		Rockland hammock[(b)]
Vanilla barbellata	Worm-vine orchid	SE		Mangroves, coastal hammocks, rocky pinelands, island hammocks in the Everglades[(c)]

Table 2-14. (contd)

Scientific Name	Common Name	State Status	Observed[a]	Habitat
Vanilla phaeantha	Leafy vanilla	SE		Island hammocks in the Everglades
Zanthoxylum coriaceum	Biscayne prickly ash	SE		Tropical coastal hammocks[c]
Zephyranthes simpsonii	Redmargin zephyrlily	ST		Disturbed upland, disturbed wetland, mesic flatwoods, swale, wet flatwoods[b]

(a) Species not listed as occurring in Miami-Dade County by the FNAI (2000-TN139).
Observed during botanical surveys within proposed transmission line corridor (FPL 2009-TN657).
(b) Gann et al. 2012-TN137
(c) FNAI 2000-TN139

Source: FPL 2014-TN4058

Table 2-15. State-Listed Terrestrial or Wetland Animal Species Occurring in the Vicinity of the Turkey Point Site not Previously Discussed as a Federal Listed Species

Scientific Name	Common Name	State Status[a]	Observed[b]	Habitat[c]
Reptiles				
Gopherus polyphemus	Gopher tortoise	ST		Dry upland habitats, including sandhills, scrub, xeric oak hammock, and dry pine flatwoods; also disturbed habitats such as pastures, oldfields, and road shoulders
Pituophis melanoleucus mugitus	Florida pine snake	SSC		Sandhill and former sandhill, including oldfields and pastures; also sand pine scrub and scrubby flatwoods
Tantilla oolitica	Rim rock crowned snake	ST		Tropical hardwood hammocks, slash pine rocklands, and disturbed habitats (vacant lots and pastures)
Birds				
Aramus guarauna	Limpkin[d]	SSC		Mangroves, freshwater marshes, swamps, springs and spring runs, and pond and river margins; mostly resident
Athene cunicularia floridana	Florida burrowing owl[d]	SSC	X	Sparsely vegetated, sandy ground; open habitats among developed landscapes; resident
Egretta caerulea	Little blue heron[d]	SSC	X	Nests in coastal areas; feeds in shallow freshwater, brackish, and saltwater habitats; resident
Egretta rufescens	Reddish egret[d]	SSC	X	Nests on coastal mangrove islands; forages in shallow water; resident

Table 2-15. (contd)

Scientific Name	Common Name	State Status[a]	Observed[b]	Habitat[c]
Egretta thula	Snowy egret[d]	SSC	X	Nests in both inland and coastal wetlands; forages in permanently and seasonally flooded wetlands, streams, swamps, and in man-made impoundments and ditches; resident
Egretta tricolor	Tricolored heron[d]	SSC	X	Nests on mangrove islands or willow thickets; forages in permanently and seasonally flooded wetlands, swamps, tidal creeks, ditches and edges of ponds and lakes; resident
Eudocimus albus	White ibis[d]	SSC	X	Freshwater and wetlands, wet prairies, swales, seasonally inundated fields, and man-made ditches; resident
Falco sparverius paulus	Southeastern American kestrel	ST		Open pine habitats, woodland edges, prairies, and pastures; resident
Grus canadensis pratensis	Florida sandhill crane	ST		Prairies, freshwater marshes, and pasture lands; frequent feedlots, crop fields, golf courses and other open lawns; nests constructed in shallow water or in marshy areas; resident
Haematopus palliatus	American oystercatcher [d]	SSC		Large areas of beach, sandbar, mudflat and shellfish beds for foraging; sparsely vegetated, sandy areas for nesting; resident
Pandion haliaetus	Osprey	SSC		On or near large lakes, rivers, and coastal areas; nest in large living or dead trees and man-made structures; resident
Patagioenas leucocephala	White-crowned pigeon[d]	ST	X	Nests on mangrove islands and islets; forages in tropical hardwood hammocks; summer resident
Pelecanus occidentalis	Brown pelican[d]	SSC	X	Coastal; uses sand spits, sand bars, and islets for roosting; nests on small islands in bays and estuaries; resident
Eudocimus albus	Roseate spoonbill[d]	SSC	X	Nests on coastal mangrove islands or man-made dredge spoil islands; forages on shallow waters of variable salinity; resident
Rynchops niger	Black skimmer[d]	SSC		Coastal waters; nest on sand beaches, small coastal islands and dredge spoil islands; resident
Sterna antillarum	Least tern[d]	ST	X	Coastal areas for foraging; nests on substrate of well-drained sand or gravel that features little vegetation; summer resident

Table 2-15. (contd)

Scientific Name	Common Name	State Status[(a)]	Observed[(b)]	Habitat[(c)]
Mammals				
Neovison vison evergladensis	Everglades mink[(d)]	ST		Wetland communities, including salt marsh, freshwater marsh, cypress swamp, and hardwood swamp
Podomys floridanus	Florida mouse	SSC		Xeric upland communities with sandy soils, including scrub, sandhill, and ruderal sites
Ursus americanus floridanus	Florida black bear	ST		Variety of forested habitats including forested wetlands

(a) State Status: ST (threatened); SSC (Species of Concern); source: FNAI 2014-TN3666.
(b) Previously observed within the Turkey Point site or within the proposed Units 6 and 7 transmission line corridors.
(c) Sources for habitat information: FNAI 2000-TN139.
(d) Determined or presumed by the FFWCC to present and have the potential to be affected (FFWCC 2012-TN520).

The FFWCC determined that the 12 bird and 1 mammal species described below and listed by the State of Florida are either known or likely to be present on the Turkey Point site (Table 2-15).

Limpkin (*Aramus guarauna*)

The limpkin is a resident wading bird that uses wetlands including mangroves, freshwater marshes, swamps, ponds, and canal banks (FNAI 2000-TN139). Although listed as a Species of Concern in Florida, its distribution is widespread in southern Florida. Land-cover classification information indicates habitat suitable for limpkins is present at all proposed onsite and offsite project locations.

Florida Burrowing Owl (*Athene cunicularia floridana*)

Florida burrowing owls are named for their propensity to nest in underground burrows. They prefer sparsely vegetated, sandy, upland habitats including dry prairies and sandhills. They have taken advantage of disturbances that create open habitats and use pastures, airports, parks, rights-of-way, and vacant residential lots (FNAI 2000-TN139). A single burrowing owl was observed in 2010 on a roadway within the IWF (FPL 2014-TN4058). The presence and abundance of this species at other proposed project locations is unknown. The affinity for upland habitats for burrowing would exclude this bird from most of the proposed project locations. Vacant upland lots and canal berms along some of the transmission line corridors may provide suitable burrowing habitat.

Little Blue Heron (*Egretta caerulea*)

This resident heron feeds in virtually all wetland habitat types in South Florida. Little blue herons nest in trees and their nesting colonies can be found nearly statewide in Florida (FNAI 2000-TN139). Little blue herons have been observed throughout the Turkey Point site

where appropriate habitat is present (FPL 2014-TN4058). Wetlands are present at all proposed project locations and this heron is likely present there.

Reddish Egret (*Egretta rufescens*)

The reddish egret is a coastal species that nests on mangrove islands as well as non-native Brazilian pepper stands on dredge spoil islands. It forages in shallow water and will use sparsely vegetated tidal flats, shorelines, and salt evaporation pools (FNAI 2000-TN139). It is a resident species in Florida. Reddish egrets have been observed throughout the FPL Turkey Point site where appropriate habitat is present (FPL 2014-TN4058). This species is also likely to occur in wetlands at all offsite locations.

Snowy Egret (*Egretta thula*)

The snowy egret is also a resident species in South Florida. It nests in woody shrubs such as willow and mangrove and prefers nesting over the water or on islands. These egrets require a variety of wetland habitat types near nesting colonies to successfully forage, and breeding success has been related to water depth (FNAI 2000-TN139). Snowy egrets have been observed throughout the Turkey Point site where appropriate habitat is present (FPL 2014-TN4058). Snowy egrets regularly nest within wading bird colonies adjacent to the proposed western transmission line corridors and are also likely to occur in wetlands at all offsite locations.

Tricolored Heron (*Egretta tricolor*)

Like the snowy egret, the tricolored heron is a resident species that also nests in mangroves and willows as well as other woody vegetation over standing water or in islands. Tricolored herons prefer to feed in coastal wetlands including seasonally flooded habitats, mangrove swamps, ditches, and tidal creeks. Seasonal water-level fluctuation is critical to nesting success (FNAI 2000-TN139). Tricolored herons have been observed throughout the Turkey Point site where appropriate habitat is present (FPL 2014-TN4058) and are likely to occur in suitable wetland habitats at all offsite locations.

White Ibis (*Eudocimus albus*)

The white ibis is a medium-sized wading bird that uses a wide variety of freshwater and saltwater wetland habitats including brackish marsh, salt flats, forested wetlands, wet prairies, and ditches. Although present in Florida throughout the year, they are known for spring and fall movements in response to changing water levels. White ibis nests are found in trees, shrubs, and vines and their nomadic behavior can result in large annual fluctuations within a local breeding population (FNAI 2000-TN139). White ibises have been observed throughout the Turkey Point site where appropriate habitat is present (FPL 2014-TN4058). White ibis commonly nest within wading bird colonies adjacent to the proposed western transmission line corridors and suitable wetland habitat is also present at all other proposed offsite locations.

Roseate Spoonbill (*Eudocimus albus*)

The roseate spoonbill is a medium-sized wading bird that uses a variety of freshwater and saltwater wetlands in search of food. Spoonbills nest on mangrove islands, in Brazilian pepper stands on dredge spoil islands, or in willows near freshwater wetlands (FNAI 2000-TN139). It is a resident in South Florida. Roseate spoonbills were observed within Turkey Point site and within the proposed Units 6 and 7 plant area (FPL 2014-TN4058). They occasionally nest within wading bird colonies adjacent to the proposed western transmission line corridors and are likely present at all proposed offsite locations.

American Oystercatcher (*Haematopus palliates*)

The American oystercatcher is a large, resident shorebird along coastal Florida. Oystercatchers require large, open expanses including beaches, sandbars, mudflats, and shellfish beds to effectively forage. They prefer to nest on the ground in a large expanse of sparsely vegetated sandy habitat, but will also nest in or near sparse cover (FNAI 2000-TN139). Although not previously observed at any of the proposed project locations, FPL determined the likelihood of occurrence in the vicinity of the Turkey Point property was moderate (FPL 2011-TN1374).

White-Crowned Pigeon (*Patagioenas leucocephala*)

This pigeon nests on isolated mangrove islands in extreme South Florida. It feeds on the fruit produced by hardwood trees including poisonwood (FNAI 2000-TN139). Most white-crowned pigeons are only present during the May-September nesting season, although some may be present in South Florida during winter. White-crowned pigeons were observed within the proposed Units 6 and 7 plant area at the Turkey Point site (FPL 2014-TN4058). The presence and abundance of this pigeon at other proposed project locations is unknown.

Brown Pelican (*Pelecanus occidentalis*)

The brown pelican is a coastal resident species that feeds mostly in shallow estuaries. It loafs and perches on exposed sand habitat such as spits and bars as well as mangrove islands. Brown pelicans nest on small islands near bays and estuaries either in small trees and shrubs or on the ground (FNAI 2000-TN139). Brown pelicans were observed during reconnaissance of the proposed project area (FPL 2014-TN4058). They would not be expected to occur at any of the offsite project areas as they are all inland.

Black Skimmer (*Rynchops niger*)

The black skimmer is a gull-like bird that forages over coastal waters including bays, estuaries, tidal creeks, and inland lakes. It is a resident species along most of the coast but is more abundant in South Florida during the winter. Black skimmers nest on sand beaches, small islands, and dredge spoil islands, and have also been found nesting along a road in an agricultural setting (FNAI 2000-TN139). They are not known to occur at any of the proposed project locations, but roads within the IWF could provide suitable nesting habitat.

Least Tern (*Sterna antillarum*)

The least tern is a coastal species that migrates to Florida to nest. Nesting occurs on well-drained sand or gravel substrates with little vegetation. These conditions typically exist on beaches along lagoons, bays, and estuaries. However, least terns have also been observed nesting on dredge spoil islands, construction sites, causeways, and mining areas (FNAI 2000-TN139). Least terns have nested along canals within the Turkey Point site (FPL 2012-TN1058). They are not known to occur at any of the proposed locations offsite and would not be expected due to habitat preferences.

Everglades Mink (*Neovison vison evergladensis*)

Very little is known about the Everglades mink, but it is a recognized subspecies of mink believed to occur locally in Florida (FFWCC 2011-TN643). Where it occurs, it would generally be found in wetland habitats. Wetland habitats occur at all onsite and offsite locations.

Other Important Species and Habitats

In addition to Federally and State-listed species and those proposed for listing, Environmental Standard Review Plan (ESRP) guidance (NRC 2000-TN614) identifies important species as those that are commercially valuable, recreationally valuable, essential to the maintenance or survival of commercially or recreationally valuable species, critical to the structure and function of local terrestrial ecosystems, and those that serve as biological indicators. Important habitats include wildlife refuges, sanctuaries, preserves, FWS-designated critical habitat, other State or Federally protected habitats, wetlands, and floodplains (see Figure 2-25).

Mangrove forests are an integral part of South Florida's ecology and are the most biologically productive ecosystems in the world. Mangroves represent the link between upland and marine ecosystems in many tropical and subtropical areas that provides vital food and habitat resources to many species (FWS 1999-TN136). The red mangrove (*Rhizophora mangle*) is an important indicator of this highly valuable forest type in South Florida. South Florida mangrove forests support an incredible number of bird species and provide vital habitat for many neotropical migrant songbirds, raptors, and estuarine birds. Listed species that depend on or use mangroves include the Florida panther, wood stork, eastern indigo snake, Florida black bear, Everglades mink, white-crowned pigeon, brown pelican, tricolored heron, little blue heron, white ibis, snowy egret, reddish egret, and roseate spoonbill. Much of South Florida's mangrove forests have been lost to coastal urbanization and alteration of freshwater hydroperiod from impoundment (FWS 1999-TN136).

Pine rockland is a savanna-like forest that occurs on limestone outcrops of the Miami Rock Ridge, which supports diverse shrub and herb layers that include almost as many as 374 different plant species (FWS 1999-TN136). Many endemic plant and animal species are dependent upon pine rocklands, and many Federally and State-listed plants and wildlife use pine rockland, including Blodgett's wild-mercury, Carter's small-flowered flax, Florida lantana, Garber's spurge, deltoid spurge, tiny polygala, small's milkpea, crenulate lead-plant, Kirtland's warbler, eastern indigo snake, Florida panther, and both Florida leafwing and Bartram's scrub-hairstreak butterflies. More than 90 plant Species of Concern have been recorded in pine

rocklands (FWS 1999-TN136). Because pine rocklands occur at relatively high elevations in the southern Florida landscape, they are also ideal for urbanization and rural development, which has resulted in extensive loss and fragmentation. On the Florida peninsula, pine rockland fragments persist in Miami-Dade County from Florida City north to Southwest 32nd Street, northern Monroe County, and southeast Collier County (FWS 1999-TN136).

Marl prairie is a sparsely vegetated, grass-dominated community that is seasonally flooded. It occurs on marl substrates, which are impermeable fine white muds deposited on limestone (FWS 1999-TN136). Unlike similar marsh habitat, marl prairie supports a very high diversity of native plants including Federally and State-listed species. Historically, marl prairie was maintained by fire and is the primary habitat of the Cape Sable seaside sparrow.

Wetlands in various forms are the dominant land cover in South Florida. Likewise, most of the Turkey Point site and the vast majority of the proposed Units 6 and 7 plant area are also wetlands including open water, mud flat, remnant canals, wetland spoil, and mangroves.

Everglades National Park, immediately west of the Turkey Point site, encompasses over 1.5 million ac in Dade, Monroe, and Collier Counties in South Florida. It is recognized as a World Heritage Site, a Biosphere Reserve, a Wetland of International Significance, and an OFW. The EMB is a FPL-owned wetland mitigation area that links Everglades National Park with Biscayne Bay. It borders the Turkey Point site immediately west and south of the industrial wastewater canal system and encompasses over 13,000 ac. Biscayne National Park, bordering much of the east side of the Turkey Point site, encompasses 172,000 ac. Included within this national park is the southern expanse of Biscayne Bay, northern portion of Card Sound, the mangroves along the mainland shore, northern-most Florida Key islands, and extensive offshore coral reefs. Crocodile Lake National Wildlife Refuge, 10 mi south of the Turkey Point site, occupies 6,700 ac near Key Largo, Florida.

There is no FWS-designated critical habitat for terrestrial species on the FPL Turkey Point site (see Section 2.4.2.3 for discussion of the American crocodile designated critical habitat). However, critical habitat has been designated for the Cape Sable seaside sparrow and Everglades snail kite within a 50 mi radius of the FPL Turkey Point site. Cape Sable seaside sparrow critical habitat exists in southwestern Miami-Dade County as near as 15 mi to the west. Everglades snail kite critical habitat can be found in west and northwest Miami-Dade County about 22 mi west of the site as well as in Broward County to the north. Critical habitat has also been designated for the Florida leafwing and Bartram's scrub-hairstreak butterflies, Florida brickell-bush, and Carter's small-flowered flax. A single pine rockland fragment designated as critical habitat for Bartram's scrub-hairstreak, Florida brickell-bush, and Carter's small-flowered flax lies within both of the proposed west transmission line corridors. Additional critical habitat for all four of these species lies alongside or nearby other portions of the proposed transmission system.

Commercially and Recreationally Valuable Species

Although numerous game species including white-tailed deer (*Odocoileus virginianus*), mourning dove (*Zenaida macroura*), and cottontail rabbit (*Sylvilagus floridanus*) are present, public access for harvest of game animals is prohibited on the Turkey Point site (FPL 2014-

TN4058). Waterfowl habitat is present and waterfowl are likely to occur in local wetlands and open water habitats. As with other game animals, public waterfowl hunting on the site is prohibited, and if hunting occurs in the immediate vicinity of the Turkey Point site waterfowl may be artificially concentrated on the site during hunting seasons.

Disease Vector and Pest Species

In epidemiology, a vector does not cause a disease, but instead spreads infection from one host to another. Numerous disease vectors exist in the animal kingdom. Blood-sucking insects such as mosquitoes, ticks, and fleas are widely known to transmit disease to both animals and humans. Mammals such as bats, raccoons, and skunks (*Mephitidae*) have also been implicated in the spread of disease. No known occurrences of vector-borne illness have been associated with disease vectors and pests on the Turkey Point site (FPL 2014-TN4058).

Exotic plant species, when aggressive in nature, can displace or eliminate native plant species. The Florida Exotic Pest Plant Council maintains a list of invasive plant species (FLEPPC 2011-TN240). Melaleuca (*Melaleuca quinquenervia*), Old World climbing fern (*Lygodium microphyllum*), Asian swordfern (*Nephrolepus multiflora*), and Burma reed (*Neyraudia reynaudiana*) have been observed during reconnaissance surveys of the proposed Units 6 and 7 transmission line corridors (FPL 2009-TN657). Brazilian pepper and Australian pine also occur in these corridors. The NPS funds efforts to control the spread of Malaleuca in the East Everglades Expansion Area (NPS 2011-TN242).

The tropical climate of South Florida has enabled the establishment of numerous reptile species in the region. The Burmese python (*Python molurus* ssp. *bivittatus*) is probably the most well-known exotic reptile that now inhabits South Florida. The establishment of this snake species has coincided with a dramatic decrease in medium-sized mammals within Everglades National Park, and control efforts to limit the Burmese python population in Florida are ongoing (Dorcas et al. 2011-TN241). The Argentine black-and-white tegu (*Tupanimbis merianae*) is a relatively new arrival, but has spread rapidly in the vicinity of Turkey Point. This egg-eating omnivore has the potential to affect many species, including alligators and crocodiles, and is the subject of a multi-agency control effort in the immediate vicinity of the Turkey Point site.

Biological Indicators

Wading birds are an important part of the South Florida ecosystem and have been identified as an indicator of ecosystem health for the Everglades and a primary goal of CERP (Recover 2005-TN4031). Listed wading bird species include the Federally threatened wood stork and State-listed little blue heron, tricolored heron, reddish egret, snowy egret, white ibis, and roseate spoonbill. Additional South Florida wading bird species in the project vicinity include the double-crested cormorant (*Phalacrocorax auritus*), great egret (*Ardea alba*), cattle egret (*Bubulcus ibis*), green heron (*Butorides virescens*), great blue heron (*A. herodias*), and black- and yellow-crowned night-herons (*Nicticorax nicticorax* and *Nictanassa violacea*). Historic wading bird population estimates, although controversial, were estimated to be approximately 125,000−150,000 attempted nests in the 1930s (Bancroft 1989-TN3571). Populations have since declined and in 2013 it was estimated that almost 50,000 wading bird nests were initiated, which is twice as many as were estimated annually from 2010−2012. As

recently as 2009 more than 87,500 nests were estimated (SFWMD 2013-TN4034). Four wading bird species are used to monitor ecosystem restoration and health: the great egret, snowy egret, white ibis, and the wood stork. Generally populations of these species are trending upward since the 1990s with the exception of snowy egrets, which have declined recently (SFWMD 2013-TN4034).

2.4.1.4 Important Terrestrial Species – Transmission Lines

This section describes commercially and recreationally valuable species, Federally and State-listed and proposed threatened and endangered terrestrial species, and designated and proposed critical habitat that may occur in the transmission line corridors and in the vicinity of the proposed 500 kV transmission line. Habitat types observed within transmission line corridors have been described as disturbed upland, disturbed wetland, Everglades tree island, marl prairie, pine rockland, Everglades swale, tidal marsh, tidal swamp, dwarf mangrove swamp, rocky glade, sinkhole, cypress strand swamp, dwarf cypress prairie, agriculture, and urban development (FPL 2009-TN657). Natural and disturbed transitional areas such as canal edges, ditch banks, and dirt roads also provide habitat.

Federally Listed Species

All existing and proposed transmission lines that would support proposed Units 6 and 7 are in Miami-Dade County. Federally listed species that could be affected by the construction, operation, and maintenance of proposed Units 6 and 7 transmission facilities are listed in Table 2-13. Field reconnaissance surveys to determine the presence, absence, distribution, and abundance of Federally listed wildlife were conducted along existing or proposed transmission lines during April and June 2008 (FPL 2011-TN94).

Fauna

The FWS and the State of Florida has identified 29 Federally and State-listed terrestrial wildlife species as occurring or potentially occurring within the existing or proposed transmission line corridors (Table 2-16). Although Bartram's scrub-hairstreak and the Florida leafwing do not occur within the corridors, proposed critical habitat for these two butterflies does occur within the west transmission line corridors. In addition, the bald eagle (*Haliaeetus leucocephalus*) is managed under the Bald and Golden Eagle Protection Act (16 USC 668 et seq.) (TN1447) and the State of Florida Bald Eagle Management Plan (FFWCC 2008-TN1448).

The Cape Sable seaside sparrow is a Federally and State-listed endangered species that nests in mixed marl prairie community in Miami-Dade County (FWS 2012-TN117; FNAI 2014-TN3668). The entire species has a total estimated population of only 2,900 individuals (FWS 2010-TN256). No Cape Sable seaside sparrows were observed during surveys of the transmission line corridors associated with rights-of-way (FPL 2014-TN4058).

The eastern indigo snake is a Federally and State-listed threatened species (FWS 2012-TN117; FNAI 2014-TN3668). Although this species is found primarily in upland habitats, it requires a mosaic of habitats and has been found in pinelands, tropical hardwood hammocks, mangrove forests, and human-altered habitats (FWS 1999-TN136). None were observed during recent surveys of the transmission line corridors (FPL 2014-TN4058).

Table 2-16. Federally and State-Listed Terrestrial Wildlife Species Identified by the State of Florida as Occurring or Potentially Occurring Within Transmission-Line Corridors Associated with Proposed Units 6 and 7

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
American oystercatcher	*Haematopus palliatus*		SSC
Black skimmer	*Rhynchops niger*		SSC
Brown pelican	*Pelecanus occidentalis*		SSC
Florida burrowing owl	*Athene cunicularia*		SSC
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	LE	SE
Eastern indigo snake	*Drmarchon couperi*	LT	ST
Everglades mink	*Mustela vison*		ST
Florida bonneted bat	*Eumops floridanus*	LE	SE
Florida black bear	*Ursus americanus floridanus*		ST
Florida mouse	*Podomys floridanus*		SSC
Florida panther	*Puma concolor*	LE	SE
Florida pine snake	*Pituophis melanoleucus mugitus*		SSC
Florida sandhill crane	*Grus canadensis pratensis*		ST
Gopher frog	*Lithobates capita*		SSC
Gopher tortoise	*Gopherus polyphemus*		ST
Least tern	*Sterna antillarum*		ST
Little blue heron	*Egretta caerulea*		SSC
Limpkin	*Aramus guarauna*		SSC
Piping plover	*Charadrius melodus*	LT	ST
Reddish egret	*Egretta rufescens*		SSC
Rim rock crown snake	*Tantilla ooliticus*		ST
Roseate spoonbill	*Platalea ajaja*		SSC
Everglades snail kite	*Rostrhamus sociabilis plumbeus*	LE	SE
Snowy egret	*Egretta thula*		SSC
Southeastern American kestrel	*Falco sparverius paulus*		ST
Tricolored heron	*Egretta tricolor*		SSC
White-crowned pigeon	*Patagioenas leucocephala*		ST
White ibis	*Eudocimus albus*		SSC
Wood stork	*Mycteria americana*	LT	SE

(a) Federal Status: LE = endangered; LT = threatened.
State Status: SE (endangered); ST (threatened); SSC (Species of Concern); source FNAI – 4/5/2010. All Federally listed species that occur in Florida are not included on the State of Florida's list as Federally designated species in addition to the State listing process (FFWCC 2011-TN158).

Source: FFWCC 2011-TN554

Historically, Florida panthers have been observed within lands that occur within the two proposed west transmission line corridors. Also, both existing and proposed transmission lines pass through the FWS-designated Florida panther primary and secondary focus zones.

The piping plover is a Federally and State-listed threatened species (FWS 2012-TN117; FNAI 2014-TN3668). Piping plovers do not breed in Florida, but individuals from all three breeding populations winter there and have been observed in Miami-Dade County (FWS 1999-TN136). Their winter habitat includes beaches, mudflats, and sandflats, as well as, barrier island beaches, and spoil islands. No piping plovers were seen during surveys of Turkey Point plant or the transmission line rights-of-way (FPL 2014-TN4058).

The Everglades snail kite is a Federally and State-listed endangered species (FWS 2012-TN117; FNAI 2014-TN3668). The snail kite is a wide-ranging New World raptor found primarily in lowland freshwater marshes. In Florida, the population appears to be restricted to the watersheds of the Everglades, Okeechobee and Kissimmee lakes, and the upper St. Johns River. FWS-designated critical habitat for the snail kite exists in western Miami-Dade County beginning about 22 mi west of the Turkey Point site.

The only Federally listed species directly observed during reconnaissance surveys was the Everglades snail kite. A single snail kite was observed perched along the West Preferred transmission line corridor. This observation was made within a portion of the proposed corridor that lies along the boundary of the East Everglades Expansion Area and passes through a sawgrass marsh. Snail kites are known to forage in sawgrass habitats.

The wood stork is a Federally and State-listed threatened species (79 FR 37077 [TN4039]; FNAI 2014-TN3668). The wood stork uses a variety of wetlands including freshwater and estuarine habitats for nesting, roosting, and foraging and constructs nests in medium to tall trees surrounded by open water. Colonial nest sites are often reused over many years (FWS 1997-TN225). Wood storks forage in almost any shallow, open water where prey items become concentrated (FWS 1997-TN225).

Wood storks have historically nested in two different locations south of the Tamiami Trail (US-41) within 5 mi of the proposed Turkey Point to Levee transmission line corridors (FPL 2014-TN4058). One colony occurs within 1 mi of the West Preferred transmission line corridors. The other colony is within 3 mi of this corridor. Wood storks could be found in shallow wetlands within existing and proposed transmission line corridors (FPL 2011-TN94). Although there is no designated critical habitat for the wood stork, the FWS Southeast Florida Ecological Services Office recognizes a 0.47 mi (0.76 km) nest colony buffer and an 18.6 mi (29.9 km) core foraging area buffer around all known wood stork colonies that have had active nests within the last 10 years in South Florida. Impacts on suitable habitats within either of these buffer zones would require mitigation depending on the impact level (FWS 2010-TN226).

Habitat within the West Preferred and West Consensus corridors has been designated as critical habitat for the endangered Bartram's scrub-hairstreak and Florida leafwing butterflies. Expansion of the Clear Sky to Davis leg of the East corridor would also occur adjacent to pine rockland that surrounds the Miami Metro Zoo, University of Miami-south campus, and the Gold Coast Railroad Museum that has also been designated as critical habitat for these two butterflies.

Flora

A single Federally listed species and two candidates have been observed within transmission line corridors that would support proposed Units 6 and 7 at the Turkey Point site. The endangered Florida brickell-bush inhabits pine rocklands with an open shrub layer, exposed limestone, and minimal leaf litter (FNAI 2000-TN139). It is endemic to the Miami Rock Ridge (FPL 2014-TN4058). The pineland spurge or pineland sandmat is found in pine rocklands with scattered shrubs and exposed limestone (FNAI 2000-TN139). Sand flax is also found in pine rockland, marl prairie, and adjacent disturbed areas (FNAI 2000-TN139). During 2009 reconnaissance surveys, two remnant pine rockland habitat patches were noted adjacent to the Davis to Miami corridor. Pine rockland habitat is known to harbor many endemic plant species, and a threatened and endangered plant survey was recommended in these areas (FPL 2009-TN1449).

State-Listed Species

As with Federally listed species, the State-listed species in Table 2-14 and Table 2-15 for the FPL Turkey Point site are also the species that could be affected by building and operating the proposed Units 6 and 7 transmission facilities. Surveys for State-listed wildlife have not been conducted along existing or proposed transmission lines. Reconnaissance surveys were conducted during September 2008 and February 2009 to determine the presence, distribution, and abundance of State-listed plants.

A total of 36 State-listed plant species, including a Federally endangered species and two candidate species, have been observed within transmission line corridors that would support proposed Units 6 and 7 (Table 2-17) (FPL 2014-TN4058; FPL 2009-TN657). The vast majority of the listed plants were found in fragments of pine rockland habitat. However, some of the plants were also observed in disturbed habitats, including at the sides of dirt roads, on transmission tower pads created from spoil within mangrove stands, in marl prairie remnants, and along canal edges.

Table 2-17. Federal and State-Listed Plant Species Observed Within Transmission-Line Corridors Associated with Proposed Units 6 and 7 (Source: FPL 2014-TN4058)

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Habitats Observed Growing in[c]
Golden leather fern	*Acrostichum aureum*		ST	Bayhead
Pineland-allamanda	*Angadenia berteroi*		ST	Pine rockland
Pinepink	*Bletia purpurea*		ST	Road edge, mangrove spoil pads
Florida brickell-bush	*Brickellia mosieri*	LE	SE	Pine rockland
Locustberry	*Byrsonima lucida*		ST	Spoil pad, Pine rockland
White sunbonnets	*Chaptalia albicans*		ST	Pine rockland
Pineland (spurge) sandmat	*Chamaesyce deltoidea ssp. pinetorum*	LC	SE	Pine rockland

Table 2-17. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Habitats Observed Growing in[c]
Florida silver palm (Silver palm)	*Coccothrinax argentata*		ST	Pine rockland
Quailberry (Christmas berry)	*Crossopetalum ilicifolium*		ST	Pine rockland
Blodgett's swallowwort	*Cynanchum blodgettii*		ST	Pine rockland
Krug's holly	*Ilex krugiana*		ST	Pine rockland
Rockland morning glory (Wild potato morning glory)	*Ipomoea tenuissima*		SE	Pine rockland
Pineland clustervine (jacquemontia)	*Jacquemontia curtissii*		ST	Pine rockland
Skyblue clustervine	*Jacquemontia pentanthos*		SE	Pine rockland
Shrub eupatorium	*Koanophyllon villosum*		SE	Pine rockland
Pineland (Florida) lantana	*Lantana depressa var. depressa*		SE	Pine rockland
Ghost plant	*Leiphaimos parasitica*		SE	Pine rockland
Sand flax	*Linum arenicola*	LC	SE	Disturbed road edge
Carter's large-flowered flax	*Linum carteri var. smallii*		SE	Canal edge
Pineland blackanthers	*Melanthera parvifolia*		ST	Pine rockland
Southern fogfruit	*Phyla stoechadifolia*		SE	Disturbance, marl prairie
Pineland poinsettia	*Poinsettia pinetorum*		SE	Pine rockland
Bahama ladder brake	*Pteris bahamensis*		ST	Road edge, mangrove spoil pads, pine rockland
Small-leaf snoutbean	*Rhynchosia parvifolia*		ST	Pine rockland
Bahama sachsia	*Sachsia polycephala*		ST	Pine rockland
Bahama senna	*Senna mexicana var. chapmanii*		ST	Pine rockland
Mullein nightshade	*Solanum donianum*		ST	Roadsides, marl prairie, mangrove spoil pads
Everglade Keys false buttonweed	*Spermacoce terminalis*		ST	Pine rockland
West Indian lilac	*Tetrazygia bicolor*		ST	Pine rockland
Abrupt-tip maiden fern	*Thelypteris augescens*		ST	mangrove spoil pads, roadside
Twisted wildpine	*Tillandsia balbisiana*		ST	Bayhead
Banded wildpine	*Tillandsia flexuosa*		ST	Bayhead
Giant wildpine	*Tillandsia utriculata*		SE	Bayhead
Pineland noseburn	*Tragia saxicola*		ST	Pine rockland
West indian (Lamarck's) trema	*Trema lamarckianum*		SE	mangrove spoil pads, roadside,
Florida gamagrass	*Tripsacum floridanum*		ST	Pine rockland

(a) Federal Status: LE = Federal endangered; LC = Federal candidate species.
(b) State Status: SE = endangered; ST = threatened. Source: FNAI 2009-TN815.
(c) Habitat information provided by FPL-2009-TN657.

Although numerous game species, including white-tailed deer, mourning dove, and cottontail rabbit, are present, public access for harvest of game animals is prohibited on the Turkey Point site (FPL 2014-TN4058). Waterfowl habitat is present and waterfowl are likely to occur in local wetlands and open water habitats. As with other game animals, public waterfowl hunting on the site is prohibited, and if hunting occurs in the immediate vicinity of the Turkey Point site waterfowl may be artificially concentrated on the site during hunting seasons.

Surveys for other important species, including ecologically, commercially, and recreationally important species and habitats, were not conducted within the transmission line corridors. Peninsular Florida includes the entire range of a subspecies of wild turkey, the Osceola turkey (*Meleagris gallopavo osceola*) that is a popular game species. White-tailed deer, mourning doves, rabbits, waterfowl, and other game species would be expected in appropriate habitats.

As noted above, pine rockland and marl prairie habitats occur within transmission line corridors associated with proposed Units 6 and 7. These habitats are recognized for their high species diversity and ecological value. The proposed transmission line corridors also pass through mangroves, another ecologically important habitat in South Florida.

2.4.1.5 Important Terrestrial Species and Habitats – Other Offsite Facilities

Access Roads and Potable Water Pipelines

FPL would build approximately 11 mi of access roads and 9 mi of potable water pipelines to support proposed Turkey Point Units 6 and 7. Although most of this work would occur within existing road rights-of-way, some agriculture, disturbed, canal, and wetland cover types would also be traversed. No surveys were conducted to determine the presence, distribution, or abundance of important terrestrial wildlife or plant species in the affected areas. FLUCFCS land-cover types present indicate water birds such as the wood stork, roseate spoonbill, white ibis, and various egret and heron species may be present. Plant species that thrive on disturbed lands in South Florida, including pinepink, sand flax, Bahama ladder brake, mullein nightshade, and West Indian trema, may be present along existing roadways (FPL 2014-TN4058). Proposed road development would occur within the primary zone of the Florida Panther Focus Area.

2.4.1.6 Terrestrial Monitoring

Ecological monitoring was required by the State of Florida Site Certification process for Units 3 and 4 at the Turkey Point site (SFWMD 2009-TN149). FPL's Groundwater, Surface Water, and Ecological Monitoring Plan calls for ecological monitoring to be conducted to establish the current status of ecological baseline conditions and biotic components (SFWMD 2009-TN149). FPL proposed a broad-scale vegetation assessment to characterize distribution and density of vegetation (SFWMD 2009-TN149). The plan calls for transects to be established within freshwater marshes, mangroves, sawgrass, pond, and nearshore habitats within the Turkey Point site to record patterns of plant community status and environmental conditions in consultation with relevant State of Florida agencies. Various vegetation characteristics, such as species composition, canopy height, and the number of sawgrass culms, would be recorded within plots at predetermined intervals. Measurements would be recorded annually, twice

annually, and quarterly depending on the plot type. Leaves would be sampled twice a year for morphological and physiological characterization to document change over time. Surface and pore-water levels and attributes would also be measured at plots and within plants. Assessment methodologies differed slightly between freshwater and saline wetland habitats. All proposed methodologies were to be consistent with those used in the Everglades National Park by the National Science Foundation-funded Long-Term Ecological Research Program. Two years of data collection before Units 3 and 4 coming online was expected, and post-operation monitoring shall be specified by the State agencies. The level of effort and results of these activities is unknown.

2.4.1.7 Related Federal Projects and Consultation

The review team reviewed the possibility that activities of other Federal agencies (e.g., building a dam) might affect the issuance of a COL to FPL. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)) (TN250).

Federal lands within a 50 mi radius of the Turkey Point site include Everglades National Park, which lies to the south and west. The CERP is a long-term effort to capture, store, and redirect freshwater for environmental restoration of the entire Everglades ecosystem. Ecologic goals of the restoration include increasing the spatial extent of natural areas, improving habitat and its functional quality, and improving native plant and animal abundance and diversity. These goals would be accomplished through water management, invasive species control, protection and restoration of key ecosystem functions and habitats, and soil conservation measures.

Biscayne National Park borders the Turkey Point site to the east. Efforts to restore the ecological function to Biscayne Bay are ongoing.

State parks within 50 mi of the Turkey Point site include Oleta River State Park, Bill Baggs Cape Florida Park, Cape Florida State Recreation Area, Barnacle Historic State Park, John U. Lloyd Beach State Park, Dagny Johnson Key Largo Hammock Botanical State Park, John Pennekamp Coral Reef State Park, Long Key State Park, Curry Hammock State Park, Lignumvitae Key Botanical State Park, and Windley Key Fossil Reef Geological State Park.

The NRC is required under Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.) (TN661) to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, NRC consulted with the FWS and National Marine Fisheries Service (NMFS). Contact correspondence is included in Appendix F.

2.4.2 Aquatic Ecology

This section describes the aquatic environment and biota near the Turkey Point site and other areas potentially affected by the building, operation, and maintenance of proposed Turkey Point Units 6 and 7 and associated facilities, including transmission lines and pipelines. This section includes a description of the aquatic ecosystems at or near the site, a description of

representative important species that are present or are expected to occur, and the location of sanctuaries, reserves, national parks, critical habitats, or other areas carrying special designation, as required by ESRP 2.4.2 (NRC 2000-TN614) and Executive Order 13158 (65 FR 34909) (TN3454).

As described in Section 2.1, the Turkey Point site is located on the southeastern coast of Florida in unincorporated Dade County. Figure 2-26 shows the location of the Turkey Point site with respect to Biscayne Bay and Card Sound, and the locations of the principal canal network near the area. Onsite aquatic resources include the IWF (cooling canals), surface-water habitats and canal systems, and Biscayne Bay nearshore areas adjacent to the Turkey Point peninsula (Figure 2-27). Nearby offsite aquatic resources include Biscayne Bay, Biscayne National Park, Biscayne Bay Aquatic Preserve, Florida Keys National Marine Sanctuary (FKNMS), and Card Sound. Everglades National Park is located south and west of the site.

Prior to drainage and development activities, the wetland and aquatic ecosystems of southern Florida encompassed approximately 8.9 million ac, and included ridge and slough landscapes, sawgrass plains, cypress and mangrove swamps, and coastal lagoons and bays (USACE/SFWMD 1999-TN116). Ogden et al. (2005-TN196) characterized this pre-drainage condition as a “hydrologically interconnected, slow-flowing system that extended from the Kissimmee River and Lake Okeechobee southward over low-gradient lands to the estuaries of Biscayne Bay, Ten Thousand Islands, and Florida Bay, and eastward and westward to the northern estuaries.” Browder et al. (2005-TN151) noted that prior to development, Biscayne Bay possessed both marine and estuarine habitat and fauna, and that construction of major canals and subsequent water drainage affected the salinity gradients and ecotones from the Everglades through coastal wetlands and tidal creeks into Biscayne Bay. Historical accounts suggest that prior to inlet and navigational dredging and related development, the northern and central portions of Biscayne Bay had much lower salinity conditions, low nutrient concentrations, and low turbidity/high light transmittance that promoted the presence of extensive seagrass meadows on the bay bottom (USACE/SFWMD 1999-TN116).

As described below, anthropogenic impacts over the last century have substantially altered the ecosystem and profoundly affected the three essential characteristics, salinity, nutrient concentrations, and turbidity, that defined historical conditions.

During the late 1800s and early 1900s, the lack of flood control was recognized as the principal impediment to development in South Florida. Land was drained to support urban and agricultural development, and a series of canals was constructed to support flood control, water supply and retention, irrigation, and transport. In 1948, Congress authorized the creation of the Central and Southern Florida Flood Control Project—one of the largest water-management systems in the world (Ogden et al. 2005-TN196). As a result of this and other projects, a substantial portion of the original wetland system in South Florida has been lost or converted to support agriculture, urban development, and related infrastructure. These changes have dramatically reduced sheet flow, and have created point-source discharge of freshwater into estuarine and coastal wetland areas. This substantially changed the dynamics of the system and resulting aquatic species compositions by reducing sheet flow, and creating pulsed point-source discharges into nearshore areas that are dissimilar in timing and duration to pre-development patterns. The effects of these practices have included the creation of deeper

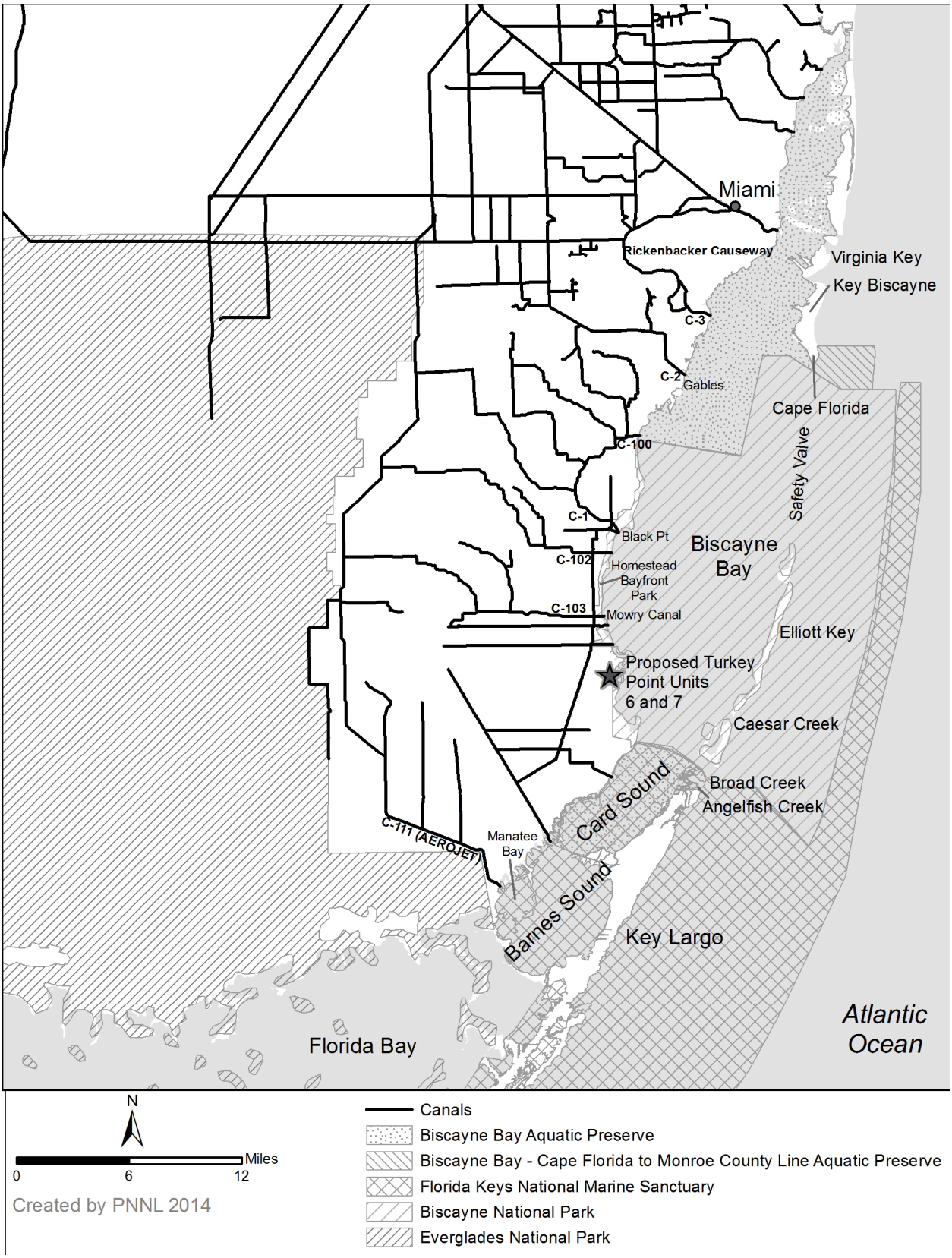


Figure 2-26. Turkey Point Site Location with Respect to Protected Areas

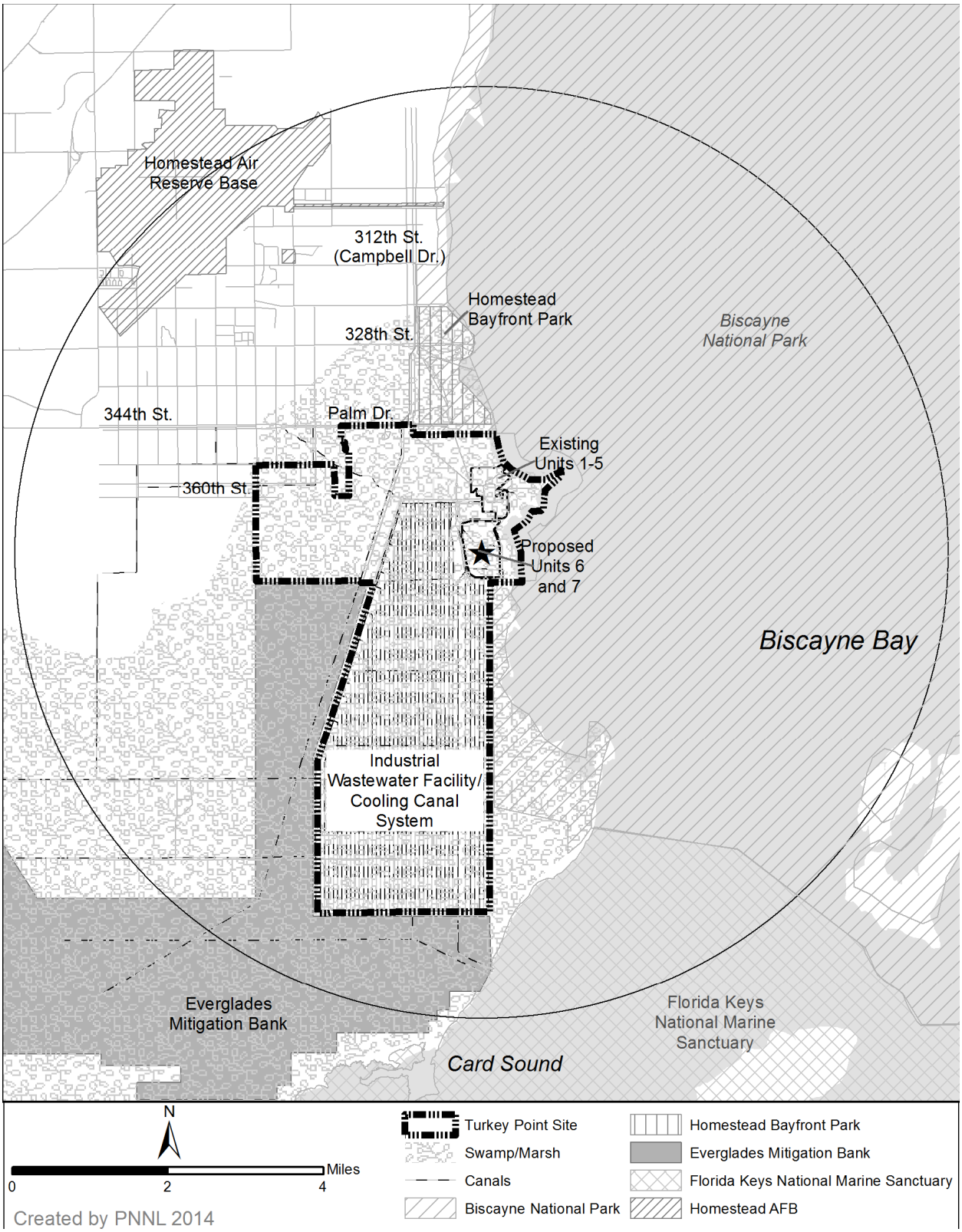


Figure 2-27. Turkey Point Site Showing Onsite Aquatic Resources, Surface-Water Habitats and Canal Systems, and Nearshore Areas Adjacent to the Turkey Point Peninsula

water habitats within canal systems that have contributed to the spread of exotic and nuisance species (Harvey et al. 2010-TN3158), the creation of unnatural habitats for predatory fishes and alligators, and unnatural reversals in wet and dry patterns (Ogden et al. 2005-TN197). Water-control structures and navigational locks have also contributed to the deaths of manatees (*Trichechus manatus latirostris*) (FWS 2001-TN223).

What follows is a description of the aquatic resources currently present at or near the Turkey Point site, including areas proposed for new transmission lines and pipelines. Resource descriptions include information provided by FPL as well as studies conducted by others to evaluate temporal trends or develop baseline assessments in support of the CERP. As discussed in Section 3, cooling-tower blowdown from the operation of proposed Units 6 and 7 would be injected into the Boulder Zone, an extremely permeable zone within a karstic fractured dolomite layer within the Lower Floridan aquifer in southeastern Florida, which extends from approximately 2,400 ft to at least 3,000 ft below ground surface (bgs) in the Miami-Dade County area (FPL 2014-TN4058). Because the review team is unaware of any aquatic resources within the Boulder Zone, it will not be discussed further with respect to aquatic resources.

2.4.2.1 Aquatic Resources – Site and Vicinity

This section provides a general description of aquatic resources that are or could be present at or near the Turkey Point site and the proposed Units 6 and 7 plant area. Sections 2.4.2.2 and 2.4.2.3 provide detailed information about proposed transmission lines and reclaimed and potable pipelines and representative important species that may be affected by the building and operation of proposed Turkey Point Units 6 and 7. As described in the ER (FPL 2014-TN4058), the surface-water habitats associated with the proposed Turkey Point Units 6 and 7 plant area include hypersaline mudflats, remnant and active canals and channels associated with operation of Units 1-4, dwarf mangrove wetlands, and open water.

What follows is a discussion of the aquatic species and habitats present on or near the Turkey Point site. As defined by ESRP 2.4.2 and Table 2.4.2.1 (NRC 2000-TN614), important habitats include the following:

- protected areas such as sanctuaries, refuges, or preserves, if they may be adversely affected by plant or transmission line and pipeline building or operation and maintenance, and
- habitats identified by State or Federal agencies as unique, rare, or of priority for protection, if these areas may be adversely affected by plant or transmission line and pipeline building, operation, and maintenance, including areas that have been designated as habitat for an evolutionary significant unit, distinct population segment, critical habitat, or essential fish habitat.

Onsite Aquatic Resources

Onsite aquatic resources include surface-water habitats and the IWF.

Onsite Surface-Water Habitats

As described in the ER (FPL 2014-TN4058), onsite surface-water habitats exclusive of the IWF include hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and areas of open water. As part of the pre-application monitoring, a survey of fish species was conducted in June 2009 in areas that would be affected by the building of the proposed new units. A variety of sampling gear was used, including minnow seines, cast nets, and minnow traps; entangling gear such as gill and trammel nets were avoided to protect resident American crocodile (*Crocodylus acutus*) populations. Water-quality measurements collected during sampling showed water temperatures ranged from 23.9 to 36.5°C; salinity was above 50 ppt at six sampling stations (TP-3A, TP-4, TP-5, TP-6, TP-7, TP-8) and ≤1.5 ppt at two stations in sawgrass/mangrove habitats (TP-1 and TP-2) (FPL 2009-TN201) (Figure 2-28). Fish collection results showed the Sheepshead Minnow (*Cyprinodon variegatus*)—the dominant species that occurred in seven of the eight sampling stations—represented 63 percent of the species composition. Sailfin Molly (*Poecilia latipinna*) and Goldspotted Killifish (*Floridichthys carpio*) were present at the majority of the sampling stations and represented 20.8 percent and 9.9 percent of the species composition, respectively. The remaining species that occurred were less common and collectively represented about 6 percent of the species composition (Table 2-18). No fish were collected at TP-2, which is in a marsh/mangrove community adjacent to Palm Drive (FPL 2009-TN201). All fish collected represented hardy species common to South Florida; no rare, unusual, sensitive, or protected species were collected (FPL 2009-TN201).

Industrial Wastewater Facility

The IWF occupies approximately 5,900 ac on the Turkey Point site (Figure 2-27). This facility provides cooling for Turkey Point Units 1–4 and receives blowdown water from the operation of Unit 5. The IWF contains an extensive system of canals and berms, and it supports a variety of species of fish, mollusks, crustaceans, and submerged aquatic vegetation that are tolerant of subtropical, hypersaline environments. Table 2-19 provides a listing of species known to occur in the IWF based on FPL monitoring studies (FPL 2014-TN4058). Many of these species are eaten by the State and Federally threatened American crocodiles that live in the IWF. FPL employees have also reported observing large game species such as Common Snook (*Centropomus undecimalis*) and Tarpon (*Megalops atlanticus*) in the IWF. These are most likely older individuals that have persisted in the system since it was isolated from Biscayne Bay in 1973 (FPL 2014-TN4058). Recruitment of fish and invertebrates could also potentially occur from hurricane storm surge overtopping IWF canal berms.

As noted in Section 2.3, the water quality in the IWF varies interannually and intra-annually in response to plant operation and meteorological conditions. Rainfall will cause the salinity to decrease, and evaporation from induced evaporation and hot, dry meteorological conditions will cause salinity to increase over time. Water temperatures in the IWF are generally highest during the summer months, and decrease during the winter. During the summer of 2014, elevations of water temperature, salinity, and nutrient levels in the IWF were detected above historic background levels. Also during the same period and an extensive algal bloom was observed, necessitating consultation with FDEP to approve addition of copper sulfate, hydrogen peroxide and bio-stimulants to control algal growth, and temporary use of water from the Floridan aquifer to reduce salinity. Additional information on these actions and their implications to IWF water quality is found in Section 2.3.

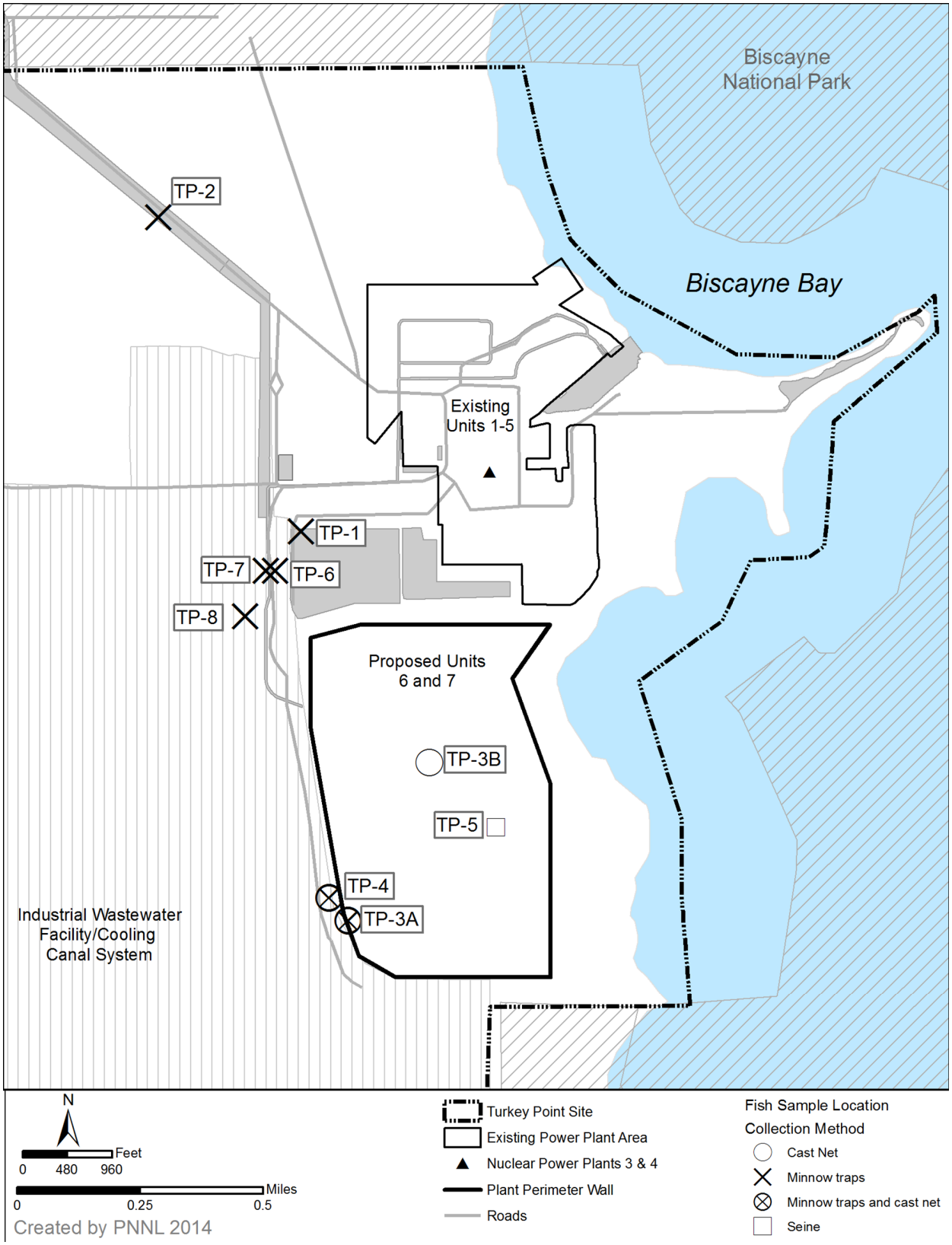


Figure 2-28. 2009 Fish Sampling Locations on the Turkey Point Site (Source: FPL 2009-TN201)

Table 2-18. Fish Species Present in Surface-Water Habitats Exclusive of the IWF on Turkey Point Site in Summer 2009

Common Name	Scientific Name	TP-1	TP-3	TP-4	TP-5	TP-6	TP-7	TP-8	Total	Percent Comp.
Sheepshead Minnow	*Cyprinodon variegatus*	4	70	25	43	87	37	7	273	63.0
Sailfin Molly	*Poecilia latipinna*	20	48	7	0	6	3	6	90	20.8
Goldspotted Killifish	*Floridichthys carpio*	0	3	1	22	15	1	1	43	9.9
Marsh Killifish	*Fundulus confluentus*	15	0	0	0	0	0	0	15	3.5
Gulf Killifish	*F. grandis*	3	0	1	0	0	1	1	6	1.4
Mosquitofish	*Gambusia holbrooki*	4	0	1	0	0	0	0	5	1.2
Gulf Toadfish	*Opsanus beta*	0	0	1	0	0	0	0	1	0.2

Source: FPL 2009-TN201

Table 2-19. Aquatic Species Documented in the Industrial Wastewater Facility (November 2007)

Common Name	Scientific Name
Reptiles	
American crocodile	*Crocodylus acutus*
Fish	
Sheepshead Minnow	*Cyprinodon variegatus*
Killifish	*Fundulus* sp.
Mosquitofish	*Gambusia* sp.
Mullet	*Mugil* sp.
Sailfin Molly	*Poecilia latipinna*
Needlefish	*Strongylura* sp.
Tarpon	*Megalops atlanticus*
Common Snook	*Centropomus undecimalis*
Mollusks	
Lightning whelk	*Busycon contrarium*
Ivory cerith	*Cerithium eburneum*
Lister's tree oyster	*Isognomon radiatus*
Flat tree oyster	*Isognomon alatus*
Giant rams horm	*Marisa cornuarietis*
Eastern melamphus	*Melampus bidentatus*
Florida crown conch	*Melongena corona*
Tellin	*Tellin* sp.
Crustaceans	
Great land crab	*Cardisoma guanhumi*
Fiddler crab	*Uca* sp.
Submerged Aquatic Vegetation	
Mermaid's wineglass (green algae)	*Acetabularia* sp.
Green algae	*Batophora* sp.
Green algae	*Caulerpa* sp.
Widgeon grass	*Ruppia maritima*

Source: Adapted from ER Rev 6 (FPL 2014-TN4058)

Adult crocodiles were first observed in the IWF in 1976, and nesting was first documented on the cooling canal berms in 1978 (Wasilewski and Enloe 2006-TN979). As a result, FPL developed a crocodile management plan that focused on the creation and enhancement of habitat and long-term population monitoring. Because of activities related to the proposed Turkey Point Units 6 and 7, aquatic resources in the canals could be affected by placement of fill to support construction activities, dewatering of excavations, stormwater runoff during construction and operation, and disposal of the "muck" excavated from the proposed Units 6 and 7 construction site along the existing IWF canal berms.

Turkey Point Nearshore Waters

Turkey Point is a narrow peninsula of land east of the Turkey Point facility that extends into Biscayne Bay. The Turkey Point peninsula is the site for the proposed radial collector wells and is adjacent to the existing barge slip and canal. Much of the area consists of previously filled areas and roadways, and adjacent mangrove swamps (FPL 2010-TN272). Environmental studies in the vicinity of the Turkey Point site have included a benthic macroinvertebrate study at three locations near the Turkey Point peninsula and three stations in Card Sound on March 18, 2009 (EAI 2009-TN97), and a seagrass study along 26 transects around the peninsula on August 11 and 12, 2009 (EAI 2009-TN153).

Methods used during the benthic invertebrate sampling study included the collection of three replicate benthic samples at each station using a diver-operated core sampler with a surface area of 225 cm^2. Samples were collected along a single transect line at 250, 500, and 750 ft from shore (EAI 2009-TN97). Summary information shows that crustaceans, mollusks, and polychaetes accounted for 90 percent of the total individuals collected, and the highest abundances were generally observed at the sampling station 250 ft from shore (Table 2-20). Numerically predominant species at the Turkey Point transect stations included the polychaetes *Fabrinicinuda trilobata* and *Exogone dispar*, the mollusk *Caecum pulchellum*, and the amphipod *Shoemakerella cubensis* (EAI 2009-TN97).

Table 2-20. Summary of Benthic Invertebrate Abundances near Turkey Point

Classification	Distance from Shore (ft)			Total
	250	500	750	
Crustaceans	207	50	63	**320**
Echinoderms	5	3	0	**8**
Miscellaneous taxa	28	37	20	**85**
Mollusks	79	64	78	**221**
Polychaetes	224	64	47	**335**
Total	543	218	208	**969**

Source: EAI 2009-TN97

On August 11 and 12, 2009, a seagrass survey around the Turkey Point peninsula was conducted by Ecological Associates, Inc. (EAI) under contract to FPL (EAI 2009-TN153). The survey encompassed a total area of approximately 49 ha and included 26 transects surrounding the Turkey Point peninsula. Transects were approximately 300 m long and spaced approximately 50 m apart (EAI 2009-TN153). At each transect, divers recorded the seagrass

conditions (species and percent cover) at the shoreward and seaward end of each transect, and at 50 m intervals in between for a total of seven observation locations per transect. At each location, seagrasses were identified to species, and their percent cover was visually estimated. As described in the survey report (EAI 2009-TN153), the Braun-Blanquet method was used to estimate percent cover and species contribution. Two species of seagrass were documented in the study area: turtle grass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*); turtle grass was the more abundant of the two species (EAI 2009-TN153). Turtle grass coverage was highest in areas immediately surrounding the peninsula and generally decreased with increasing distance from shore. Average Braun-Blanquet coverage was estimated to be 25 to 50 percent. Shoal grass was less abundant and generally more restricted in its distribution; it occurred most often in shallow water near the shoreline (EAI 2009-TN153). Braun-Blanquet coverage was estimated to be <5 percent and was completely absent at most sampling stations. Various species of macroalgae were also observed during the survey, including *Halimeda* spp., *Penicillius* spp., *Udotea* spp., and *Laurecia* spp., and at times approached 100 percent coverage over some sampling locations (EAI 2009-TN153).

Offsite Aquatic Resources

Offsite aquatic resources include Biscayne Bay and its associated park and preserve; FKNMS; Card Sound and Canal; the EMB, Model Lands Basin, and Southern Glades Addition; as well as Everglades National Park and the Crocodile Lake National Wildlife Refuge.

Biscayne Bay, Biscayne National Park, Biscayne Bay Aquatic Preserve

Biscayne Bay and regions encompassing Biscayne National Park and Biscayne Bay Aquatic Preserve are a shallow subtropical saline lagoon that extends the length of Miami-Dade County (Figure 2-26). The eastern edge of the bay is bordered by a series of barrier islands that form the Florida Keys in Monroe County, and (from north to south) Virginia Key, Key Biscayne, Soldier Key, and Boca Chita Key, in Miami-Dade County. The western boundary of the bay is mainland, and the northern boundary of the bay near Miami is highly urbanized. Connection to the Atlantic Ocean is greatest north of Boca Chita where open access to the ocean is present at an area called “the Safety Valve,” and most restricted in the southern bay at Card Sound and Barnes Sound due to the presence of Key Largo and associated barrier islands. The average depth of the bay is approximately 5 ft at mean lower low water; its maximum depth is approximately 13 ft. Salinity is highly variable, ranging from approximately 24 to 44 ppt, and highly influenced by rainfall and the point-source discharges of the existing canal systems. Annual natural water temperatures range from approximately 59°F to 92°F (15°C to 33°C) at the surface (FPL 2014-TN4058). The shallow depths of the bay and maximum spring tidal range of 0.9 m (3 ft) result in a vertically well-mixed system with weak stratification except in Biscayne Bay at the mouths of drainage canals (Wang et al. 2003-TN105).

Biscayne National Park was first established in 1968 as a national monument and was expanded in 1980 to approximately 173,000 ac of water, coastal lands, and 42 islands. Activities such as boating, snorkeling, and recreational and commercial fishing are allowed in the park, and numerous environmental studies are conducted or sponsored by the NPS to assess the condition of natural resources within park boundaries and provide information to support preservation and restoration activities (NPS 2011-TN184). The Biscayne Bay Aquatic

Preserve (BBAP) includes 67,000 ac of sovereign submerged lands in Biscayne Bay and is managed by the FDEP's Office of Coastal and Aquatic Managed Areas. Waters within the BBAP are designated as an OFW, which affords special protection because of their natural attributes (FPL 2014-TN4058). A portion of the BBAP is located approximately 0.5 mi east of the proposed Units 6 and 7 plant area (FPL 2014-TN4058).

As noted above, Biscayne Bay was hydrologically connected to the Greater Everglades ecosystem through a series of tributaries, sloughs, and groundwater flow, and possessed both estuarine and marine habitats (Browder et al. 2005-TN151). Subsequent development of an extensive canal system has substantially changed the hydrodynamics, resulting in pulsed discharge of freshwater into the bay via point-sources at intervals that are dissimilar in timing and duration to pre-development patterns. As a result, large discharges now occur during the wet season (May through October), and less freshwater reaches the bay during the dry season (November through April) (Wang et al. 2003-TN105). Freshwater discharge has contributed to bottom scouring, rapid salinity fluctuations, and changes in benthic and nearshore habitats that affect the growth, survival, and reproduction of many species (Browder et al. 2005-TN151).

Biscayne Bay in its present form supports a dynamic assemblage of fish, invertebrates, marine mammals, and extensive seagrass beds. As described by Browder et al. (2005-TN151), at least seven species of seagrass occur in Biscayne Bay, and seagrass has been documented to cover up to 64 percent of the bay bottom. Common seagrass species include turtle grass, shoal grass, manatee grass (*Syringodium filiforme*), widgeongrass (*Ruppia maritime*), and three species of *Halophila*, including *H. johnsonii,* which is Federally protected species (Browder et al. 2005-TN151). Coastal mangrove communities are also present, and provide important habitat for many estuarine fish and invertebrate species. In a study from 1998 to 2005, Serafy et al. (2007-TN215) found that mangrove-lined shorelines of Biscayne Bay were used by subadult and adult Gray Snapper (*Lutjanus griseus*), juvenile Great Barracuda (*Sphyraena barracuda*), and adult Goldspotted Killifish. Species identified by Browder et al. (2005-TN151) of special relevance and utility for monitoring and assessment of Biscayne Bay included pink shrimp (*Farfantenaeus duorarum*), blue and stone crabs (*Callinectes sapidus* and *Menippe mercenaria*), oysters (*Crassostrea* spp.), estuarine fish communities, common bottlenose dolphin (*Tursiops truncatus*), American crocodile, Florida manatee, and wading birds. Representative marine species identified by Robles et al. (2005-TN198) to assess the condition of marine resources in Biscayne National Park included spiny lobster (*Panulirus argus*), Red Grouper (*Epinephelus morio*), Red Drum (*Sciaenops ocellatus*), and Gray Snapper.

During the process of developing the salinity target for western portions of Biscayne Bay, the NPS identified six taxa considered to be highly dependent on estuarine salinities: the American crocodile, the Spotted Seatrout (*Cynoscion nebulosus*), Mojarra (*Eucinostomus* spp.), Silver Perch (*Bairdiella chrysoura*), pink shrimp, and eastern oyster (*Crassostrea virginica*) (NPS 2006-TN183). Additional information about the spatial and temporal distribution, relative abundance, and life history characteristics of 40 fish and invertebrate species in 20 estuaries along the Atlantic coast of North Carolina, South Carolina, Georgia, and Florida (including Biscayne Bay) is provided by Nelson et al. (1991-TN174). Of the 40 species included in the assessment, 20 were either not present or were considered rare in Biscayne Bay, including the blue mussel (*Mytilus edulis*), common ranga (*Rangia cuneata*), white shrimp (*Litopenaeus setiferus,* formerly *Penaeus setiferus*), Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*),

Blueback Herring (*Alosa aestivalis*), and Alewife (*A. pseudoharengus*). Nineteen species were common or highly abundant as adults, spawning adults, juveniles, larvae, or eggs in salinity ranging from 0.5 to >25 ppt (Table 2-21). This list, and the information above, represents a reasonable starting point for identifying ecologically, recreationally, or commercially important species in Biscayne Bay that may be affected by the construction and operation of the new units at Turkey Point, as required by ESRP 2.4.2 (NRC 2000-TN614).

Florida Keys National Marine Sanctuary

The FKNMS was designated on November 16, 1990, and is one of 14 marine protected areas in the National Oceanographic and Atmospheric Administration's (NOAA's) National Marine Sanctuary System. Sanctuary borders encompass 2,900 mi^2 of water surrounding the Florida Keys extending from south of Miami to the Dry Tortugas, excluding Tortuga National Park. FKNMS includes all of Card Sound and a slender area of Biscayne Bay to the east of Biscayne National Park. Biscayne National Park's eastern and southern boundaries are FKNMS boundaries as well. Natural features within sanctuary boundaries include extensive seagrass beds, mangrove-fringed islands, and the world's third-largest barrier reef. NOAA estimates more than 6,900 species of marine life are found in the waters of FKNMS (NOAA 2014-TN3201).

Card Sound and Card Sound Canal

Card Sound is a shallow bay south of the Turkey Point site (Figure 2-26) wholly within the FKNMS with limited connection to the Atlantic Ocean. The mangrove forests surrounding Card Sound are part of the longest continuous stretches of mangroves remaining on the east coast of Florida, and they serve as food and refuge for approximately 70 percent of the area's commercially and recreationally important marine species (FPL 2014-TN4058). Both Biscayne Bay and Card Sound are nursery areas for the spiny lobster, and the area from Cape Florida near Key Biscayne south to Card Sound is designated as the Biscayne Bay-Card Sound Lobster Sanctuary by the State of Florida (FPL 2014-TN4058).

In 2008 and 2009, EAI conducted a study in Card Sound near the Turkey Point site to characterize fish and shellfish resources. Sampling was conducted every other week from March 4, 2008 to February 17, 2009, for a total of 26 sampling events at three locations along the western shore of Card Sound near the southern boundary of Biscayne Bay. Trawl samples were used to collect juvenile and adult fish and shellfish; towed nets were used to collect icthyoplankton and shellfish larvae (EAI 2009-TN154). Table 2-22 provides a summary of the baseline aquatic resource sampling results for fish in Card Sound and Card Sound Canal in 2008–2009.

During the fish survey, a total of 4,679 individual fish were captured; the overall catch per unit effort (CPUE) was 7.5 specimens captured per 100 m trawled. Seven species accounted for 90 percent of the total captured; Pinfish were the most numerous (Table 2-22).

Table 2-21. Relative Abundance of Aquatic Species Commonly Found in Biscayne Bay for Given Salinity Ranges

Common Name	Scientific Name	Adult	Spawning Adults	Juveniles	Larvae	Eggs
Bay scallop	*Argopectin irradians*	Common >25 ppt	Common >25 ppt	Common >25 ppt	Common >25 ppt	Common >25 ppt
American oyster	*Crassostrea virginica*	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt
Hard clam	*Mercenaria* sp.	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt
Pink shrimp	*Penaeus duorarum*	Not present	Not present	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt	Not present
Grass shrimp	*Palaemonetes pugio*	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt
Blue crab	*Callinectes sapidus*	Abundant to highly abundant 0.5 - >25 ppt	Common to abundant 0.5 - >25 ppt	Abundant to highly abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt
Ladyfish	*Elops saurus*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Not present
American Eel	*Anguilla rostrata*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Not present
Bay Anchovy	*Alosa mitchilli*	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt
Sheepshead Minnow	*Cyprinodon variegatus*	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt
Mummichug	*Fundulus heteroclitus*	Not present	Not present	Not present	Not present	Not present
Atlantic Silverside	*Menidia menidia*	Abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt	Abundant 0.5 - >25 ppt
Gray snapper	*Lutijanus griseus*	Highly abundant 0.5 - >25 ppt	Not present	Highly abundant 0.5 - >25 ppt	Abundant to highly abundant 0.5 - >25 ppt	Not present
Pinfish	*Lagodon rhomboids*	Highly abundant 0.5 - >25 ppt	Not present	Highly abundant 0.5 - >25 ppt	Highly abundant 0.5 - >25 ppt	Not present
Spotted Seatrout	*Cynoscion nebulosus*	Common 0.5 - >25 ppt	Common >25ppt	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Common >25 ppt
Spot	*Leiostomus xanthurus*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Not present
Striped Mullet	*Mugil cephalus*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Not present
Spanish Mackerel	*Scomberomorus maculates*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common >25 ppt	Not present
Gulf Flounder	*Paralichthys albigutta*	Common 0.5 - >25 ppt	Not present	Common 0.5 - >25 ppt	Common 0.5 - >25 ppt	Not present

Source: Adapted from Nelson et al. 1991-TN174.

Table 2-22. Fish Species Composing 90 Percent of the Total Catch in Card Sound During 2008−2009 Sampling Events

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Pinfish	*Lagodon rhomboides*	919	19.64	1.47
Bluestriped Grunt	*Haemulon sciurus*	591	12.63	0.94
Silver Jenny	*Eucinostomus gula*	577	12.33	0.92
White Grunt	*Haemulon plumierii*	544	11.63	0.87
Fringed Pipefish	*Anarchopterus criniger*	324	6.92	0.52
Scrawled Cowfish	*Acanthostracion quadricornis*	192	4.10	0.31
Gulf Toadfish	*Opsanus beta*	172	3.68	0.27
Gray Snapper	*Lutjanus griseus*	156	3.33	0.25
Planehead Filefish	*Stephanolepis hispida*	152	3.25	0.24
Mojarra	*Eucinostomus* spp.	130	2.78	0.21
Sea Bream	*Archosargus rhomboidalis*	104	2.22	0.17
Striped Burrfish	*Chilomycterus schoepfii*	82	1.75	0.13
Bandtail Puffer	*Sphoeroides spengleri*	81	1.73	0.13
Fringed Filefish	*Monocanthus ciliates*	72	1.54	0.11
Hogfish	*Lachnolaimus maximus*	57	1.22	0.09
Trunkfish	*Lactophrys trigonus*	40	0.85	0.06
Grass Porgy	*Calamus arctifrons*	39	0.83	0.06

Source: Adapted from EAI 2009-TN154.

During the March 2008 to February 2009 sampling period, a total of 2,063 shellfish were collected with an overall CPUE of 3.3 specimens per 100 m trawl. Four species accounted for 90 percent of the total captured; pink shrimp were the most abundant, followed by other penaeid shrimp (*Farfantepenaeus* spp.), ornate blue crab (*Callinectes ornatus*), and Caribbean spiny lobster (*Panulirus argus*) (Table 2-23).

Table 2-23. Shellfish Species Composing 90 Percent of the Total Catch in Card Sound During 2008−2009 Sampling Events

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Pink shrimp	*Farfantepenaeus duorarum*	1,153	55.89	1.84
Penaeid shrimp	*Farfantepenaeus* spp.	354	17.16	0.56
Ornate blue crab	*Callinectes ornatus*	187	9.06	0.30
Caribbean spiny lobster	*Panulirus argus*	172	8.34	0.27

Source: Adapted from EAI 2009-TN154.

EAI (2009-TN154) also collected icthyoplankton samples from Card Sound from March 2008 to February 2009. For the assessment of fish egg abundance, a total of 26,277 eggs were collected from 3,991.6 m^3 of water, resulting in an overall density of 6.6 eggs per m^3. The majority of fish eggs were unidentified; approximately 12 percent were determined to be herring eggs (EAI 2009-TN154). Fish larvae sampling identified a total of 3,152 fish larvae representing

47 taxa in plankton samples, resulting in an average of 0.8 larvae per cubic meter of water. Larvae of gobies (family Gobiidae) accounted for approximately 22 percent of the total captured, followed by herring and blennies (family Labrisomidae and Chaenopsidae). In all, 10 taxa represented 90 percent of the total numbers collected (Table 2-24). The March 18, 2009 invertebrate study also included collections from three transects in Card Sound near the southern end of the Turkey Point site (EAI 2009-TN97). Crustaceans were the most numerically abundant taxa, followed by mollusks and polychaetes (Table 2-25). The general conclusion of EAI (2009-TN154) was that the 2008–2009 sampling of Card Sound was comparable to previous studies in Biscayne Bay.

Table 2-24. Fish Larvae Composing 90 Percent of the Total Collection in Card Sound During 2008–2009 Sampling Events

Common Name	Scientific Name	Total Number Collected	Percentage of Total	Catch per Unit Effort
Gobies	Family Gobiidae	921	29.22	0.2307
Herring	Family Clupeidae	509	16.15	0.1275
Labrisomid blennies	Family Labrisomidae	313	9.93	0.0784
True blennies	Family Chaenopsidae	257	8.15	0.0644
Hardhead Silverside	*Atherinomorus stipes*	234	7.42	0.0586
Code Goby	*Gobiosoma robustum*	203	6.44	0.0509
Spotted Dragonet	*Diplogrammus pauciradiatus*	132	4.19	0.0331
Sleepers	Family Eoeotridae	117	3.71	0.0293
Gobies	Suborder Gobioidei	86	2.73	0.0215
Herring-like fishes	Order Clupeiformes	71	2.25	0.0178

Source: Adapted from EAI 2009-TN154

Table 2-25. Summary of Benthic Invertebrate Abundances near Card Sound

	Distance from Shore (ft)			
Classification	**250**	**500**	**750**	**Total**
Crustaceans	234	498	268	**1,000**
Echinoderms	3	16	9	**28**
Miscellaneous taxa	31	4	26	**61**
Molusks	129	132	179	**440**
Polychaetes	27	45	88	**160**
Total	424	695	570	**1,689**

Source: EAI 2009-TN97

Everglades Mitigation Bank, Model Lands Basin, and Southern Glades Addition

The EMB is a 13,000 ac expanse of freshwater and estuarine wetlands west and south of the IWF (Figure 2-27). The EMB is owned and operated by FPL and is used as a commercial mitigation bank with wetland habitat credits that can be purchased to offset regional wetland impacts. The Model Lands Basin and Southern Glades Addition are also located to the west and south of the Turkey Point site. These areas represent a collaborative effort by the

Environmentally Endangered Lands Program of Miami-Dade County and the SOR Program of the SFWMD to restore the natural environments of Biscayne Bay and its watershed. This area encompasses approximately 34,000 ac of freshwater and coastal wetlands, excluding the land reservations by RMC South Florida, Inc. and FPL for permitted industrial and/or mitigation uses, as described above (SFWMD 2005-TN217). These areas serve as habitat and refuge for a variety of birds, fish, reptiles, amphibians, and mammals, including numerous Federal and State threatened or endangered species. Key management issues in these locations include the continuing loss of habitat in adjacent areas due to land-use conversion, the presence of invasive and exotic species, and damage associated with unauthorized public use, including the discharge of firearms and solid waste dumping (SFWMD 2005-TN217).

Everglades National Park and Crocodile Lake National Wildlife Refuge

Everglades National Park is located south and west of the Turkey Point site and encompasses 2,353 mi^2 of wetlands, uplands, and submerged lands. The distance from the western border of the park to the boundary of the Turkey Point property ranges from 6 to 13 mi. The park was authorized by Congress in 1934 and established in 1947 to protect the biological resources of the southern Everglades ecosystem. Important ecosystem features of Everglades National Park include sawgrass sloughs, tropical hardwood hammocks, mangrove forests, and numerous lakes, ponds, and bays that sustain many threatened and endangered species (USACE 2010-TN113). Nearly 300 species of fish inhabit the freshwater marshes and marine coastlines of Everglades National Park, and fishing is popular within park boundaries. American alligator (*Alligator mississippiensis*), American crocodile, and sea turtles are found in Everglades National Park. Marine mammals documented within park boundaries include pilot whales (*Globicephala macrorhyncha*), common bottlenose dolphin, and Florida manatee (NPS 2010-TN194).

The 6,600 ac Crocodile Lake National Wildlife Refuge is approximately 10 mi south of the Turkey Point site, and it serves as a refuge for crocodiles and other wildlife requiring mangrove habitats.

2.4.2.2 Aquatic Resources – Transmission Lines and Related Pipeline

This section provides a general description of the proposed transmission lines that would need to be constructed or upgraded to support proposed Units 6 and 7 followed by a summary of the aquatic resources that are or could be present in those areas. Aquatic resources that may occur near the proposed pipeline are expected to be similar to those co-located transmission lines (Clear Sky to Davis and Davis to Miami). Detailed information on the proposed transmission line routes and configurations are provided in Section 2.2.2; additional information is provided in the Section 9 of SCA Rev 1 (FPL 2010-TN272), ER Revision 6, Section 2.2.2 (FPL 2014-TN4058), and the supplemental information on transmission corridor information provided by FPL in 2013 (FPL 2013-TN2941).

East Transmission Corridor

As described in Section 2.2.2, a new 230 kV approximately 19 mi long transmission line, would be constructed to connect the proposed new Clear Sky substation to the existing Davis

substation, and a new approximately 18 mi long 230 kV line would be constructed to connect the Davis substation to a new 230 kV bay position at Miami substation. FPL stated (FPL 2014-TN4058) that these transmission lines would be largely collocated in an existing right-of-way or other linear/transportation corridors. Along the Clear Sky to Davis route, streams, waterways, and canals account for about 2 percent of the land cover, and mangrove swamps account for approximately 10 percent of the land use. Streams, waterways, canals, and reservoirs along the Davis to Miami Route account for less than 2 percent of the land use (FPL 2014-TN4058).

West Corridor Options

As described in Section 2.2.2, FPL has outlined two options for the West corridor that connects the Clear Sky, Levee, and Pennsuco substations. The two options differ primarily as to where the corridor would pass with respect to the Everglades National Park. The first option, termed the West Preferred corridor, passes along a segment of the eastern perimeter of the park. The second option, termed the West Consensus corridor, avoids the park perimeter by passing through lands to the east used mostly for limerock mining. Land use associated with these corridors is predominantly related to farming activities. Aquatic habitats along the routes (e.g., streams, waterways and canals) represent between 16 percent and 36 percent of the land use, and vary with respect to the route chosen and transmission line segment (FPL 2013-TN2941).

Aquatic Resources

Table 2-26 lists the fish species that could occur in open water habitats associated with the proposed transmission line and pipeline corridors in Miami-Dade County based on information provided in ER Revision 6 (FPL 2014-TN4058). Based on FNAI findings, FPL believes the only State of Florida fish Species of Special Concern in Miami-Dade County that could potentially occur along the proposed transmission line and pipeline corridors is the Mangrove Rivulus (*Rivulus marmoratus*), although the corridors would not include ideal habitat (mangrove) for the fish (FPL 2014-TN4058). Federally or State-listed species that could potentially occur in transmission line and pipeline corridors include the American alligator and the Florida manatee, which may be found in the canal systems adjacent to the transmission and pipeline corridors. A discussion of these species follows. Because any or all of these species could potentially occur in the aquatic and wetland habitats crossed by the proposed corridors, the review team assumes threatened and endangered species surveys would occur prior to building.

Table 2-26. Fish Species that Could Occur in Open Water Habitats Associated with the Proposed Transmission-Line Corridors in Dade County, Florida

Common Name	Scientific Name
Florida Species of Special Concern	
Mangrove Rivulus	*Rivulus marmoratus*
Common Native Freshwater Forage Fish	
Mosquitofish	*Gambusia holbrooki*
Sailfin Molly	*Poecilia latipinna*
Least Killifish	*Heterandria formosa*
Sunfishes	*Lepomis* spp.
Gars	*Lepisosteus* spp.

Table 2-26. (contd)

Common Name	Scientific Name
Common Non-Indigenous Fish	
Peacock Bass	*Cichla ocellaris*
Spotted Tilapia	*Tilapia mariae*
Blue Tilapia	*Oreochromis aureus*
Mayan Cichlid	*Cichlasoma urophthalmus*
Jaguar Guapote	*Cichlasoma managuense*
Oscar	*Astronotus ocellatus*

Source: ER Rev 6 (FPL 2014-TN4058)

2.4.2.3 Aquatic Species and Habitats

Important aquatic species are defined in ESRP 2.4.2 (NRC 2000-TN614) as all life stages that are critical to the structure and function of the local aquatic ecosystem, and include the following:

- rare species, defined as (1) those listed as threatened or endangered or designated as experimental populations or species by FWS or NMFS; (2) species listed as threatened or endangered by State agencies; and (3) Species of Concern as identified by State or Federal agencies
- commercially or recreationally valuable, or subsistence species
- species essential to the maintenance or survival of species that are rare and commercially or recreationally valuable
- species that serve as biological indicators to monitor the effects of the facilities on the aquatic environment
- marine mammals.

Ecologically, Commercially, and Recreationally Important Species

Table 2-27 lists species considered by the review team to be ecologically, commercially, and recreationally important to Biscayne Bay in the vicinity of the Turkey Point site based on the data and information presented above and past studies. These species contribute to the structure and function of Biscayne Bay, and could potentially be affected by the construction and operation of proposed Units 6 and 7. Table 2-27 also includes non-native and invasive species that occur in Biscayne Bay and have the potential to influence ecosystem dynamics. Federally and State-listed species are discussed later in this section. Brief descriptions of the life histories of species presented in Table 2-27 follow. The susceptibility of these species to adverse impacts associated with the construction and operation of the proposed Units 6 and 7 at Turkey Point is discussed in Chapters 4 and 5, respectively. Separate discussions are provided for Federally or State-listed species, and for those species with designated essential fish habitat.

Table 2-27. Ecologically, Recreationally, and Commercially Important Aquatic Species Likely to Occur at or near the Turkey Point Site

Common Name	Scientific Name	Classification	Designation[a]	Citation
Common bottlenose dolphin	*Tursiops truncatus*	Marine Mammal	Eco	(b)
Common Snook	*Centropomus undecimalis*	Game fish	Rec, Eco	(c)
Tarpon	*Megalops atlanticus*	Game fish	Rec, Eco	(c)
Spotted Seatrout	*Cynoscion nebulosus*	Game fish	Eco, Rec	(d)
Red Drum	*Sciaenops ocellatus*	Game fish	Eco, Com, Rec	(e)
Red Grouper	*Epinephelus morio*	Game fish	Eco, Com, Rec	(e)
Gray Snapper	*Lutjanus griseus*	Forage fish	Eco, Com, Rec	(e)
Mojarras	*Eucinostomus* spp.	Forage fish	Eco	(d)
Silver Jenny	*Eucinostomus gula*	Forage fish	Eco	(d)
Grunts	*Haemulon* spp.	Forage fish	Eco, Com, Rec	(f)
Bluestriped Grunt	*Haemulon sciurus*	Forage fish	Eco, Com, Rec	(f)
Fringed Pipefish	*Anarchopterus criniger*	Forage fish	Eco	(f)
Pinfish	*Lagodon rhomboides*	Forage fish	Eco, Rec	(f)
Sheepshead Minnow	*Cyprinodon variegatus*	Forage fish	Eco	(c)
Killifishes	*Fundulus* spp.	Forage fish	Eco	(c)
Mosquitofish	*Gambusia* sp.	Forage fish	Eco	(c)
Sailfin molly	*Poecilia latipinna*	Forage fish	Eco, Com	(c)
Needlefish	*Strongylura* sp.	Forage fish	Eco	(c)
Silver perch	*Bairdiella chrysoura*	Forage fish	Eco	(c)
Pink shrimp	*Farfantepenaeus duorarum*	Crustacean	Eco, Com	(b, d, f)
Caribbean Spiny lobster	*Panulirus argus*	Crustaceran	Eco, Com, Rec	(e)
Blue crab	*Callinectes sapidus*	Crustacean	Eco, Rec, Com	(b)
American oyster	*Crassostrea virginica*	Mollusk	Eco, Rec, Com	(b, d)
Green sea urchin	*Lytechinus variegatus*	Echnonderm	Eco	(f)
Turtle grass	*Thalassia testudinum*	Seagrass	Eco	(g, h)
Shoal grass	*Halodule wrightii*	Seagrass	Eco	(g, h)
Manatee grass	*Syringodium filiforme*	Seagrass	Eco	(g, h)
Algae	*Batophora* spp.	Macroalgae	Eco	(g)
Pacific whiteleg shrimp	*Litopenaeus vannamei*	Non-indigenous	Eco, Com	(i)
Lionfishes	*Pterois* spp.	Non-indigenous	Eco	(j)
Mayan Cichlid	*Cichlasoma urophthalamus*	Non-indigenous	Eco	(j)
Oscar	*Astronotus ocellatus*	Non-indigenous	Eco	(j)
Asiatic clam	*Corbicula fluminea*	Non-indigenous	Eco	(k)
Zebra mussel	*Dreissena polymorpha*	Non-indigenous	Eco	(k)

(a) Eco = ecologically important; Rec = recreationally important; Com = commercially important.
(b) Identified as species of special relevance and utility for monitoring and reporting the state of the Biscayne Bay by Browder et al. (2005-TN151)
(c) Documented in ER Rev 6 (FPL 2014-TN4058)
(d) Used by NPS (2006-TN183) to develop salinity targets for Western Biscayne Bay
(e) Representative marine species identified by Robles et al. (2005-TN198) to assess the condition of marine resources in Biscayne National Park
(f) Numerically abundant in Card Sound (EAI 2009-TN154)
(g) Abundant near Turkey Point site (EAI 2009-TN153)
(h) Common in Biscayne Bay (b).
(i) Non-indigenous crustacean species used in aquaculture (FAO 2012-TN155)
(j) Non-indigenous fish Species of Concern (NPS 2011-TN185)
(k) Non-indigenous mollusk species in freshwater systems (Ogden et al. 2005-TN196)

Marine Mammals

The Biscayne Bay stock of common bottlenose dolphins is bounded to the north by Haulover Inlet (north of Miami) and to the south by the Card Sound Bridge, south of the Turkey Point site. Population trend data are not available for the Biscayne Bay stock, but NOAA initiated a photo-identification project for this species in 1990 (NOAA 2011-TN182). Threats to dolphins include coastal pollution, fatal interactions with crab and lobster pots, and entanglement in fishing gear (NOAA 2009-TN175). As discussed below, manatee are also present in Biscayne Bay. Marine mammals may also be sensitive to noise and vibration associated with nearshore construction activities and radial collector well installation.

Game Fish

Examples of game fish common to Biscayne Bay in the vicinity of the Turkey Point site that could be affected by the construction and operation of proposed Units 6 and 7 include Common Snook, Tarpon, Spotted Seatrout, Red Drum, and Red Grouper (Table 2-27). Many of these species have been included in monitoring programs to assess the condition of Biscayne Bay, or were numerically abundant in recent collections near the Turkey Point site are presented in Table 2-22. Unless otherwise noted, the following life history information was obtained from the Florida Museum of Natural History (FMNH 2012-TN167).

Common Snook (*Centropomus undecimalis*). Common Snook can tolerate a wide range of salinity but cannot tolerate water temperatures below 60°F. The lower lethal limit of water temperatures is 48.2 to 57.2°F for juveniles, and 42.8 to 53.6°F for adults. Primary prey of Common Snook include small fish, crabs, and mollusks (FFWCC 2011-TN159).

Tarpon (*Megalops atlanticus*). Tarpon are common in coastal waters from Virginia to central Brazil, inhabiting coastal waters, bays, estuaries, and mangrove-lined lagoons. Tarpon are also tolerant to a wide range of salinity (0 to 47 ppt) and low dissolved oxygen conditions but prefer water temperatures ranging from 72 to 82°F. Juveniles are planktiverous, and adults are carnivorous, and feed on a variety of smaller fish, shrimp, and crab. Only recreational Tarpon fishing is allowed in Florida (FFWCC 2011-TN159).

Spotted Seatrout (*Cynoscion nebulosus*). The geographical range of Spotted Seatrout is limited to the western Atlantic from Cape Cod, Massachusetts, to southern Florida and the Gulf of Mexico. In Biscayne Bay, adults, spawning adults, juveniles, larvae, and eggs are present in salinities ranging from 0.5 to >25 ppt (Nelson et al. 1991-TN174). During the summer months, seatrout are found in seagrass beds, and they move to deeper pockets of water in estuaries during the cooler months. Migration out of nursery estuaries is rare.

Red Drum (*Sciaenops ocellatus*). The Red Drum is a euryhaline species found along the Atlantic and Gulf of Mexico coasts from Cape Cod, Massachusetts, to Tuxpan, Mexico. Red Drum are found in a variety of habitats, including estuaries, river mouths, bays, and seagrass beds. Adults are generally found in salinities of 30 to 35 ppt, and are tolerant of temperatures ranging from 39 to 83°F. The Red Drum is harvested commercially, is a popular recreational species, and has been used in commercial aquaculture operations.

Red Grouper (*Epinephelus morio*). The Red Grouper is found in the western Atlantic Ocean from North Carolina to southern Brazil, including the Gulf of Mexico and the Caribbean Sea. This species can be found in depths ranging from 16 to over 1,000 ft on both rocky and muddy substrates. Juveniles are generally found in seagrass beds. Predators include larger fish, including sharks and Great Barracuda. Although Red Grouper are fished commercially and recreationally, they are considered overfished in the South Atlantic, and harvests in U.S. waters have decreased by 50 percent over the past 55 years.

Forage Fish

Aquatic areas within FPL property and in Biscayne Bay near the Turkey Point site support a diverse assemblage of forage fish that could be affected by the construction and operation of proposed Units 6 and 7. In addition to providing food for a variety of larger fish, turtles, birds, and marine mammals, many have been used as representative species to assess changes in Biscayne Bay. The following discussion focuses primarily on species common or numerically dominant in areas at or near the Turkey Point site based on the recent investigations discussed above, and those included in monitoring studies as indicator species. Unless otherwise noted, the following life history information was obtained from FMNH 2012-TN167.

Gray Snapper. Gray Snapper are found in the western Atlantic Ocean from Massachusetts to Bermuda, and are abundant along the Florida coast. Robles et al. (2005-TN198) included this species as a surrogate for assessing the condition of marine resources in Biscayne Bay. Nelson et al. (1991-TN174) noted that Gray Snapper adults, juveniles, and larvae were abundant to highly abundant in Biscayne Bay in salinities ranging from 0.5 to >25 ppt. Young fish are found in nearshore seagrass beds and soft and sand-bottom habitats. Adults tend to remain in the same area for long periods of time. Predators include sharks, barracudas, groupers, moray eels, and other larger fish.

Mojarras (*Eucinostomus spp.*) and Silver Jenny (*E. gula*). Mojarras and Silver Jenny are forage fish common to Biscayne Bay and Card Sound. *Eucinostomus* spp. were identified by NPS (2006-TN183) as an indicator for developing salinity targets for Biscayne Bay; Silver Jenny were numerically abundant in nearby Card Sound during the 2008-2009 sampling by EAI (2009-TN154) and FPL (2014-TN4058). Optimal salinity ranges for Mojarras are considered to be approximately 10 to 20 ppt (NPS 2006-TN183).

Grunts (*Halemulon spp.*), Pipefishes (*Anarchopterus spp.*), and Pinfish (*Lagodon rhomboides*). Grunts, pipefishes, and Pinfish are common in the western Atlantic Ocean from South Carolina to Brazil, and are often found in mangroves, reefs, and seagrass beds. Juvenile grunts are abundant in turtle grass. Bluestriped and White Grunt (*H. sciurus*, *H. plumierii*), Fringed Pipefish (*A. criniger*), and Pinfish were numerically abundant during the 2008-2009 EAI sampling in Card Sound (Pinfish had the highest abundance) (EAI 2009-TN154). Predators include snappers, groupers, Spanish Mackerels, and sharks. Pinfish have also recently been considered as a candidate species for Florida aquaculture given their tolerance for a wide range of environmental conditions (Ohs et al. 2010-TN219).

Sheepshead Minnow, Killifishes (*Fundulus* spp.), Mosquitofish (Genus *Gambusia*), Sailfin Molly, and Needlefishes (*Strongylura* spp.). Sheepshead Minnow, Killifishes, Mosquitofish, Sailfin Molly, and Needlefishes are hardy forage fish that are tolerant of high salinities, and occurrences of these fish in the Turkey Point IWF are documented. Most are not common to Biscayne Bay, but Sailfin Molly are often found in shallow surface waters along the edges of marshes, ponds, and swamps. Silver Perch are found in seagrass beds, tidal creeks, rivers, and marshes, and are similar in appearance to Sand Seatrout (FFWCC 2011-TN159). The NPS (2006-TN183) included Silver Perch as an indicator species for establishing ecological targets for western Biscayne National Park.

Crustaceans and Mollusks

Pink Shrimp (*Farfantepenaeus duroarum*). Pink shrimp is an ecologically, recreationally, and commercially important species in Biscayne Bay. A commercial industry that harvests shrimp for live bait has existed in Biscayne Bay for many years, and collection of shrimp for human consumption is expanding. Juvenile pink shrimp immigrate to Biscayne Bay from offshore spawning areas and are found in seagrass beds near freshwater inputs (Browder et al. 2005-TN151). Nelson et al. (1991-TN174) indicate pink shrimp juveniles and larvae are highly abundant in Biscayne Bay in salinities ranging from 0.5 to >25 ppt; the NPS identified pink shrimp as an indicator species for Biscayne Bay with regard to evaluating and establishing salinity targets, and specified the optimal salinity range for juveniles to be from approximately 10 to 20 ppt (NPS 2006-TN183).

Caribbean Spiny Lobster (*Panulirus argus*). The Caribbean spiny lobster is the most common lobster in Biscayne Bay. In South Florida, spawning occurs from April through October, when water temperatures exceed 23°C (FFWCC 2010-TN162). Juvenile lobsters are found in nursery areas featuring seagrass meadows and algal beds; subadults and adults gradually migrate to offshore reef systems and ledges (NPS 2011-TN184). According to FFWCC (2010-TN4071), commercial landings of Caribbean spiny lobster in Florida have varied without trend since about 1970, with landings ranging from between 4.3 and 7.9 million pounds. Commercial landings are primarily from South Florida in Monroe, Miami-Dade, Collier, Palm Beach, and Broward Counties (FFWCC 2010-TN4071).

Blue Crab (*Callinectes sapidus*). In the western Atlantic, blue crab are found from Nova Scotia to Northern Argentina (FFWCC 2010-TN162). This species is commonly found in the south-central portion of Biscayne Bay, and blue crab represents an important ecological, recreational, and commercial resource. Optimum blue crab hatching takes place in salinities ranging from 23 to 28 ppt, and juveniles use seagrass habitats where salinities range from 2 to 21 ppt (Browder et al. 2005-TN151). Commercial blue crab landings in Florida reached more than 18 million pounds in 1987 and 1996, then dropped to less than 8 million pounds in 2001 and 2002. Landings in 2009 were approximately 5 million pounds (FFWCC 2011-TN2220).

American Oyster (*Crassostrea virginica*). The American oyster is present in south-central Biscayne Bay where suitable conditions are available. The presence of planktonic food and substrate for attachment of veligers is needed for oysters to survive and thrive; optimum salinity is between 12 and 28 ppt (Ogden et al. 2005-TN197; Ogden et al. 2005-TN196). Oyster reef systems are an important part of nearshore estuarine food webs and provide food for other

species, substrate and habitat for benthic invertebrates and fish, and the ability to filter 4 to 34 L of water per hour that removes suspended materials (including phytoplankton, suspended organic carbon, and pollutants) from the water column (Ogden et al. 2005-TN196). Dozens to hundreds of species depend directly or indirectly on oyster reef systems for survival (Ogden et al. 2005-TN196). Because this species is sensitive to salinity and turbidity, it has been included in ecosystem conceptual models as an indicator species for water quality and was used as a species of interest by the NPS during the development of ecological targets for western Biscayne National Park (NPS 2006-TN183). Although oysters are capable of surviving in salinities of 4 to 40 ppt, the optimum salinity range for supporting reef systems is believed to be 10 to 20 ppt (NPS 2006-TN183).

Coral

In addition to the marine mammal, fish, and invertebrate species discussed above, coral reef systems are present in Biscayne Bay. These systems generally consist of a limited number of species in comparison to those present at offshore locations composing the Florida reef tract (Lirman et al. 2003-TN1519). Both staghorn (*Acropora cervicornis*) and elkhorn (*A. palmata*) corals are currently Federally threatened reef-building corals found primarily along the Atlantic coast of Florida and the Caribbean and occur in some portions of Biscayne Bay. In 2009, the Center for Biological Diversity Petition requested threatened or endangered listing of 83 species of coral occurring in U.S. waters of the Caribbean and Indo-Pacific (Center for Biological Diversity 2009-TN1518). In a subsequent 90-day finding published on February 10, 2010, NOAA determined that listing actions may be warranted for 82 of the 83 species (75 FR 6616) (TN1516). On August 27, 2014, NOAA listed 20 new coral species as threatened (NOAA Fisheries 2014-TN4022; 79 FR 53851 [TN4097]). Of these, the following are known to occur in the Florida Atlantic region:

- *Acropora cervicornis* (Staghorn coral)
- *Acropora palmata* (Elkhorn coral)
- *Mycetophyllia ferox* (Cactus coral)
- *Dendrogyra cylindrus* (Pillar coral)
- *Montastraea (Orbicella) annularis* (Boulder star coral)
- *Montastraea (Orbicella) faveolata* (Mountainous star coral)
- *Montastraea (Orbicella) franksi* (Star coral).

In its 2011 Status Review Report (Brainard et al. 2011-TN1517), NOAA indicated that all seven species have been reported in Biscayne Bay, and noted that temperature, acidification, disease, predation, land-based sources of pollution, and collection or trade as major threats to all coral species. Hard-bottomed areas near Turkey Point are generally considered a marginal habitat for coral, with fewer species occurring in the western portion of Biscayne Bay than in the central bay, east bay, and offshore locations. This is probably because of the variability in both temperature and salinity that occurs in these areas in comparison to conditions present in the central and eastern bay and offshore oceanic environments (Lirman et al. 2003-TN1519). Thus, the listed species described above are not likely to be present near Turkey Point.

Submerged Aquatic Vegetation

Submerged aquatic vegetation in Biscayne Bay includes a variety of seagrasses and calcareous algae. Seagrass beds play a key role in estuarine community dynamics, providing habitat and food sources to many vertebrate and invertebrate species, stabilizing bottom substrate, acting as nutrient and sediment traps, and contributing to primary and secondary productivity (Robles et al. 2005-TN198). At least seven seagrass species are found in Biscayne Bay, including turtle grass, shoal grass, manatee grass, widgeon grass, and three species of the genus *Halophila*, including Johnson's seagrass, a Federally protected species discussed below. As described by Robles et al. (2005-TN198), the distribution and health of seagrass beds in Biscayne Bay are influenced by a variety of natural and anthropogenic factors, including sediment depth, water depth, natural precipitation cycles, and light attenuation. In addition, the discharge of freshwater from canal systems and groundwater seepage into Biscayne Bay can influence distribution. For instance, turtle grass is often absent where groundwater seepage is present, and present where it is not (Browder et al. 2005-TN151). The general condition of Biscayne Bay seagrass communities, as reported by Robles et al. (2005-TN198) suggests some areas of the bay have experienced a slow decline in seagrass biomass, while other areas near freshwater canal outputs or areas where dredging has occurred have lost seagrass or experienced a shift to more freshwater-tolerant species, such as *Ruppia* spp. Seagrass studies conducted by EAI in August 2009 near the Turkey Point site found turtle grass and shoal grass were present at varying levels of coverage along all study transects (EAI 2009-TN153). Turtle grass was generally highest in areas immediately surrounding the Turkey Point peninsula, and generally decreased with increasing distance from shore. Shoal grass was much more restricted in distribution, occurring in the shallow-water areas near the peninsula. EAI (2009-TN153) also found that the algae *Batophora* spp. were abundant in the shallower areas along the periphery of the peninsula, and approached 100 percent coverage at some locations over small spatial scales.

Non-Indigenous Species

Non-indigenous species, including those identified by resource managers as exotic, non-native, alien, and introduced, are a growing concern in Florida, because their presence has the potential to alter existing food webs and alter species composition through competition, predation, or disease. As reported by Ogden et al. (2005-TN197), South Florida has one of the largest non-indigenous faunal communities in the world – more than 25 percent of the resident mammals, birds, reptiles, amphibians, and fish are classified as non-native. Non-indigenous species released into aquatic systems via the pet trade have the potential to use the existing canal systems to move into different aquatic environments, including nearshore areas of Biscayne Bay. Species used to support nearshore aquaculture industries may also be introduced intentionally or unintentionally into freshwater or nearshore ecosystems (Fuller and Nico 1999-TN172). An example of this is the introduction of Pacific whiteleg shrimp (*Litopenaeus vannamei*) into Biscayne Bay from commercial aquaculture enterprises (Ogden et al. 2005-TN197; FAO 2012-TN155). Fish Species of Concern to the NPS include the lionfish species (*Pterois volitans*, and *P. miles*) that are now common and increasing in occurrence in the bay, and Oscar (*Astronotus ocellatus*) and Mayan Cichlid (*Cichlasoma urophthalamus*), which are now found in canal systems (NPS 2011-TN185). Canal and freshwater systems are also susceptible to the spread of exotic bivalves, including the Asiatic clam (*Corbicula fluminea*)

and zebra mussel (*Dreissena polymorpha*) (Fuller and Benson 1999-TN171; Ogden et al. 2005-TN197). Asiatic clams have not been recognized as a nuisance to existing Turkey Point units (FPL 2014-TN4058). In recent years, the Argentine black-and-white tegu (*Tupanimbis merianae*) has been observed in southeastern Florida and is spreading rapidly in the vicinity of Turkey Point. This egg-eating reptilian omnivore has the potential to affect many species, including alligators and the endangered American crocodile, and is the subject of a multi-agency control effort (FFWCC 2014-TN4048; USGS 2014-TN4049).

Federally or State-Listed Species and Designated Critical Habitat

Based on information provided to FPL by the FWS and NOAA/NMFS (FPL 2010-TN272), information from the State of Florida (FFWCC 2013-TN3075), and examination of life history and distribution information, the review team identified one marine mammal, five species of sea turtles, two other aquatic reptiles, one fish species, and one seagrass species Federally and/or State-listed as threatened or endangered that could occur at or near the Turkey Point site (Table 2-28). The State listings in Table 2-28 reflect changes to threatened species rules that went into effect on November 8, 2010, stating that all Federally listed species that occur in Florida are now included on Florida's list as Federally designated endangered or Federally listed threatened (FFWCC 2013-TN3075). A number of other species included on the NMFS letter to FPL (2010-TN272) are either infrequent visitors to Biscayne Bay or are not reported to occur in the vicinity of the Turkey Point site. For instance, although blue whales (*Balaenoptera musculus*) finback whales (*B. physalus*), humpback whales (*Megaptera novaeangliae*), North Atlantic right whales (*Eubalaena glacialis*), sei whales (*B. borealis*), and sperm whales (*Physeter macrocephalus*) are occasionally sighted in Biscayne Bay, they are more commonly found in open-ocean or coastal environments and would not be present in the shallow waters near Turkey Point. Although the shortnose sturgeon (*Acipenser brevirostrum*) occurs in Florida waters, the southern limits of its range appear to be the St. Johns River near Jacksonville (FFWCC 2010-TN160). Likewise, the Atlantic and Caribbean coral species discussed above that are listed by NOAA may be found at offshore reef systems in Biscayne Bay, but are not known to occur at or near the Turkey Point site NOAA 2014 (NOAA Fisheries 2014-TN4022; 79 FR 53851 [TN4097]).

Although the FWS communication identified only the American crocodile as likely to occur near the Turkey Point site, the review team included the American alligator in Table 2 28 because of its similarity in appearance to the American crocodile. The Florida manatee was also included, as it is known to occur in the vicinity of the Turkey Point barge channel, or in the nearby canal systems that discharge into Biscayne Bay. A brief description of the life histories of the species listed in Table 2 28 and a discussion of critical habitat requirements, if defined, follow. Biological Assessments for FWS and NMFS are included in Appendix F.

Table 2-28. Federally or State-Listed Species, Proposed Species, or Candidate Species Likely to Occur at or near the Turkey Point Site

Common Name	Scientific Name	Classification	Designation[(a)]
Florida manatee	*Trichechus manatus latirostris*	Marine mammal	Federally Endangered State Endangered
Green sea turtle	*Chelonia mydas*	Turtle	Federally Endangered State Endangered
Hawksbill sea turtle	*Eretmochlys imbricata*	Turtle	Federally Endangered State Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Turtle	Federally Endangered State Endangered
Loggerhead sea turtle	*Caretta caretta*	Turtle	Federally Threatened State Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Turtle	Federally Endangered State Endangered
American alligator	*Alligator mississippiensis*	Reptile	Federally Threatened (SOA)[(b)] Florida Threatened SOA)[(b)]
American crocodile	*Crocodylus acutus*	Reptile	Federally Threatened State Threatened
Smalltooth Sawfish	*Pristis pectinata*	Fish	Federally Endangered State Endangered
Johnson's seagrass	*Halophila johnsonii*	Seagrass	Federally Threatened

(a) Federally listed species that occur in Florida are now included on Florida's list as Federally designated endangered or Federally designated threatened FFWCC 2013-TN3075. See also January 9, 2009 letter from Teletha Mincey, NMFS, to FPL (SCA Appendix 10.7.1.3) (TN1897).
(b) SOA (similarity of appearance to threatened American crocodile

Florida Manatee (*Tricechus manatus latirostris*)

The Florida manatee, a subspecies of the West Indian manatee, is a large marine mammal found in coastal and freshwater systems on both coasts of Florida. Manatees are Federally and State-listed as endangered, and their critical habitat includes "all waters of Card [Sound]… between portions of Biscayne Bay, Card Sound adjacent to the Turkey Point site, and the nearby streams, rivers, and canals" (41 FR 41914) (TN275) (Figure 2-29). Manatees have been observed in the barge-turning basin at the northern end of the Turkey Point site and in nearby state canals but not in the IWF (FPL 2014-TN4058). Areas defined by the FWS as "manatee consultation areas" include coastal regions of South Florida and large inland water bodies such as Lake Okeechobee. Thus, the Turkey Point site would be included in the manatee consultation area (FPL 2012-TN1618). Manatees are general herbivores that are able to feed on a variety of vegetation types. They are tolerant of changes in salinity but sensitive to temperature variations because they lack a thick insulating layer of blubber common to other marine mammals (Smith 1993-TN218). Several anthropogenic activities pose threats to manatees. Deaths are attributable to the management of water-control structures and navigational locks, loss of habitat associated with coastal development (FWS 2001-TN223), and several other activities. During the winter of 2008-2009, researchers reported a disproportionately high number of manatee deaths related to cold stress; 261 carcasses were reported statewide and 1 death was reported in Biscayne Bay (FFWCC 2010-TN161). The number of deaths (51) due to watercraft strikes during the winter of 2008–2009 was also

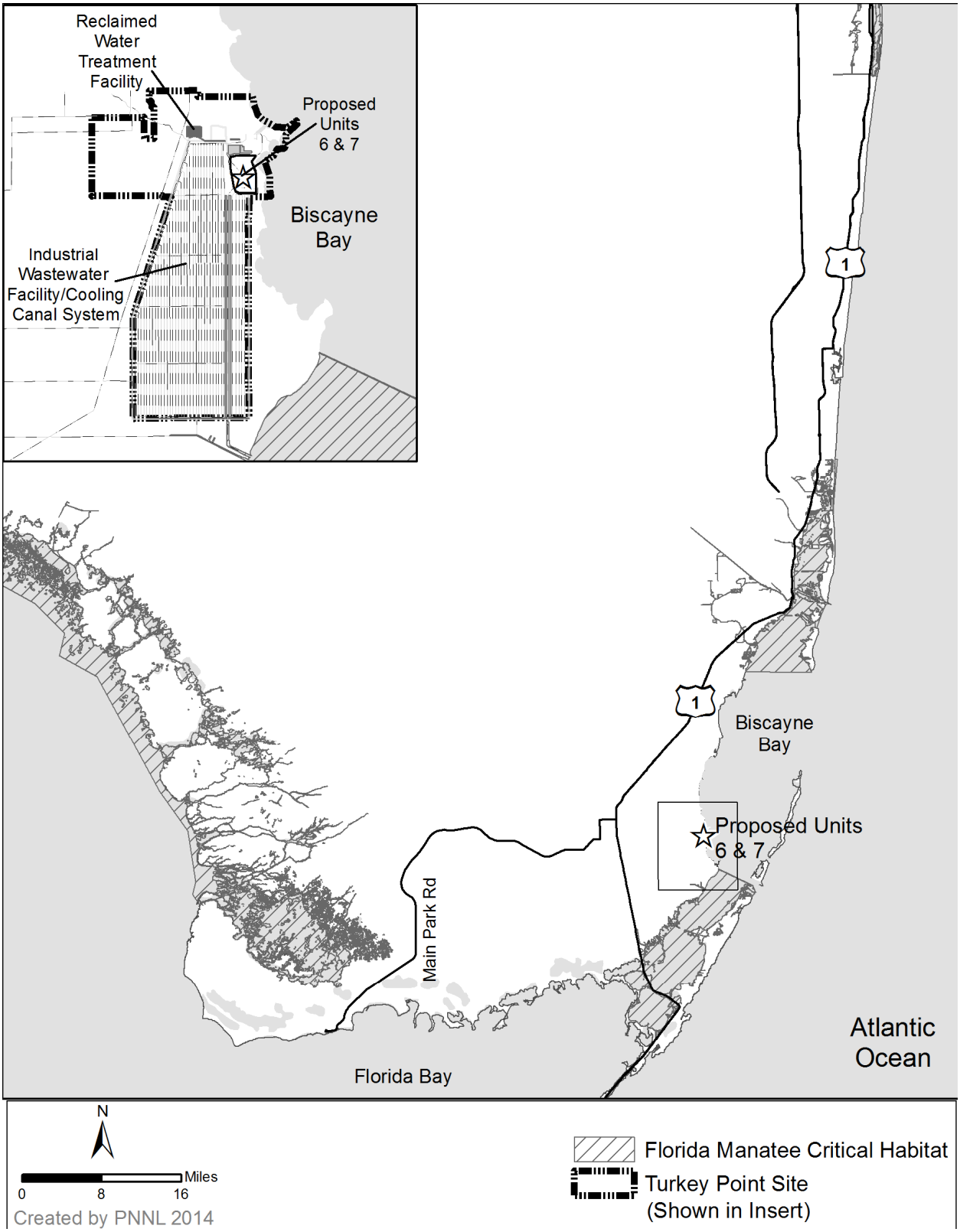


Figure 2-29. Critical Habitat for the Florida Manatee near the Turkey Point Site

relatively high statewide. Approximately 33 percent and 31 percent of the total deaths occurred in the southeast and southwest regions, respectively (FFWCC 2010-TN161). Annual manatee deaths in Miami-Dade County from 2000 to 2012 ranged from 5 to 22, with the highest mortality observed in 2010. Of the 22 deaths reported in 2010, 1 was attributed to perinatal death, 3 were caused by watercraft, 2 were attributed to natural causes, and 16 were undetermined/unrecovered. FFWCC reported one manatee death in January, 2013, the last reporting period available on their website (FFWCC 2014-TN3478). Causes of manatee deaths listed in FFWCC 2014-TN3478) include collisions with watercraft, entrapment in flood gates and canal locks, cold stress, natural mortality, perinatal death, and undetermined causes.

FPL procedures for protecting manatees from collision during the construction of proposed Turkey Point Units 6 and 7 are described in the SCA Barge Delivery Plan (FPL 2009-TN169); potential construction-related impacts on this species are discussed in Chapter 4 of this EIS. Additional information on this species is found in the FWS Biological Assessment in Appendix F.

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle is the largest of the hard-shelled turtles and unique among sea turtles in that adults are exclusively herbivorous. The species is found in the open ocean and in coastal areas and uses beaches for nesting (NOAA 2010-TN179). Green sea turtles are relatively common in Biscayne Bay and Card Sound; they visit these areas at various times of the year to feed (FPL 2014-TN4058; FDEP 2010-TN156). Green turtles have not been reported in the IWF, but are commonly observed in Biscayne Bay. Nests have occasionally been reported on Elliott Key approximately 7 to 9 mi east and north of the Turkey Point facility (FFWCC 2014-TN3530). NMFS and FWS have joint jurisdiction for sea turtles; NOAA is the lead agency in marine environments, and FWS is the lead for nesting beaches. The green sea turtle was Federally listed under the ESA on July 28, 1978, and the Florida population is currently considered endangered by Federal and Florida resource agencies. Critical habitat was designated in 1998 to include the coastal waters around Culebra Island, Puerto Rico. General threats to green sea turtles that apply to all sea turtle species include loss of habitat associated with anthropogenic or natural stressors, harvest of eggs, and mortality associated with incidental capture or entanglement in fishing nets and gear (NOAA 2010-TN179). Additional information on this species, including information on its occurrence near Turkey Point, is found in the NMFS Biological Assessment in Appendix F.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The hawksbill sea turtle is a medium-sized sea turtle most commonly found in coral reef systems, where the ledges and caves provide shelter (NOAA 2010-TN179). Hawksbill turtles were Federally listed under the ESA as endangered in 1970 and are currently listed as endangered by Federal and Florida resource agencies. As described above, NMFS and FWS have joint responsibility for this species. Critical habitat was designated in the coastal waters of Mona and Monito Islands, Puerto Rico, in 1998 (NOAA 2010-TN179). Hawksbill are less common in Biscayne Bay than green or loggerhead turtles, but nests have been recorded along the outer keys of the bay (FDEP 2010-TN156). Hawksbill turtles have not been reported in the IWF. Additional information on this species, including information on its occurrence near Turkey Point, is found in the NMFS Biological Assessment in Appendix F.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

Kemp's ridley sea turtles are the smallest marine turtle in the world, with adults weighing less than 100 lb. This species is found primarily in neritic habitats containing muddy or sandy bottoms. Prey items include fish, jellyfish, and mollusks. Kemp's ridley turtles were first Federally listed under the ESA in 1973 and are currently considered endangered by Federal and Florida resource agencies; they are listed as State endangered in Monroe County but not in Miami-Dade County, Florida (FPL 2014-TN4058). Kemp's ridley turtles typically nest in large aggregations called arribadas, but no arribadas occur in Florida. In February 2010, NMFS and FWS were jointly petitioned to designate critical habitat for this species along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean. This petition is currently under review (NOAA 2010-TN179). Kemp's ridley turtles have been observed in Biscayne Bay (FDEP 2010-TN156) but have not been found in the IWF. Additional information on this species, including information on its occurrence near Turkey Point, is found in the NMFS Biological Assessment in Appendix F.

Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle is commonly found near the Turkey Point site (FPL 2014-TN4058). The loggerhead's large head and powerful jaws enable the turtle to feed on hard-shelled prey, including whelks and conchs. A circumpolar species, loggerheads occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans, and loggerheads make extensive migrations between feeding and nesting grounds. In the southwestern United States, approximately 80 percent of nesting occurs in six Florida counties (NOAA Fisheries 2014-TN4028). Loggerhead turtles are also known to nest on Elliot Key in Miami-Dade County. Suitable beach habitat for nesting apparently does not exist in the vicinity of the Turkey Point site (FPL 2014-TN4058). The loggerhead was first Federally listed under the ESA as threatened throughout its range on July 28, 1978, and the most recent status review was published in 2009 (NOAA 2010-TN179). In 2010, the loggerhead turtle listing was changed to identify nine distinct population segments (DPSs), with four DPSs listed as threatened and five listed as endangered. The loggerhead population in Biscayne Bay is included in the Northwest Atlantic DPS and considered Federally threatened (75 FR 12598) (TN2763). In 2014, NOAA designated critical habitat for the loggerhead sea turtle which includes oceanic areas east of Biscayne Bay, but does not include nearshore areas near Turkey Point (79 FR 39855) (TN4032). Loggerhead turtles are of particular interest to the Biscayne National Park because they are the most common sea turtle observed within park boundaries, (NPS 2011-TN195). Loggerhead turtles have not been reported in the IWF, but nests have been reported on Elliott Key approximately 7 to 9 mi east and north of the Turkey Point facility (FFWCC 2014-TN3530). Additional information on this species, including information on its occurrence near Turkey Point, is found in the NMFS Biological Assessment in Appendix F.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is the largest reptile in the world, reaching an adult weight of 2,000 lb and a total length exceeding 6 ft. This species is unique in that it lacks a hard, bony shell. Leatherback turtles are common in open-ocean environment but also forage in coastal waters, eating soft-bodied prey. Leatherback turtles were listed under the ESA as endangered in 1970

and are currently classified as endangered by Federal and Florida resource agencies. Critical habitat that included the coastal waters adjacent to Sandy Point, St. Croix, in the U.S. Virgin Islands, was designated in 1998; NMFS is also proposing to revise the critical habitat to include areas off the U.S. West Coast (NOAA 2010-TN179). Leatherback turtles have not been reported in the IWF, and nests have been observed on Miami Beach and Key Biscayne (FDEP 2010-TN156). Leatherback turtles have been observed in Biscayne Bay but have not been observed in the IWF. Additional information on this species, including information on its occurrence near Turkey Point, is found in the NMFS Biological Assessment in Appendix F.

American Alligator (*Alligator mississippiensis*)

The American alligator is found in swamps, rivers, streams, lakes, and ponds throughout the southeastern United States where fresh or brackish water is present. Alligators are found in both Biscayne Bay and Card Sound, but are not known or expected to be in the IWF (FPL 2014-TN4058). Alligators are considered Federally threatened because of their resemblance to American crocodiles and are listed as a Species of Concern in the State of Florida. Alligators are opportunistic feeders eating fish, turtles, wading birds, snakes, frog, and small mammals (SREL 2012-TN221). Threats to this species include habitat loss, pollution, and interactions with humans. Alligators can be harvested only by individuals with approved licenses and permits (FFWCC 2012-TN163). Additional information on the potential effects of the proposed action on the American alligator may be found in the FWS Biological Assessment (Appendix F-2).

American Crocodile (*Crocodylus acutus*)

American crocodiles are commonly found in coastal areas throughout the Caribbean Sea in both brackish and saltwater habitats, including ponds, coves, creeks, and mangrove swamps. Crocodiles are opportunistic feeders, eating a variety of fish, snails, crustaceans, crabs, turtles, snakes, birds, and mammals. South Florida is considered the northern edge of their range (FFWCC 2012-TN164). Optimum nesting requirements include the presence of elevated, well-drained substrate near water >1 m deep, salinity ranging from 10 to 20 ppt, and locations that are protected from wind and wave action and free from human disturbance and predators. The use of artificial substrates to promote nesting has contributed to the increase of nests in South Florida and at the Turkey Point site (FPL 2009-TN974). This species was downlisted by FWS from Federally endangered to threatened for the Florida DPS in 2007 (72 FR 13027) (TN274) and is currently State endangered (FFWCC 2011-TN158). The designated critical habitat for American crocodile includes the majority of the Turkey Point IWF and other adjacent canals and aquatic habitats west and south of the Turkey Point site as well as a major portion of the proposed Units 6 and 7 site (Figure 2-30) (41 FR 41914) (TN275). Additional information about the potential effects of the proposed action on the American crocodile may be found in the FWS Biological Assessment (Appendix F-2).

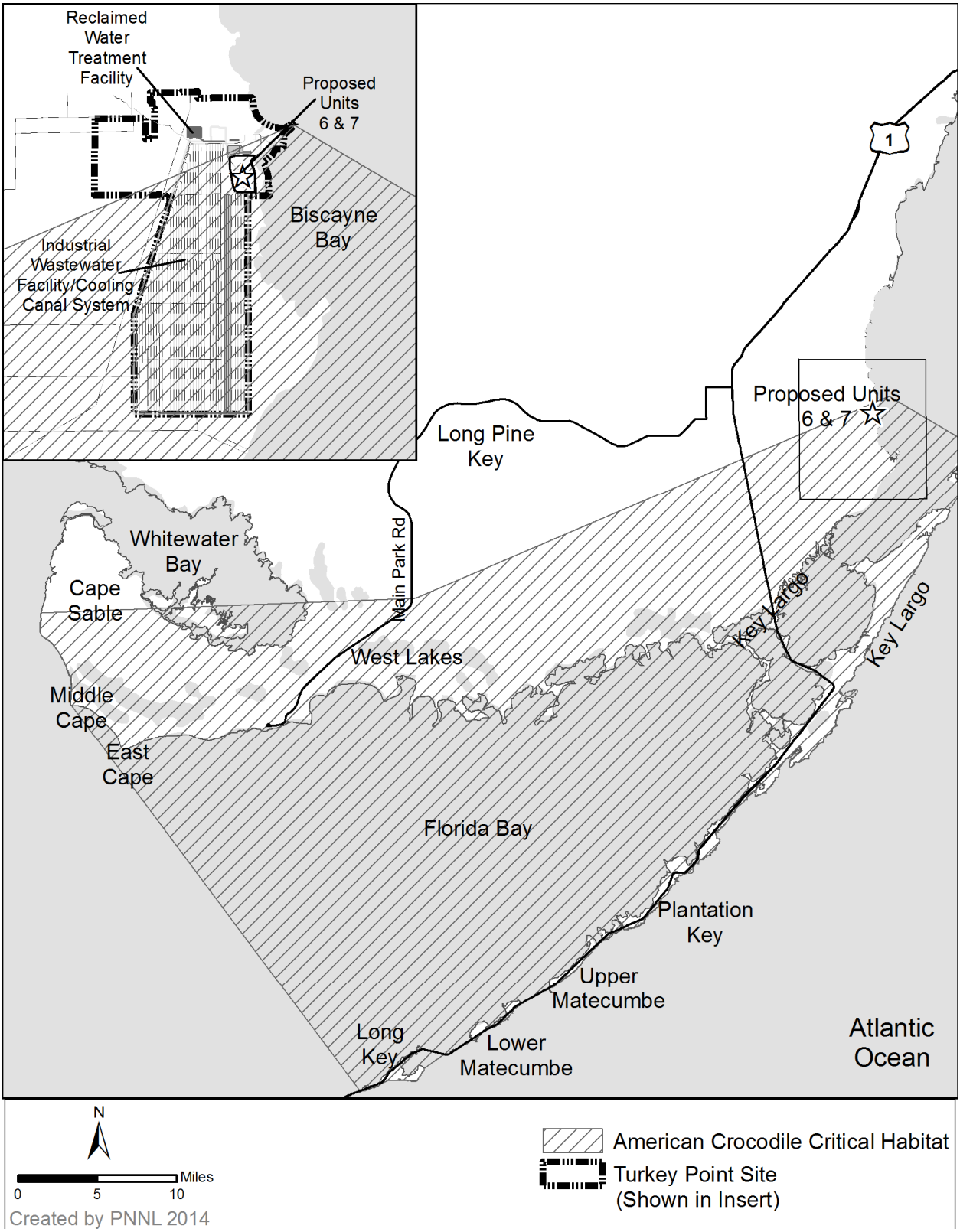


Figure 2-30. Critical Habitat for the American Crocodile Near the Turkey Point Site

Crocodiles were first observed at the Turkey Point site in 1976, and nesting was first documented in 1978. FPL subsequently developed a crocodile monitoring plan that described activities for creating and enhancing crocodile habitat, and for monitoring reproductive success, growth, and survival of hatchlings (FPL 2010-TN272). The current plan describes monitoring procedures as well as maintenance procedures for the IWF, including timing the method of vegetation clearing to result in minimal disturbance of nests, hatchlings, and adults (FPL 2014-TN4058). As discussed in Chapter 4, FPL has also developed a threatened and endangered species evaluation and management plan to ensure construction-related effects on listed species are minimized (FPL 2010-TN170). As described in the 2006 Biological Opinion by FWS (FWS 2006-TN832), FPL's 5,900 ac IWF has become particularly important nesting habitat for this species, and nesting activity has increased since it was first documented in 1978. FWS concludes that the crocodile nests within FPL property make up roughly one-third of the annual nest production in all of South Florida (FWS 2006-TN832).

As requested by the review team, FPL provided crocodile monitoring reports from 2000 to 2013. Table 2-29 summarizes the number of nests observed and hatchlings captured during that time. Successful nests from 2000 to 2013 have ranged from a low of 14 in 2001 to a high of 28 in 2008; hatchlings captured have ranged from 134 in 2004 to 548 in 2009. The general conclusions of the 2009 monitoring report were (1) the record numbers of hatchlings in 2009 may be a result of FPL's efforts or an increase in clutch size of the more mature females, and (2) the population of the crocodiles may be stabilizing as a result of younger reproductive females moving offsite and finding suitable nesting habitat elsewhere (FPL 2009-TN210). FPL attributes the reduction in observed nests and hatchlings captured in 2010 to the record low temperatures recorded in South Florida during the winter of 2009-2010. The cold winter may have caused a delay in successful courtship interactions or prohibited females from storing enough energy to reproduce (FPL 2010-TN211). In 2013, 25 successful nests produced 429 tagged hatchlings. FPL considers these results encouraging, as the nesting activity observed in the IWF was similar to that observed in the Everglades National Park (FPL 2013-TN3232).

With regard to crocodile nest distribution within the IWF, information provided by FPL shows that from 1978 to 2010, the majority of the nesting sites were in the southern end of the canal system (identified as Zones 4 and 5 in yearly monitoring reports) and throughout the return canal. In addition, clusters of nests were observed just south of the proposed location for proposed Units 6 and 7 (Figure 2-31). Nesting information from 2011 to 2013 also shows a few nests were located near the proposed Units 6 and 7 plant area and along the IWF Grand Canal where muck disposal would occur (Figure 2-32).

Table 2-29. American Crocodile Monitoring Results at the Turkey Point Site, 2000−2013

Year	Nests Identified	Hatchlings Captured and Tagged	Citation
2000	17	298	FPL 2000-TN202 RAI 5704 ML11168A043
2001	14	227	FPL 2003-TN168 RAI 5704 ML11168A043
2002	17	291	FPL 2003-TN203 RAI 5704 ML11168A043

Table 2-29. (contd)

Year	Nests Identified	Hatchlings Captured and Tagged	Citation
2003	17	295	FPL 2003-TN204 RAI 5704 ML11168A043
2004	18	134	FPL 2004-TN205 RAI 5704 ML11168A043
2005	24	282	FPL 2005-TN206 RAI 5704 ML11168A043
2006	24	340	FPL 2006-TN207 RAI 5704 ML11168A043
2007	21	305	FPL 2007-TN208 RAI 5704 ML11180A084
2008	28	510	FPL 2008-TN209 RAI 5704 ML11180A084
2009	24	548	FPL 2009-TN210 RAI 5704 ML11180A084
2010	16	196	FPL 2010-TN211 RAI 5704 ML11180A084
2011	15	268	FPL 2011-TN2471
2012	18	229	FPL 2012-TN2470
2013	25	429	FPL 2013-TN3232

The primary threats to this species in South Florida include destruction or modification of nesting habitat, changes in nesting behavior or nest location from repeated interactions with humans, dramatic changes in weather patterns or temperature extremes, and fatal encounters with motor vehicles along major highways. Deaths occurring in 2005–2006 on the Turkey Point site resulted in increased signage warning drivers to watch for crocodiles on the roads at all times and to observe posted speed limits. A crocodile death was reported in November 18, 2011. The November 2011 death involved a young crocodile found on site in the vicinity of the current work on the exploratory UIC well. The cause of death was determined to be physical trauma (NRC 2011-TN4121). Another death was reported on July 25, 2014. The 2014 death involved an adult crocodile discovered inside the intake well for Units 3 and 4 within the IWF. Based on visual evidence of no physical injury or trauma, the crocodile's death was not attributed to plant operations (NRC 2014-TN3718). In both cases, the Federal FWS and the FFWCC were notified. A third dead American crocodile was also reported on an access road outside of the Turkey Point controlled area in July 2014. The death was attributed to a vehicle collision.

Smalltooth Sawfish (*Pristis pectinata*)

The Smalltooth Sawfish is a tropical marine and estuarine fish with a circumtropical distribution. This species is currently Federally endangered. The largest populations in the United States are south and southwest of Florida, from Charlotte Harbor to the Dry Tortugas. Peninsular Florida has the largest number of capture records within U.S. waters and probably contained the largest historic populations (NOAA 2010-TN1724). The preferred habitat of Smalltooth Sawfish is shallow nearshore areas with muddy or sandy bottoms. Limited life history information is available for this species. Smalltooth Sawfish have been observed in Biscayne Bay and Card

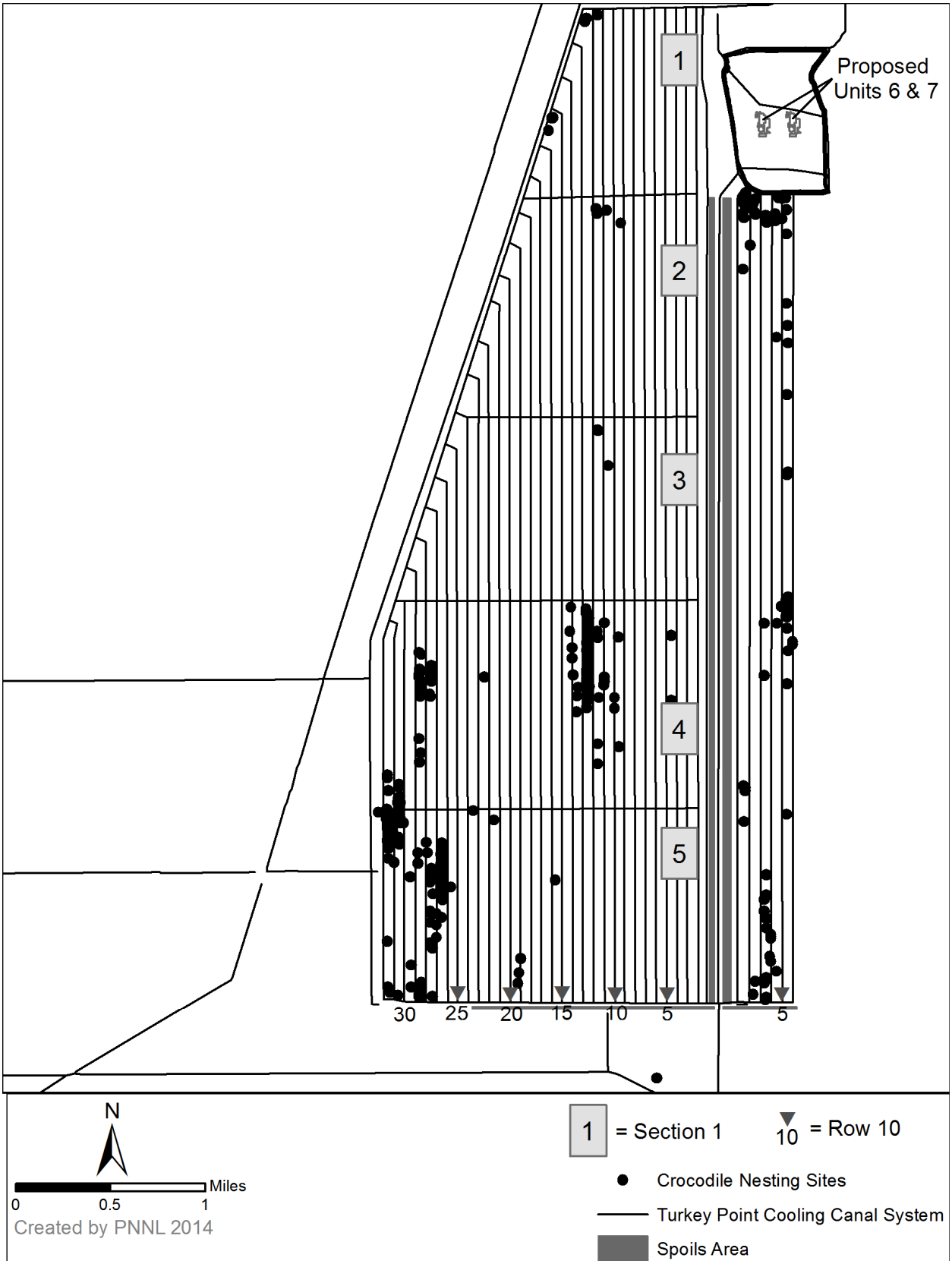


Figure 2-31. Locations of Crocodile Nests in the Turkey Point IWF, 1978−2010

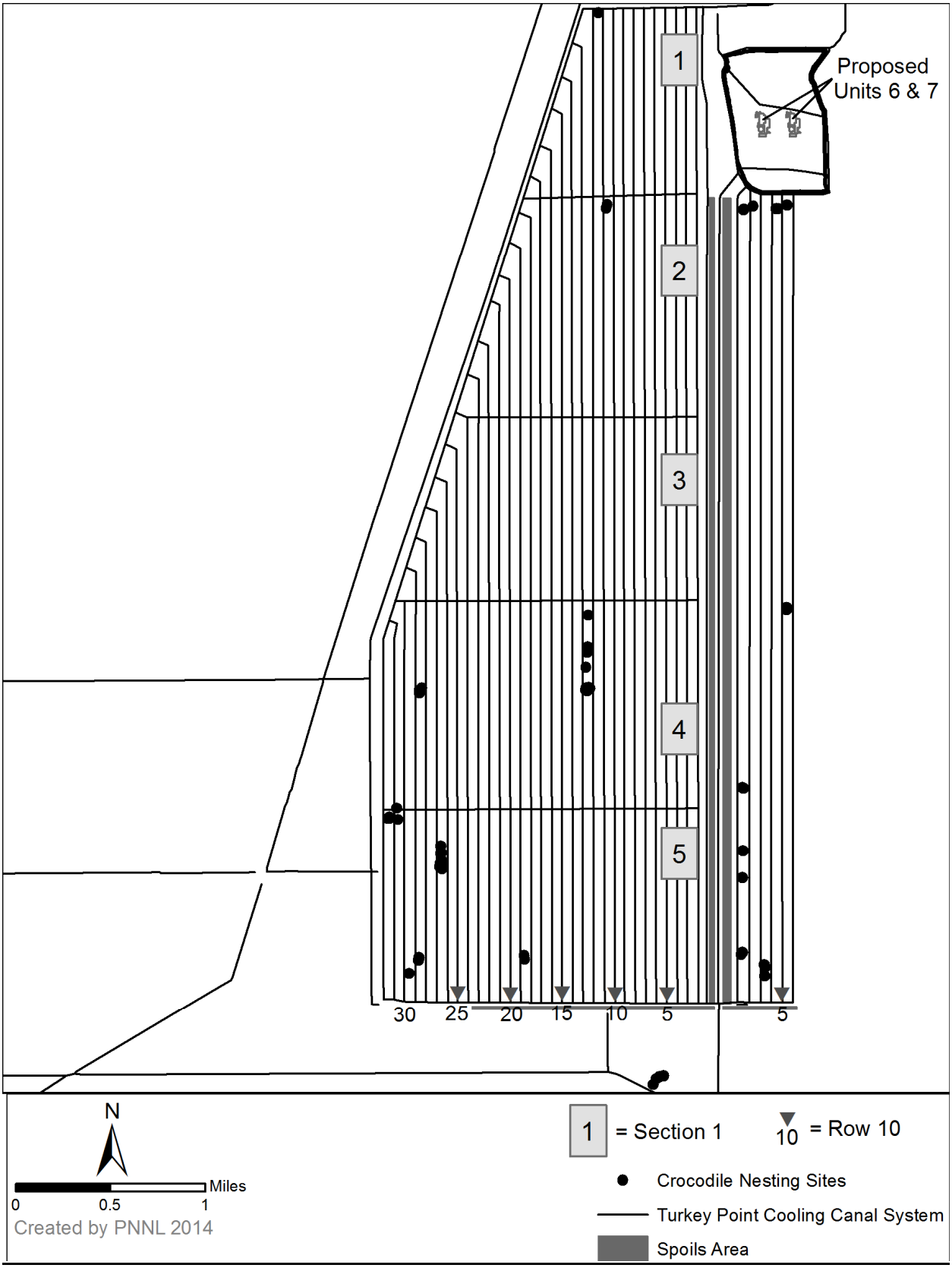


Figure 2-32. Location of Crocodile Nests in the Turkey Point IWF, 2011-2013

Sound and at nearshore locations near Turkey Point (FPL 2014-TN4058; FFWCC 2014-TN3530) but have not been observed in the IWF. Primary threats to this species are incidental catch in commercial and recreational fisheries and habitat loss or degradation (74 FR 45353) (TN271). Critical habitat for the Smalltooth Sawfish consists of two units: the 221,459 ac Charlotte Harbor Estuary Unit, and the 619,013 ac coastal habitat of the Ten Thousand Islands/Everglades Unit, both located on the west coast of Florida. No critical habitat for this species has been designated in Biscayne Bay or Card Sound (NOAA 2010-TN179). A complete description of this species, including documented occurrences in Biscayne Bay near the Turkey Point site, is found in the NMFS Biological Assessment in Appendix F.

Johnson's Seagrass (*Halophila johnsonii*)

Johnson's seagrass is a Federally threatened species that is known to occur near Sebastian Inlet to Virginia Key (NOAA 2007-TN187). This species may occur near Key Biscayne north and east of Turkey Point and to the south in Card Sound, but it has not been observed near the Turkey Point site or in the IWF (FPL 2014-TN4058). Physical habitat requirements for this species are variable, including both shallow intertidal and deeper subtidal zones in water that is clear and deep or shallow and turbid (NOAA 2010-TN180). In tidal channels, this seagrass is found in coarse sand substrates. Johnson's seagrass was not reported to occur near the Turkey Point peninsula by EAI (2009-TN153). Primary threats include propeller and anchor scouring, effects of dredging, overwater structure construction and shading, water pollution, and shoreline development. Critical habitat for Johnson's seagrass designated on April 5, 2000 in Florida includes the central portion of Biscayne Bay extending from Virginia Key north to Miami (65 FR 17786) (TN273).

A Johnson's Seagrass Recovery Plan was prepared in 2002 by the Johnson's Seagrass Recovery Team for NOAA/NMFS (NOAA 2002-TN173). Actions included the identification and protection of populations and habitat, range-side mapping and monitoring, studies to understand life histories, genetic traits, development of management and restoration techniques, and education and outreach. Recovery goals were designed to ensure (1) the present geographic range remains stable or increases for at least 10 years, (2) self-sustaining populations are present throughout the range at distances that allow for stable vegetative recruitment and genetic diversity, and (3) long-term protection on populations and supporting habitat (NOAA 2002-TN173). In 2007, a 5-year review was completed. The major findings suggested that although the populations in the northern range of the species appeared to be stable and self-sustaining, longer-term monitoring data were needed to confirm the status and stability of the population in the southern range (Jupiter Inlet to Biscayne Bay). The final conclusions of the report stated that Johnson's seagrass populations continue to remain vulnerable to natural and anthropogenic stressors, and the species continues to meet the definition of threatened under the ESA because it is still likely to become endangered in the foreseeable future throughout its range (NOAA 2007-TN187).

Federal or State Species of Concern or Proposed for Listing

Information provided to FPL by NMFS (FPL 2010-TN272) includes a list of fish and invertebrate Species of Concern, which are not protected under the ESA but may warrant listing in the future. Table 2-30 lists species likely to occur at or near the Turkey Point site. None of these

species are known or expected to occur in the IWF but could occur in nearshore locations in Biscayne Bay and Card Sound. A brief life history description for each follows.

Table 2-30. Federally or State-Listed Species of Concern Likely to Occur at or near the Turkey Point Site

Common Name	Scientific Name	Classification	Designation
Mangrove Rivulus	*Rivulus marmoratus*	Fish	Federal Species of Concern[(a)] Florida Species of Special Concern[(b)]
Dusky Shark	*Carcharhinus obscurus*	Fish	Federal Species of Concern[(a)]
Opossum Pipefish	*Microphis brachyurus lineatus*	Fish	Federal Species of Concern[(a)]
Sand Tiger Shark	*Carcharias taurus*	Fish	Federal Species of Concern[(a)]
Speckled Hind	*Epinephelus drummondhayi*	Fish	Federal Species of Concern[(a)]
Nassau Grouper	*Epinephelus striatus*	Fish	Federal Proposed for Listing[©]
Warsaw Grouper	*Epinephelus nigritus*	Fish	Federal Species of Concern[(d)]
Ivory Tree Coral	*Oculina varicosa*	Coral	Federal Species of Concern[(d)]

(a) FPL 2010-TN272
(b) FFWCC 2011-TN158
(c) 77 FR 61559 (TN3238)
(d) NOAA 2013-TN4099

Mangrove Rivulus (*Rivulus marmoratus*)

The Mangrove Rivulus is a small fish that occurs in marine and brackish-water habitats and is able to tolerate a wide salinity range from 0 to 68 ppt (FMNH 2010-TN165). Its diet includes terrestrial and aquatic invertebrates, including mosquito larvae, polychaete worms, and copepods (NOAA 2009-TN176). Along the east coast of Florida, it occurs in marsh habitats above the intertidal zone and is often found in the burrows of great land crabs. This species was once listed as threatened in the Gulf of Mexico but has been downlisted in Florida as a Species of Special Concern (FFWCC 2011-TN158). Habitat degradation and fragmentation related to the destruction of mangroves are considered the greatest threats to this species (NOAA 2009-TN176). This species has not been reported on Turkey Point site but is known to occur in the vicinity where suitable habitat is available (FPL 2014-TN4058).

Dusky Shark (*Carcharhinus obscurus*)

The dusky shark is included as a Species of Concern by NMFS (FPL 2010-TN272). This cosmopolitan species occurs in tropical and temperate waters from Nova Scotia to Cuba. Its range includes shallow inshore waters, but adults tend to avoid areas of low salinity and are rarely found in estuaries. Young sharks are found in shallow-water nursery areas from New Jersey to Cape Hatteras (FMNH 2010-TN166). This species has also been documented in the waters within Biscayne National Park (NPS 2011-TN184). Globally, dusky shark populations are considered to be at-risk, and the World Conservation Union (IUCN) considers the species “near threatened.” An ongoing decline in numbers indicated by low catch rates in the western North Atlantic has prompted a ban on the harvesting of dusky sharks by U.S. commercial fishermen and has led to this regional population being placed on the 2000 IUCN's Redlist of threatened species (FMNH 2010-TN166).

Opossum Pipefish (*Microphis brachyurus lineatus*)

The opossum pipefish is designated by NMFS as a Federal Species of Concern (FPL 2010-TN272). There is evidence of three western Atlantic metapopulations, and the North Atlantic and Caribbean metapopulations are present in waters of the United States. Little is known about population size or variations because this species is difficult to survey (NOAA 2009-TN188). Opossum pipefish has been reported from the waters within Biscayne National Park (NPS 2011-TN184).

Sand Tiger Shark (*Carcharius taurus*)

The sand tiger shark is commonly found in all warm and temperate seas except the eastern Pacific Ocean. Preferred habitats include surf zones, shallow bays (including Biscayne Bay), and around coral or rocky reefs. Increased exploitation of this species along the U.S. East Coast in the 1980s and 1990s reportedly reduced abundance by up to 90 percent from historical populations. (NOAA 2010-TN190). This species has not been reported from the water of Biscayne National Park. A status update by the Southeast Science Center of NMFS in February 2009 concluded that while the population decline was not as severe as previously reported, the sand tiger shark should be retained as a Species of Concern due to low productivity and uncertainty with regard to abundance trends (NOAA 2010-TN190).

Speckled Hind (*Epinepheuls drummondhayi*)

The speckled hind derives its name from the tiny white spots covering its body. Adults are found in offshore rocky habitats in waters up to 1,300 ft deep; juveniles can occur in shallow water (NOAA 2009-TN189). Speckled hind is known to occur in the waters of Biscayne National Park (NPS 2011-TN184), and its distribution is believed to be from the Carolinas to Texas (NOAA 2009-TN189). Direct threats to this species are as bycatch from the deep-water snapper/grouper fisheries off the Atlantic and Gulf coasts, and both recreational and commercial fisheries are regulated in the South Atlantic. Speckled hind are considered a Species of Concern by NMFS, and a review of its status is currently underway (NOAA 2009-TN189).

Nassau Grouper (*Epinephelus striatus*)

The Nassau Grouper is designated as a Federal species proposed for listing under ESA (77 FR 61559) (TN3238). This species is considered a top-level predator, occurs in water depths of up to 330 ft and is known to occur in Biscayne Bay. Adults are often found in coral reef or rocky bottom habitats (NOAA 2009-TN191). Fishing pressure in the twentieth century led to the commercial extinction of the species in the U.S. Caribbean by the mid-1980s; Florida populations declined from the 1950s to very low levels in the early 1990s (Sadovy and Eklund 1999-TN200). Currently, Nassau Grouper are considered overfished in Florida, and fishing for this species is prohibited within U.S. waters (NOAA 2009-TN191). This species is a solitary, diurnal predator that is found from inshore water to depths of about 100 m in waters of the South Atlantic Ocean and Caribbean Sea and is known to occur in Biscayne Bay. Nassau Grouper reach maturity at about five years of age, and may live several decades, reaching a maximum size of about 39 in (100 cm) (Sadovy and Eklund 1999-TN200). Prey items include a wide variety of fish and invertebrates. This species is primarily gonochoristic (exhibiting

separate sexes), and is known to congregate in very large numbers at specific nearshore locations to spawn. Although Nassau Grouper were not reported in the environmental studies sponsored by FPL to support the proposed Units 6 and 7 project, this species has been reported in Biscayne Bay and likely occurs near the Turkey Point site. A complete description of this species, including documented occurrences in Biscayne Bay near the Turkey Point site, is found in the NMFS Biological Assessment in Appendix F

Warsaw Grouper (*Epinephelus nigritus*)

The Warsaw Grouper is NOAA Species of Concern that occurs from North Carolina to the Gulf of Mexico. This large sea bass is generally found near rough, irregular sea bottoms and steep cliffs at water depths ranging from 180 to 1,700 ft. Juveniles are occasionally found in shallower waters. The reproductive habits of this species are not well understood, but it is assumed that eggs and larvae are pelagic. Warsaw Grouper are believed to reach sexual maturity between 4 and 9 years of age, may live over 40 years, and reach a maximum size of approximately 7.7 ft and 440 pounds. Prey items include fish and crustaceans (75 FR 59690) (TN4100).

Ivory Tree Coral (*Oculina varicosa*)

The ivory tree coral is a NOAA Species of Concern that occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas in water depths ranging from 2 to 152 m. Colonies are generally found on limestone rubble and outcroppings, and soft-bottom sloping habitats. This species is believed to be tolerant of a wide range of temperature and light intensity. The major threats to this species include damage from mechanical fishing gear, including dredges, trawls, and anchors, and climactic changes that create temperature extremes that lead to bleaching and susceptibility to disease (Aronson et al. 2014-TN4101).

Species with Designated Essential Fish Habitat

The Sustainable Fisheries Act of 1996 (16 USC 1801 et seq.) (TN1060) amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act (16 USC 1801 et seq.) (TN1061) to create a program to protect essential fish habitat (EFH) and to identify habitat areas of particular concern (HAPCs). The South Atlantic Fisheries Management Council (SAFMC) and NMFS are responsible for designating EFH for each life stage of Federally managed marine fish and shellfish species. Based on information provided in the *Federal Register* and interagency meetings involving the NRC and Federal and State resource agencies, NMFS identified EFH and HAPCs that could be affected by the construction and operation of proposed Turkey Points Units 6 and 7 in a letter to the NRC (NOAA 2010-TN835). Table 2-31 provides a summary of species included in the EFH Assessment (in Appendix F), the applicable fishery management plan, and EFH habitat designations. A brief discussion of EFH and HAPCs follows.

Table 2-31. Designated Essential Fish Habitat Likely to Occur near the Turkey Point Site

Common Name	Scientific Name	Applicable Fishery Management Plan	Essential Fish Habitat Designation[(a)]	
			Mangrove	Seagrass and Unconsolidated Bottom
Gray Snapper	*Lutjanus griseus*	Snapper-Grouper	X	X
Dog Snapper	*L. jocu*	Snapper-Grouper	X	
Mutton Snapper	*L. analis*	Snapper-Grouper		X
Bluestriped Grunt	*Haemulon sciurus*	Snapper-Grouper	X	
White Grunt	*H. plumieri*	Snapper-Grouper		X
Spiny lobster	*Panulirus argus*	Spiny Lobster	X	X
Pink shrimp	*Farfantepenaeus duorarum*	Shrimp Fishery	X	X

(a) Biscayne Bay and Biscayne National Park are also EFH-HAPC for coral, coral reefs, and hard-bottom communities.

Source: NOAA 2010-TN835

Snapper-Grouper Fishery Management Plan

The Snapper-Grouper Fishery Management Plan includes 17 species (SAFMC 1998-TN212). Based on the information described above, five species belonging to this group have designated EFH near the Turkey Point site. Mangrove habitat is identified as EFH for Gray Snapper; seagrass and unconsolidated bottom are identified as EFH for both adult and juvenile Gray Snapper, juvenile Mutton Snapper, and adult White Grunt (NOAA 2010-TN835). EFH for the snapper-grouper group includes coral reef systems, hard-bottom substrates, submerged aquatic vegetation, and artificial reefs and outcroppings from shore to at least 600 ft (2,000 ft for Wreckfish [*Polyprion americanus*]), where annual water temperature is sufficient to maintain adults. EFH also includes spawning areas in the water column above adult habitat and additional pelagic environments. With regard to specific life stages of this group, EFH includes areas inshore of the 100 ft contour and includes macroalgae, seagrass beds, salt and brackish marshes, tidal creeks, mangrove fringes, oyster reefs, shell banks, and soft- or hard-bottom substrates. HAPCs for the snapper-grouper species complex include medium- to high-profile hard-bottom areas and all designated nursery areas (SAFMC 1998-TN212).

Spiny Lobster

As described by NOAA (2010-TN835), both mangrove and seagrass/unconsolidated bottom habitats are EFH for the spiny lobster. EFH for spiny lobster includes nearshore shelf and oceanic waters, shallow subtidal bottom, seagrass habitat, soft sediment, and coral, hard-bottom, sponge, algal and mangrove communities (SAFMC 1998-TN212). Juvenile and adult spiny lobster may be present near the Turkey Point site (EAI 2009-TN154).

Pink Shrimp

The SAFMC's Shrimp Fishery Management Plan includes five species: brown shrimp (*Farfantepenaeus aztecus*), pink shrimp, rock shrimp (*Sicyonia brevirostris*), royal red shrimp

(*Pleoticus robustus*), and white shrimp. Of these, the pink shrimp is considered the most common to Biscayne Bay, is expected to occur near the Turkey Point site, and was specifically identified by NMFS as a species with designated EFH near the Turkey Point site (Nelson et al. 1991-TN174; EAI 2009-TN154; NOAA 2010-TN835). Juvenile and adult shrimp are omnivorous bottom feeders; they eat polychaetes, amphipods, nematodes, other small crustaceans, and organic debris or detritus. This species is most commonly found on hard sand and shell bottom habitats. Rates of growth for all penaeid shrimp are highly variable and influenced by water salinity and temperature; low temperatures and high salinity inhibit growth (SAFMC 1998-TN212). EFH for penaeid shrimp includes inshore estuarine nursery areas, offshore marine habitats, and all interconnecting water bodies. Inshore nursery areas include tidal freshwater, estuarine and marine wetland systems, nearshore mangrove and seagrass habitats, and intertidal and subtidal non-vegetated flats.

Habitat Areas of Particular Concern (HAPC)

HAPCs identified by NOAA (2010-TN835) near the Turkey Point site included mangrove and seagrass habitats described above for the snapper-grouper complex, and Biscayne Bay for spiny lobster. Biscayne Bay and Biscayne National Park are also EFH-HAPC for coral, coral reefs, and hard-bottom communities.

2.4.2.4 Aquatic Monitoring

This section describes the analysis and evaluation of the proposed aquatic monitoring program. Unless otherwise noted, the summary below was developed from information provided by FPL (2014-TN4058) which also includes information about study design and results. Information is also provided in FPL 2009-TN201; EAI 2009-TN97; EAI 2009-TN153; and EAI 2009-TN154.

Pre-Application Monitoring

Surveys of onsite surface-water habitats that could be affected by the construction and operation of proposed Units 6 and 7 were conducted in August and November 2007. Survey areas included hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and open water areas within the Turkey Point site. Other than the American crocodile, no Federally or State-listed aquatic or semi-aquatic species were observed within the area proposed for the construction of Units 6 and 7. Florida manatee and Smalltooth Sawfish may occur, however, in nearshore areas of Biscayne Bay adjacent to the Turkey Point site, including the proposed location for the radial collector well system and the equipment barge-unloading facility. During the summer of 2009, fish surveys occurred in areas of the site that would be affected by construction, including two remnant canals, the dead-end canal area where construction laydown would occur, pools within the mangrove areas where buildings and parking areas were planned, a portion of the return canal, shallow flats in the east-central part of the nuclear island, and two locations along the cooling canals within the IWF (FPL 2009-TN201).

Because modifications to the existing equipment barge-unloading area were expected to be needed to support construction of the proposed Units 6 and 7, a survey of seagrass presence in that area was conducted during the summer of 2008 (EAI 2009-TN153). Manatees have also

been observed in this area, necessitating a manatee protection plan, as previously described. In addition to the seagrass survey, a 1-year baseline aquatic characterization study was completed in March 2009 to characterize aquatic biota in Card Sound and the Card Sound Canal and included studies of benthic invertebrates (EAI 2009-TN97) and fish and shellfish (EAI 2009-TN154).

Building, Preoperational, and Operational Monitoring

As described in its ER, FPL (2014-TN4058) does not consider preoperational and operational monitoring to be necessary. Federally listed species occur in the vicinity of the Turkey Point site, and building activities may cause some species to temporarily leave the area. Barge and tug traffic may, but is unlikely to, result in fatal or non-fatal collisions with some species. FPL also states that aquatic species in the regional canals along the roads and corridors for transmission and reclaimed and potable water are common to South Florida. Cooling water for Units 6 and 7 will primarily be reclaimed water supplied by the MDWASD. A backup source of cooling water will be from subsurface radial wells located on the Turkey Point peninsular. Because Units 6 and 7 will not have a conventional intake to withdraw surface water FPL has determined that additional preoperational or operational monitoring is not required because no aquatic species would be exposed to impingement or entrainment during the procurement of cooling-water. Because the cooling water would be discharged into UIC (or deep-injection) wells, FPL has also determined that additional preoperational or operational monitoring is not required because no aquatic species would be exposed to cooling-water discharge from the proposed Units 6 and 7. The review team notes that this statement is unsubstantiated because no published biological studies on the deep-aquifer communities in this area are available.

Building activities would be conducted under stormwater permits requiring the use of best management practices. Additional monitoring may be warranted if required by Federal or State resources areas with appropriate jurisdiction. The review team's assessment of aquatic impacts related to the building and operation of the proposed units is provided in Chapters 4 and 5, respectively.

Existing Monitoring Programs or Procedures

As part of the SCA submission, FPL provided information about a variety of monitoring programs related to the Turkey Point site in the SCA (FPL 2010-TN272). Programs pertinent to aquatic resources are described below, including the terms and conditions regarding crocodile monitoring and protection related to the operation of Units 3 and 4, as described in FWS 2006-TN832.

Barge Delivery Plan

The Turkey Point Barge Delivery Plan (FPL 2010-TN272) describes the minimum requirements and procedures that would be used during the delivery of major equipment and components needed for the building of proposed Units 6 and 7. The plan supplements an existing operations manual developed for fuel-oil transfer at the existing barge-unloading facilities at the northern end of the Turkey Point site adjacent to Biscayne Bay. Included in the Barge Delivery Plan is a section that describes approved procedures associated with in-water work within the

barge-turning basin and entrance channel to protect manatees. The plan requires dedicated observers on all vessels used during in-water work, the maintenance of a logbook detailing sightings, collisions, or injuries to manatees; and the prohibition on movement of work barges, other associated vessels, or any in-water work after sunset or before sunrise, when the potential for spotting manatees is negligible. As described in FPL 2013 (TN2630), Turkey Point Unit 2 was converted to synchronous condenser mode in January 2013, and Unit 1 is scheduled for conversion in October 2016. Conversion of these fossil-fuel units is expected to greatly reduce or eliminate the need for fuel-oil deliveries.

Threatened and Endangered Species Evaluation and Management Plan

The FPL Turkey Point Units 6 and 7 Threatened and Endangered Species Evaluation and Management Plan (FPL 2010-TN170) provides a description of the proposed project, the expected extent of impacts on aquatic, wetland, and terrestrial communities within site boundaries. The Threatened and Endangered Species Evaluation and Management Plan also describes the American crocodile management program, including the current status of the species, likely effects of the proposed action, proposed mitigation activities, and assessment of potential cumulative effects. Specific activities described in the plan include the following:

- crocodile habitat preservation and creation
- use of exclusion zones at known nest sites
- daytime and nighttime monitoring surveys to document nests in the cooling canals and IWF
- hatchling capture and tagging using microchip technologies
- relocation of hatchlings to low-salinity habitats to improve survival
- recapture, monitoring, and release of individuals to assess growth and survival.

As described in the plan, crocodile monitoring occurs throughout the year, and specific activities are based on known seasons for mating, egg incubation, and hatching. The plan also describes strategies for reducing the risk of vehicle/crocodile collisions during routine maintenance activities onsite and during construction events. Section 7 of the plan describes specific actions that would be taken during preconstruction, construction, and post-construction to ensure minimal disturbance of this species.

Sea Turtle and Smalltooth Sawfish Construction Conditions

In addition to the above plans, NMFS (2006-TN3077) has established procedures to protect sea turtles and Smalltooth Sawfish during nearshore construction activities. Activities to protect these species include training construction personnel in ESA requirements, ensuring siltation barriers do not entangle species, “no-wake” operation of vessels, and potential cessation of construction activities if species are sighted within 50 ft of moving equipment.

American Crocodile Monitoring and Protection Related to Operation of Unit 3 and 4

As described in FWS 2006-TN832 the terms and conditions regarding American crocodile monitoring and protection are as follows:

- The installation of four warning signs labeled as “Slow Crocodile Crossing” along Bechtel Road near the test canals on the Turkey Point site.

- Distribution of an informational bulletin on the American crocodile to all employees at the Turkey Point site every six months that includes photographs of a crocodile, information on hatchlings, and reminders to use caution when driving or conduction actives on the site.
- Inclusion of a presentation on American crocodiles twice a year at monthly safety meetings attended by all plant personnel. The presentations are to be made during the crocodile mating season when the activity of crocodiles at the site is greatest.

FWS notification if a dead or injured crocodile is found.

2.5 Socioeconomics

This section describes the socioeconomic baseline of the proposed site. It describes the characteristics of the 50 mi region surrounding the Turkey Point site, including population demographics, density, and use to form the basis for assessing the potential social and economic impacts from building and operating the proposed two new nuclear units. There are four counties within the 50 mi region surrounding the Turkey Point site: Miami-Dade, Broward, Monroe, and Collier Counties.

The analytical area is a 50 mi radius circle centered midway between the two new proposed units and includes all of Miami-Dade County and portions of Broward, Collier, and Monroe Counties. Table 2-32 provides population information for each county and Figure 2-33 shows the 50 mi analytical area.

Table 2-32. Population of Counties Within 50 Miles of the Proposed Site

County	Resident Population (2000)[(a)]	Resident Population (2010)[(b)]	Resident Population (2012)[(c)]
Miami-Dade County	2,253,362	2,496,435	2,512,219
Broward County	1,623,018	1,748,066	1,761,993
Collier County	251,377	321,520	323,548
Monroe County	79,589	73,090	73,475

(a) USCB 2000-TN470.
(b) USCB 2010-TN4087.
(c) USCB 2012-TN4098.

The main data sources used in this section to describe the current population in the 50 mi region are the United States Census Bureau (USCB) 2008–2012 American Community Survey (ACS) 5-Year Estimates. These were the latest data for which poverty estimates were available at the block group level. Poverty data at the block group level are important for the environmental justice analysis (see Section 2.6). For consistency, the 2008–2012 ACS 5-Year Estimates are used to describe current population throughout the document, referred to as USCB 2012-TN4098. Population data in the 50 mi region were estimated by overlaying the 2012 census block data on the 50 mi area shown in Figure 2-33, using ArcMap 10 geographic information system (GIS) software (ESRI 2012-TN1469). In addition, the review team analyzed the economic, employment, and population trends for the region using additional U.S. Census data sets and population projections from the Office of Economic and Demographic Research of the Florida Legislature and from the Bureau of Economic and Business Research of the University of Florida.

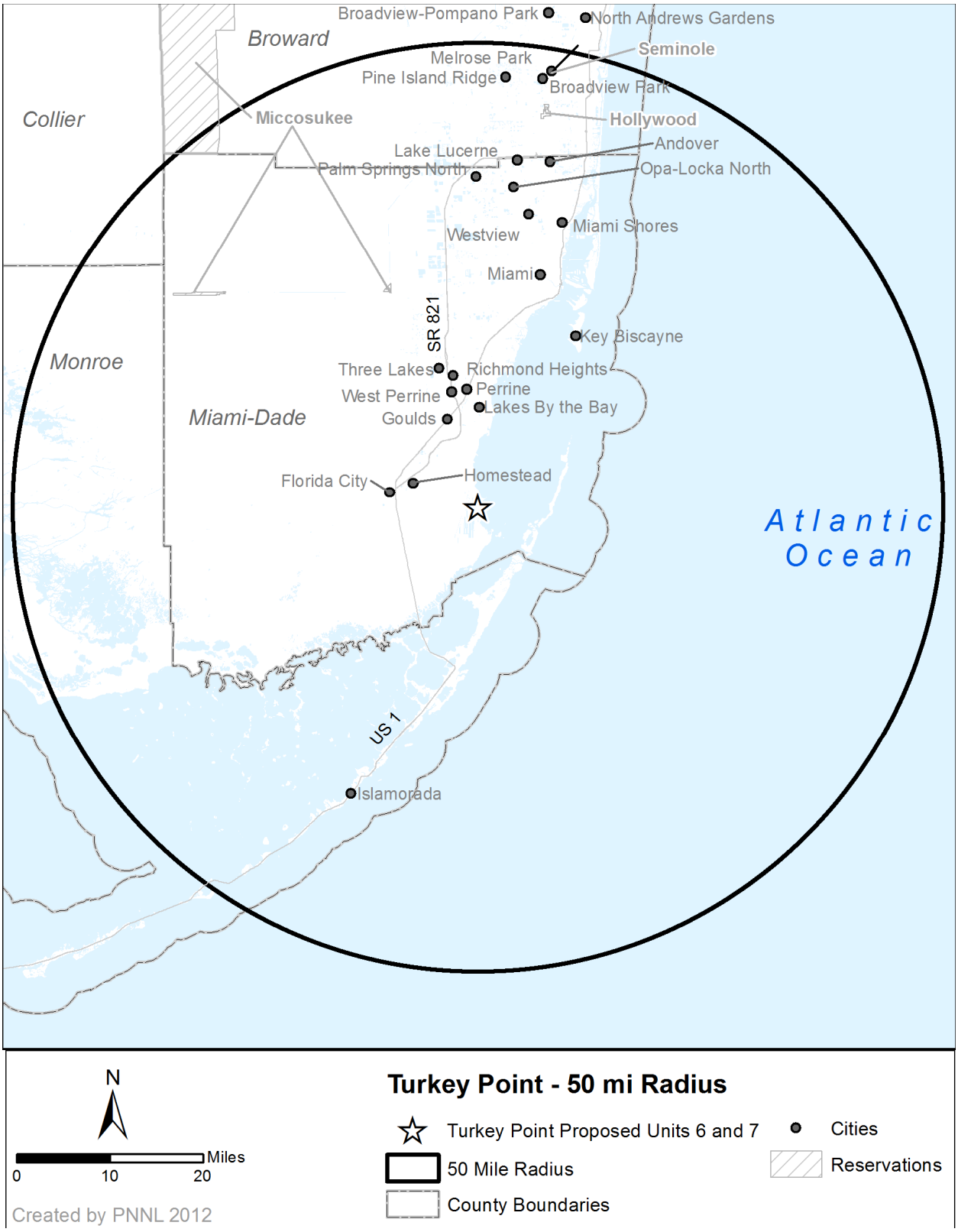


Figure 2-33. Map of South Florida, Showing Counties Potentially Affected by Proposed Units 6 and 7 (Source: ESRI 2012-TN1469)

This section discusses all four counties in the 50 mi region but emphasizes the socioeconomic characteristics of Miami-Dade County, the economic impact area, where the proposed site is located and in which the majority of the demographic and socioeconomic impacts would occur (NRC 2000-TN614). The review team expects the workforce to be principally drawn from Miami-Dade County for two reasons. First, county-to-county worker flow data from the U.S. Census Bureau Longitudinal Employer-Household Dynamics program (USCB 2011-TN4078) show that 79.0 percent of the workers of Miami-Dade County resided in Miami-Dade County, another 12.0 percent resided in Broward County, and only 0.4 percent or in each of Collier and Monroe Counties (Table 2-33). Because the proposed site is located approximately 40 mi south of the Broward County border, the commute time from Broward County to the proposed site would be longer than the average commute time of workers residing in Broward County (Table 2-33). Second, more than 83 percent of Turkey Point plant's current workforce resides in Miami-Dade County. Another 11.3 percent of the current workforce resides in the three other counties that surround Miami-Dade County and that intersect with the 50 mi region: Broward, Monroe, and Collier. The remaining current workforce resides in counties beyond the 50 mi region surrounding the Turkey Point site (Table 2-33).

Table 2-33. Commuting Characteristics of Workers in the 50-Mile Region

County	Average Commute Time of Workers Residing in County[(a)]	Percent of Working Residents, by County of Residence, that Commute to Miami-Dade County[(b)]	Percent of Miami-Dade Workers by County of Residence[(b)]
Miami-Dade	29 minutes	79.0%	74.5%
Broward	27 minutes	12.0%	14.7%
Monroe	19 minutes	0.4%	0.6%
Collier	23 minutes	0.4%	0.4%

(a) USCB 2012-TN4088
(b) USCB 2011-TN4078

Most of the data and analysis in this section are concerned with Miami-Dade County. In addition, particular attention is given to the Homestead and Florida City area, the nearest small communities where, based on Table 2-34, a considerable share of the building and operations workforce is expected to reside.

Table 2-34. Distribution of Turkey Point Plant Employees

County	City	Total Number of Current Turkey Point Plant Employees in Residence	Percent of Total Number of Employees
Miami-Dade		814	83.3%
	Homestead	*391*	*40.0%*
	Miami	*380*	*38.9%*
	Florida City	*27*	*2.8%*
	Other	*16*	*1.6%*
Broward		63	6.4%
Monroe		47	4.8%
Collier		1	0.1%
Other		52	5.3%
Total		977	100%

Source: FPL 2014-TN4058

The scope of the review of community characteristics is guided by the magnitude and nature of the expected impacts of building, maintaining, and operating the proposed plants and by those site-specific community characteristics that can be expected to be affected by these impacts.

2.5.1 Demographics

Miami-Dade County is the most populous of the three counties—Miami-Dade, Broward, and Palm Beach—that constitute the Miami-Fort Lauderdale-Pompano Beach Metropolitan Statistical Area (MSA), the seventh most populous MSA in the United States. It is also the most populous county in the State of Florida (USCB 2011-TN472). However, north of the plant along the coast is highly urbanized, while the rest of Miami-Dade County is more agricultural or parkland. Population density is greater in the proximity of the City of Miami, in the northeast portion of the county, and along US-1 and the Florida Turnpike, than in the rest of the county, including the areas to the west and south of Homestead and Florida City.

For historical perspective, Miami-Dade County has grown at a lower rate than the State of Florida as a whole in the last few decades. Although its population roughly doubled between 1970 and 2010, population growth rates have been declining (Table 2-35). In 1992, Hurricane Andrew hit Miami-Dade County and the greatest damage occurred in the Homestead and Florida City area. An estimated 350,000 residents were driven from their homes, most from South Dade (Homestead and Florida City area). An estimated 40,000 did not return to Miami-Dade County (Smith and McCarthy 1996-TN467). An important employer in South Dade, the Homestead Air Force Base, was destroyed by the hurricane and not rebuilt. The location today supports a smaller Air Reserve Base. For the purposes of this analysis, the review team divided the total population within the analytical area into three major groups: residents who live permanently in the area; transient people who may temporarily live in the area but have a permanent residence elsewhere; and migrant workers who travel into the area to work and then leave after their job is done. Transients and migrant workers are not fully characterized by the U.S. Census, which generally captures only resident populations.

Table 2-35. Population Growth in Miami-Dade and Florida, 1970−2030

	Miami-Dade		Florida	
Year	Population	Annual Growth Rate in Decade Prior to Indicated Year	Population	Annual Growth Rate in Decade Prior to Indicated Year
1970	1,267,792	NA	6,789,447	NA
1980	1,625,509	2.5%	9,746,961	3.7%
1990	1,937,194	1.8%	12,938,071	2.9%
2000	2,253,779	1.5%	15,982,824	2.1%
2010	2,496,435	1.0%	18,801,310	1.6%
2020	2,788,100	1.1%	21,149,700	1.2%
2030	3,056,700	0.9%	23,609,000	1.1%

Source: BEBR 2004-TN438 (for years 1970-2000), USCB 2010-TN4087 (for year 2010) and BEBR 2014-TN4077 (for years 2020-2030)

2.5.1.1 Resident Population

The 2012 estimate for the resident population within 50 mi of the center of the proposed Turkey Point site is 3,466,602 (USCB 2012-TN4098).(2) The nearest population concentrations are the cities of Florida City, 8 mi west of the site with a population estimate of 11,313, and Homestead, 9 mi northwest of the site with a population estimate of 59,866 (USCB 2012-TN4098). Both communities are on the southern end of the Miami urbanized area that extends from Florida City and Homestead north and northeast to Miami, Fort Lauderdale, and Pompano Beach and crosses Miami-Dade, Broward, and Palm Beach Counties. To the south and southwest of the site lie the Florida Keys in Monroe County. Because the proposed site is located on the coast, much of the 50 mi radius around the site is on the sea and unpopulated. Everglades National Park is another unpopulated area and occupies much of the land between 20 and 50 mi west of the site.

The population for Miami-Dade County projected to 2030 is shown in Table 2-35 with projections for the State of Florida provided for comparison. The sources of projections are the Florida Legislature's Office of Economic and Demographic Research (EDR) and the University of Florida's Bureau of Economic and Business Research (BEBR).(3) BEBR projections are based on U.S. Census data from 2000 and 2010, as well as data from the Florida Department of Health's Office of Vital Statistics.(4) In most Florida counties, migration has typically been the major determinant of population growth (EDR 2011-TN454). The projections in Table 2-35 show that the EDR and BEBR expect the population growth in Miami-Dade County to slow, mainly due to a slowdown in migration.

Table 2-36 shows resident population estimates in the 50 mi radius projected to 2030, by county. Estimates for the 2012 resident population are the 2008–2012 ACS 5-Year Estimates, calculated for the 50 mi radius using GIS to capture the data from the relevant census block groups. To estimate the population in the 50 mi radius in 2015, 2020, 2025, and 2030, the review team compared data from the 2008–2012 ACS survey with data from projections for all four counties included in the 50 mi radius. The review team then calculated the growth rate of the resident population for each county between 2012 and 2015, 2020, 2025, and 2030. These growth rates were applied, by county, to the population in the 50 mi radius.

Table 2-36. Resident Population in the 50-Mile Radius, Projected to 2030, by County

Year	Total 50 mi Radius	Miami-Dade	Broward	Collier	Monroe
2012	3,466,602	2,512,219	931,797	1,025	21,561
2015	3,558,523	2,589,844	946,153	1,078	21,447
2020	3,736,407	2,740,009	973,914	1,184	21,300
2025	3,902,440	2,881,819	998,210	1,285	21,125
2030	4,048,422	3,003,975	1,022,087	1,381	20,979

Source: USCB 2012-TN4098; projections based on BEBR 2014-TN4077

(2) Estimate obtained using ArcMap 10 and based on census block group data. Block groups were included if they were totally or partially within the 50 mi radius.
(3) County projections are done by BEBR under contract to EDR and are made to be consistent with EDR State projections.
(4) For a detailed methodology, see BEBR 2011-TN437.

2.5.1.2 Transient Population

Regulatory Guide 4.7 (NRC 1998-TN1008), Section C.4, defines transient populations as people (other than those just passing through the area) who work, reside part-time, or engage in recreational activities in a given area, but are not permanent residents of the area. Under this definition, transients include people in

- workplaces
- places where people reside part-time, such as hotels and motels and seasonal housing
- recreational areas or at special events.

Transient population estimates within 20 mi of the proposed site were obtained based on (1) commuter data from the U.S. Census Bureau Longitudinal Employer-Household Dynamics program (USCB 2011-TN4078) to estimate the number of employees commuting from outside municipalities in the 20 mi radius; and (2) FPL provided estimates for other transient population based on internet searches, overhead imagery (for counting of parking spaces), and direct phone calls to major recreational facilities and marinas and to lodging facilities, including hotels, motels, and seasonal housing.

The review team estimated the number of commuters from outside municipalities in the 20 mi radius using data from the U.S. Census Bureau Longitudinal Employer-Household Dynamics program (USCB 2011-TN4078). For municipalities partially located within the 20 mi radius commuters were assumed to reside in or outside the 20 mi radius depending on whether the majority of the land area of the municipality was inside or outside the 20 mi radius. The review team reached an estimate of 143,763 transient workers in the 20 mi radius.

For other transient population, FPL's research included the Biscayne National Park, Black Point Park, Black Point Marina, Camp Owaissa Bauer, Coral Castle Museum, Harris Field, Kevs Gate Golf Club, Larry & Penny Thompson Memorial Park, Prime Outlets of Florida City, Southland Mall, Homestead Bayfront Marina/Herbert Hoover Marina and Park, and a list of lodging facilities. From phone call interviews, FPL gathered information about the extent to which visitors were local residents or from out of the affected area (transients). When no information about the number of visitors was available, FPL obtained estimates by counting parking spaces with overhead imagery and assuming two or three occupants per vehicle, depending on the facility. FPL reached an estimate for other transient population of 19,055 (FPL 2014-TN4058). The review team received a detailed explanation of the procedures adopted and found them to be reasonable. The estimate did not, however, include large racing events. The review team met with the City of Homestead representatives who indicated that racing events occur several times a year at the Homestead-Miami Speedway. Large racing events (e.g., NASCAR) could add 65,000 to the other transient population, for a total of approximately 85,000 people.

Adding the number of transient employees (143,763) and the number of other transient population (19,055), the total transient population within 20 mi of the proposed site is estimated to be 162,818, with the exception of those days when large events are being held at the Homestead-Miami Speedway (65,000), when the estimate surpasses 220,000.

2.5.1.3 Migrant Labor

The U.S. Census Bureau defines a migrant laborer as someone who is working seasonally or temporarily and moves one or more times from one place to another to perform seasonal or temporary work. Migrant laborers are often agricultural or construction workers.

The 2012 Census of Agriculture provides some information regarding the migrant farm labor population within Miami-Dade County. Of the 9,045 hired farm workers in Miami-Dade County, 1,296 (14.3 percent) were migrant workers. In addition, farms in Miami-Dade County reported 228 migrant contract workers for a total of 1,524 migrant workers in Miami-Dade County (USDA 2012-TN4081).

Turkey Point Units 3 and 4 are currently in operation and function on an 18-month refueling cycle. During each refueling event, between 600 and 1,000 temporary workers are employed during a period of 25 to 35 days (FPL 2014-TN4058). A portion of these are migrant workers who come from outside the economic impact area.

2.5.2 Community Characteristics

Miami-Dade County's economy has been transitioning from mixed service and industrial in the 1970s to one dominated by services, primarily due to the expansion in international trade, the tourism industry, and health services. The Miami-Dade County government projects wholesale trade and retail trade will become stronger economic forces in the local economy. This reflects the county's position as a wholesale center in Southeast Florida, which serves a large international market. The tourism industry remains one of the largest sectors in the local economy (Miami-Dade County 2012-TN462).

The remainder of this section addresses community characteristics including the regional economy, transportation networks and infrastructure, taxes, aesthetics and recreation, housing, community infrastructure and public services, and education.

2.5.2.1 Economy

In 2012, Miami-Dade County's total personal income ranked first in the State of Florida and accounted for 12.7 percent of the State's total personal income reported. The county's per capita personal income was 95 percent of the State average (BEA 2014-TN4075). Miami-Dade County includes highly urbanized and suburban areas surrounding the City of Miami along the Atlantic coast; rural agricultural areas further south; and portions of the Everglades, including Everglades National Park, in the western half of the county. Near Turkey Point, the non-wetland area centered around the Homestead and Florida City area is primarily agricultural. The region's subtropical climate allows the winter production of green beans, tomatoes, strawberries, and squash for distribution throughout the United States, as well as year-round production of tropical fruits and vegetables such as avocados, passion fruit, malanga, and boniato. Another sector of the agricultural industry is Asian specialties such as Thai guava, Thai basil, Thai eggplant, lemon grass, bitter melon, and various herbs and spices (FPL 2014-TN4058).

Miami-Dade County's economy is largely based on services. Major sectors of current employment include healthcare and social assistance, retail trade, administrative and waste

services, accommodation and food service, professional, scientific, and technical services, local government, and real estate, rental and leasing (BEA 2012-TN4074). Table 2-37 shows employment by industry in Miami-Dade County from the Bureau of Economic Analysis (BEA). Workers are most often employed in service sectors such as retail trade, healthcare and social assistance, and in government. Employment in transportation and warehousing and in wholesale trade is affected by the importance of Miami as an international trade center. There were 57,345 full-time and part-time jobs in construction in Miami-Dade County in 2012.

The U.S. Department of Labor Bureau of Labor Statistics (BLS) disaggregates construction workers by occupation type in the Miami-Miami Beach-Kendall Metropolitan Area (Table 2-38). The most common construction occupations in 2013 in this area were construction laborers; carpenters; supervisors; electricians; equipment operators and operating engineers; plumbers, pipefitters and steamfitters; and painters. The top four employers in Miami-Dade County are governmental entities: Miami-Dade County Public School District, Miami-Dade County, Federal government, and Florida State government. The largest private employers are Baptist Health South Florida, the University of Miami, American Airlines and Publix Super markets (Beacon Council 2013-TN4076). Table 2-39 lists the largest employers in the county.

The Turkey Point site currently employs approximately 977 employees supporting the operations of the existing Units 1 through 5. In addition, Units 3 and 4 are on 18-month refueling cycles and, during each refueling event, employ an additional 600 to 1,000 outage workers for a period of 25 to 35 days (FPL 2014-TN4058).

Table 2-40 shows the number of workers employed and the unemployment rates for Miami-Dade County and for the State of Florida in 2000, 2010, and 2013. These data show that both the labor force and the number of employed workers in Miami-Dade County grew more slowly than the labor force and number of employed workers in the state. As of 2013, the Miami-Dade unemployment rate was above the unemployment rate for Florida and above the national average: 8.4 percent for Miami-Dade County compared to 7.2 percent for Florida and 7.4 percent for the country as a whole (BLS 2013-TN4085; BLS 2014-TN3674).

2.5.2.2 Taxes

Several types of taxes would be affected by proposed Units 6 and 7. The following subsections describe major taxes, their structure, and annual dollar yield. Taxes included in this discussion include corporate income taxes, sales and use tax and other taxes on sales and services, and property taxes.

Personal and Corporate Income Taxes

The State of Florida does not levy a personal income tax on individuals. In fiscal year (FY) 2011 (July 1, 2010-June 30, 2011), the State of Florida received $1.87 billion (6.3 percent of its total tax revenue of $29.7 billion) from corporate income and excise taxes (FDOR 2011-TN460). The tax is based on 5.5 percent of the Federal taxable income with specific adjustments for the State of Florida and a $25,000 exemption (FDOR 2012-TN450).

Table 2-37. Employment by Industry, Miami-Dade County, 2012

	Miami-Dade		Florida
Industry	**Jobs**	**Percent of Total**	**Percent of Total**
Total	*1,515,304*	*100.00*	*100 (10,359,941 persons)*
Farm employment	7,444	0.49	0.82
Nonfarm employment	1,507,860	99.51	99.18
Private employment	*1,359,457*	*89.72*	87.90
Forestry, fishing, related activities, and other	2,702	0.18	0.64
Mining	898	0.06	0.19
Utilities	3,270	0.22	0.23
Construction	57,345	3.78	4.77
Manufacturing	41,279	2.72	3.37
Wholesale trade	83,241	5.49	3.49
Retail trade	155,494	10.26	11.11
Transportation and warehousing	87,923	5.80	3.13
Information	23,820	1.57	1.64
Finance and insurance	86,044	5.68	6.12
Real estate and rental and leasing	101,615	6.71	6.49
Professional, scientific, and technical services	104,017	6.86	6.69
Management of companies and enterprises	8,986	0.59	0.95
Administrative and waste services	118,994	7.85	7.85
Educational services	37,971	2.51	1.94
Health care and social assistance	169,064	11.16	11.18
Arts, entertainment, and recreation	28,177	1.86	2.99
Accommodation and food services	117,377	7.75	8.32
Other services, except public administration	131,240	8.66	6.80
Government and government enterprises	148,403	9.79	11.28
Federal, civilian	19,921	1.31	1.28
Military	7,300	0.48	0.94
State and local	121,182	8.00	9.05
State government	17,361	1.15	1.98
Local government	103,821	6.85	7.07

Source: BEA 2012-TN4074

Table 2-38. Construction and Extraction Occupation in the Miami-Miami Beach-Kendall Metropolitan Area, 2013

Occupation Title	Employment
Construction and Extraction Occupations	22,510
First-Line Supervisors/Managers of Construction Trades and Extraction Workers	2,780
Brickmasons and Blockmasons	90
Carpenters	3,190
Tile and Marble Setters	300
Cement Masons and Concrete Finishers	720
Construction Laborers	3,750
Paving, Surfacing, and Tamping Equipment Operators	170
Pile-Driver Operators	150
Operating Engineers and Other Construction Equipment Operators	1,240
Drywall and Ceiling Tile Installers	390
Electricians	2,380
Glaziers	340
Insulation, Workers, Floor, Ceiling, and Wall	NR
Painters, Construction and Maintenance	1,170
Pipelayers	380
Plumbers, Pipefitters, and Steamfitters	1,180
Plasterers and Stucco Masons	NR
Roofers	NR
Sheet Metal Workers	770
Structural Iron and Steel Workers	NR
Helpers—Carpenters	NR
Helpers—Electricians	630
Helpers—Pipelayers, Plumbers, Pipefitters, and Steamfitters	200
Helpers, Construction Trades, All Other	90
Construction and Building Inspectors	640
Elevator Installers and Repairers	NR
Hazardous Materials Removal Workers	40
Highway Maintenance Workers	180
Septic Tank Servicers and Sewer Pipe Cleaners	80
Construction and Related Workers, All Other	190
Earth Drillers, Except Oil and Gas	NR

NR = Not Released.

Source: BLS 2013-TN4086

Table 2-39. Major Employers in Miami-Dade County, by Number of Employees, 2013

Employer	Private/Public	Number
Miami-Dade County Public School District	Public	33,477
Miami-Dade County	Public	25,502
Federal Government	Public	19,600
Florida State Government	Public	18,300
Baptist Health South Florida	Private	13,376
University of Miami	Private	12,720
Jackson Health System	Public	8,208
American Airlines	Private	9,000
Publix Super Markets	Private	4,604
Florida International University	Public	3,534
Miami-Dade College	Public	2,356
City of Miami	Public	3,656
Carnival Cruise Lines	Private	3,500
Mount Sinai Medical Center	Private	3,000
Miami Children's Hospital	Private	2,800
Sedanos Supermarkets	Private	2,600
Miami V A Health Care System	Public	2,385
Royal Caribbean International/Celebrity Cruises	Private	2,051
Bank of America Merrill Lynch	Private	2,000

Source: Beacon Council 2013-TN4076

Table 2-40. Employment and Unemployment Statistics for Miami-Dade County and Florida, Annual Averages

Place	Year	Labor Force	Employment	Unemployment	Unemployment Rate
Miami-Dade	2000	1,103,485	1,046,900	56,585	5.1%
	2010	1,231,368	1,077,442	153,926	12.5%
	2013	1,287,348	1,179,118	108,230	8.4%
Annualized Growth Rate, 2000-2013		1.19%	0.92%		
Florida	2000	7,869,690	7,569,406	300,284	3.8%
	2010	9,182,506	8,121,770	1,060,736	11.6%
	2013	9,432,295	8,749,590	682,705	7.2%
Annualized Growth Rate, 2000-2013		1.40%	1.12%		

Source: BLS 2013-TN4085

Sales and Use Taxes

The State sales tax rate for Florida is 6 percent of the sale price of taxable goods and services. Non-taxable goods and services include groceries and services provided by Federal, State, County, and city governments and some nonprofit organizations. A 6 percent use tax is also applied to out-of-state purchases imported into the State, but a credit is given for sales taxes paid in another State. In FY 2011, the State of Florida received $19.35 billion (65.2 percent of its total tax revenue) from sales and use taxes (FDOR 2012-TN450). Counties may also impose a discretionary sales surtax on items or services delivered into the county, often only applied to the first $5,000 of sales. In Miami-Dade the surtax is 1 percent (FDOR 2012-TN456). In FY 2011-2012, Miami-Dade's adopted budget in FY 2011-2012 shows $282.7 million in sales and use taxes (Table 2-41).

Table 2-41. Miami-Dade County Adopted Budget Revenues by Major Sources, FY 2011−2012, $Thousands

Revenue Source	FY 2011-2012 General Fund	FY 2011-2012 Proprietary and Other Funds	Total
Property Taxes	957,913	285,089	**1,243,002**
Sales Taxes	120,458	162,245	**282,703**
Misc. State Revenues	83,480	-	**83,480**
Gas Taxes	62,120	-	**62,120**
Utility and Communications Taxes	113,365	-	**113,365**
Fees and Charges	5,892	2,774,738	**2,780,630**
Miscellaneous Revenues	11,677	70,679	**184,356**
State and Federal Grants	-	443,225	**443,225**
Interagency Transfers	-	347,645	**347,645**
Fund Balance/Carryover	110,241	484,371	**594,612**
Total	**$1,567,146**	**$4,567,992**	**$6,135,138**

Source: Miami-Dade County 2012-TN462, Appendix A

Other Taxes on Sales and Services

In FY 2011, the State of Florida received 7.7 percent of its total tax revenues from a Communications Services Tax and 3.9 percent from a Documentary Stamp Tax. The Communications Services Tax is imposed on all communications—cable and direct-to-home satellite services. The State tax rate is 9.17 percent (13.17 percent for direct-to-home satellite) and local taxing jurisdictions may add their own rates. In Miami-Dade County, the rates currently vary between 0.5 percent and 6.72 percent depending on place (FDOR 2012-TN457).

The Documentary Stamp Tax is applied to the value of Florida real property whenever a transfer is made or to written obligations to pay such as bonds and mortgages when documents are executed or delivered in Florida. The rate in Miami-Dade County rate is 60 cents per $100 (or portion thereof) on all documents, plus 45 cents per $100 surtax on documents transferring anything other than a single-family residence (FDOR 2010-TN458).

Property Taxes

Florida does not have a State-level property tax. Private property owners pay property taxes to the county and a local school district and may also pay taxes to special taxing units. Property values are set by the County property appraisers and some exemptions may apply. The tax rate (millage) is set by each taxing unit. County and school district governments may levy taxes up to 10 mills each (1 percent) (FDOR 2012-TN459). For FY 2011−2012, the overall millage rate for Miami-Dade County is 9.7405 mills (Miami-Dade County 2012-TN462).

Miami-Dade County budgeted property taxes for FY 2011−2012 were $1,243,002,000 (Table 2-41). These taxes fund four separate taxing jurisdictions: Countywide, the Unincorporated MSA, the Fire Rescue District, and the Library System. These latter two appear in Table 2-42 under the “proprietary and other funds column.”

Table 2-42 shows Florida's FY 2010–2011 tax revenues by major sources and Table 2-41 shows Miami-Dade County budgeted revenues for FY 2011–2012.

Table 2-42. Florida Tax Revenues by Major Sources, FY 2010–2011

Revenue Source	$ millions	Share of Total
Sales and Use Tax	19,353.0	65.2%
Communications Services Tax	2,307.1	7.7%
Corporate Income and Excise Tax	1,869.9	6.3%
Documentary Stamp Tax	1,176.8	3.9%
Other Sources	4,984.6	16.9%
Total Revenue Administered Taxes	**29,691.4**	**100%**

Source: FDOR 2011-TN460

Miami-Dade Public School District is a taxing entity separate from Miami-Dade County. The Florida Education Finance Program (FEFP) is the primary mechanism for funding the operating costs of Florida school districts. Funding comes from local, State, and Federal government sources. Local funding is from property taxes on properties located within the school district. State funding is by legislative appropriation and the major source of revenue is the State sales tax. Federal funding is coordinated by the Florida Department of Education. School districts receive funds from the Federal government directly and through the State as an administering agency. Under FEFP, funding is based on the number of full-time equivalent students, and considers variations in several factors when determining funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs due to the student population's density and distribution (FPL 2014-TN4058). As a result of legislative action in 2004, State funding for the Miami-Dade Public School District has declined as a share of total funding from 53.4 percent in 2000-2001 to 28.2 percent in 2009-2010. In the same period, the local portion has risen from 37.2 percent to 54.0 percent (FPL 2014-TN4058). Miami-Dade County Public School District 2011-12 budget included approximately $3,612 million in new revenues, of which $2,068 million (57.2 percent) were local revenues, $1,556 million of which from local property taxes (M-DCPS 2011-TN1494).

Under Florida law, both real property (land and permanent buildings) and tangible personal property (primarily business equipment) are subject to property tax. FPL pays real property taxes to Miami-Dade County and the Miami-Dade School District. In 2011, taxes were $6.7 million on the nuclear units and $9.2 million on the fossil-fuel units, for a total of $15.9 million. The County received 55 percent of this tax, while the school district received 45 percent of the tax revenue. FPL also paid personal property taxes for the existing units to Miami-Dade County, the Miami-Dade School District, and several special taxing districts. These include the Florida Inland Navigation District, the SFWMD, the Everglades Construction Project, the Children's Trust Authority, and the Library District. In 2011, FPL paid $15.3 million in tangible personal property taxes on its Turkey Point property (FPL 2014-TN4058).

Table 2-43 shows revenues for Homestead. In FY 2012, the City of Homestead had budgeted revenues of almost $156 million. Most of these revenues were associated with proprietary funds, particularly the City of Homestead owned and operated electric utilities, as well as water and wastewater utilities and fees associated with stormwater and solid waste management.

Tax revenues are included in Table 2-43 under Property Taxes and other General Fund revenues. In addition to property taxes, these include local option gas taxes, communication service taxes and utility service taxes. About 57 percent of General Fund revenues are budgeted to fund police services.

Table 2-43. City of Homestead Adopted Budget FY 2012

Revenue Source	Value $
Property Taxes	$10,225,371
Other General Fund Revenues	26,556,523
Electric Utility Revenues	61,811,741
Other Utility Revenues	27,822,562
Other	29,550,045
Total	**155,966,242**

Source: City of Homestead 2012-TN1465

2.5.2.3 Transportation

The Turkey Point site's transportation network includes U.S. and interstate highways, multilane divided State highways, and local streets. The County operates public transportation services including rail, express bus, and buses that have multiple stops. Rail freight service in Miami-Dade County is provided by CSX Corporation. Rail passenger service is provided by Amtrak and TRI-Rail. The county also includes air transportation infrastructure including airports, heliports, and a seaplane base; a seaport for commercial freight and passenger service; and an intermodal transportation hub for air, rail, and ship. The county is also served by private airstrips, heliports (including the FPL corporate and Turkey Point heliports), and seaplane bases (FPL 2014-TN4058).

Roads

The major Federal highways in Miami-Dade County are US-1, which bisects the county from north to south and continues to the Florida Keys south of Miami-Dade County, and Interstates 75 and 95 (I-75 and I-95), which also have a north-south direction. Both of the Interstate highways terminate in Miami. These U.S. and Interstate highways are shown on Figure 2-34. Two of the major State highways in the county are the Florida Turnpike and SR-997.

Florida's Turnpike is a multilane divided toll road that traverses much of Florida, linking I-75 in the interior south of Ocala to Miami. The Homestead extension of Florida's Turnpike terminates at US-1 north of Florida City. SR-997 connects US-1 in Homestead with US-27 northwest, skirting the western fringes of the Miami metropolitan area and terminating in Homestead where the road changes names to Krome Avenue. Krome Avenue continues south and terminates at US-1 south of Florida City. These highways are shown in Figure 2-34.

Access to the Turkey Point site is currently through road SW 344th Street/Palm Drive that intersects both US-1 and SR-997 approximately 8 mi west of the site. SW 344th Street/Palm Drive is a four-lane road that narrows to two lanes as it leads to Turkey Point (at its intersection with SW 137th Avenue/Tallahassee Road). SW 344th Street/Palm also provides access to

Figure 2-34. Transportation Infrastructure Within the 50-Mile Radius of the Site (Source: FPL 2014-TN4058)

Homestead-Miami Speedway and Homestead Bayfront Park. The speedway hosts premier motorsports events including NASCAR and IndyCar races, and has parking for more than 30,000 vehicles and 1,300 recreational vehicles (FPL 2014-TN4058). Figure 2-35 shows streets in the vicinity of the site, as well as existing Miami-Dade County traffic count stations. The station near the Speedway on SW 344th Street/Palm Drive west of SW 137th Avenue/Tallahassee Road (9,956) estimated, in October of 2008, an available peak hour capacity of 2,799 trips. Traffic counts and estimated available peak hour capacity for all three traffic count stations are shown in Table 2-44.

In its visit to the site, the review team confirmed the current low use of the roads in the vicinity of site through interviews conducted with local and County authorities and in a driven tour of the roads.

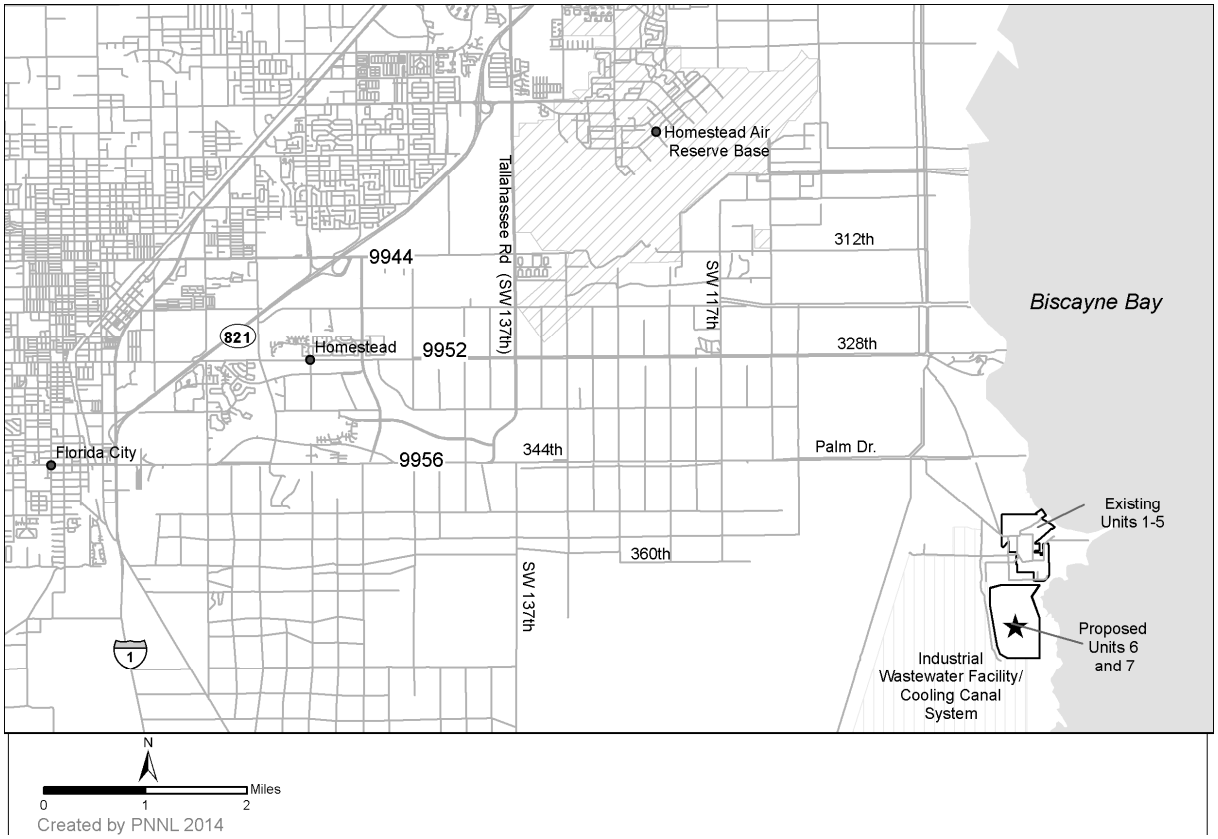


Figure 2-35. Highways, Streets, and Traffic Count Stations in the Vicinity of the Site (Source: Traf Tech 2009-TN1266)

Table 2-44. Available Peak Hour Capacity at Traffic Count Stations, 2008

Traffic Count Station	Location	Peak Hour Capacity	Peak Hour Trips	Available Peak Hour Capacity
9956	SW 344 St. W. of SW 137th Ave/Tallahassee Rd.	3,030	231	2,799
9952	SW 328th St. W. of SW 137th Ave./Tallahassee Rd.	2,600	254	2,346
9944	SW 312th St. E. of Florida Turnpike	3,350	2,061	1,289

Source: Traf Tech 2009-TN1266

Rail

Rail passenger service is provided to Miami by Amtrak and TRI-Rail; neither rail service travels to locations south of Miami. Rail freight service in Miami-Dade County is provided by CSX operating Class 1 rail lines and services the Port of Miami. The rail line terminates in Homestead. There is no rail service to the Turkey Point site.

Waterways

The Port of Miami is in Miami and offers passenger and freight services. The Atlantic Intracoastal Waterway traverses the eastern coastline of Florida and intersects with the Port of Miami. The existing equipment barge-unloading area at Turkey Point is accessed via the Atlantic Intracoastal Waterway to receive shipments of oil and equipment. Fuel oil is currently delivered to Turkey Point by barge from a terminal at the Port of Miami on Dodge Island.

Air

Miami-Dade County operates five airports including Miami International, a major commercial airport in Miami, and the Homestead General Aviation Airport. Homestead is also host to the Homestead Air Reserve Base, the closest airport to Turkey Point. Miami-Dade has many privately owned heliports, including the FPL Helistop and the FPL Turkey Point Heliport (FPL 2014-TN4058).

2.5.2.4 Aesthetics and Recreation

The Turkey Point site lies in an unincorporated area in Miami-Dade County, Florida, approximately 8 mi east of Florida City and 4.5 mi east of the southeastern municipal limits of Homestead. The Units 1 and 2 emissions stacks are the tallest structures on the site, approximately 400 ft tall. There are some resources in the vicinity (within 6 mi) of the site that, because of their residential or recreational use, could be sensitive to the visual presence of an industrial plant. These resources include residential neighborhoods in Homestead; a portion of Biscayne National Park, including the visitor's center to the north and east; and Homestead Bayfront Park to the north. The privately owned Homestead-Miami Speedway is approximately 5 mi northwest of the Units 6 and 7 proposed site. Although the topography surrounding the site is relatively flat and sparsely populated with trees, there is sufficient vegetation to screen the existing units from area roadways and recreational areas on land. SW 344th Street/Palm Drive and SW 328th Street/North Canal Street provide the best opportunity for the public to view the existing units from roadways. However, trees and scrub growth aid in screening the units, including the emissions stacks, from area roadways. Because of the vegetation, the existing units and emission stacks are not visible from most points in Biscayne National Park and Homestead Bayfront Park. The emission stacks may be visible from some upper level seats in the grand stand at the Homestead-Miami Speedway. The existing units are fully visible from Biscayne Bay. Beyond the 6 mi radius, on land, the existing units are not visible. Over the waters in Biscayne Bay however, the units can be clearly seen (FPL 2014-TN4058). An outdoor light monitoring study conducted in 2008 concluded that light from existing Turkey Point units is visible from several locations surrounding the site such as Homestead-Miami Speedway and

Biscayne Bay. Sky glow was observed from urban areas such as Homestead and Miami (FPL 2014-TN4058).

Many public and private recreational opportunities and facilities are present in Miami-Dade County, often close to the City of Miami, including festivals, zoos, botanical gardens, museums, sports venues, beaches, and parks. The Florida Keys are known for sport fishing and other water events. Everglades National Park offers recreational opportunities for camping, hiking, boating, and wildlife viewing. Homestead and Florida City host several festivals throughout the year and offer 21 local parks (FPL 2014-TN4058). Table 2-45 lists major parks and wildlife areas within 50 mi of the Turkey Point site.

Table 2-45. Wildlife Management Areas, National Wildlife Refuges, Preserves, and State Parks Within 50 Miles of the Turkey Point Site (2007-2008)

Name	County	Acres	Annual Visitors	Distance to the Site (mi)
Wildlife Management Areas, National Wildlife Refuges, and Preserves (open to the public)				
Big Cypress National Preserve	Broward, Collier, Miami-Dade, and Monroe	720,561	822,864	44
Biscayne National Park	Miami-Dade	172,971	517,442	Adjacent
Cross Key	Monroe	124	NA	15
Crocodile Lake National Wildlife Refuge	Monroe	6,692	NA	12
Everglades National Park	Collier, Miami-Dade, and Monroe	1,508,533	1,074,764	29
Florida Keys Wildlife and Environmental Area	Monroe	3,089	NA	31
Mary Krome Bird Refuge	Miami-Dade	2	NA	10
Tarpon Basin	Monroe	598	NA	21
State Parks				
Bill Baggs Cape Florida State Park	Miami-Dade	432	893,543	20
Curry Hammock State Park	Monroe	1,000	60,544	26
Dagny Johnson Key Largo Hammock Botanical State Park	Monroe	2,421	11,372	12
Indian Key Historic State Park	Monroe	110	18,295	43
John Pennekamp Coral Reef State Park	Monroe	63,836	878,939	17
John U. Lloyd Beach State Park	Broward	311	495,609	47
Lignumvitae Key Botanical State Park	Monroe	10,818	23,416	42
Oleta River State Park	Miami-Dade	1,033	357,178	36
San Pedro Underwater Archaeological Preserve State Park	Monroe	644	712	45
The Barnacle Historic State Park	Miami-Dade	10	31,545	21
Windley Key Fossil Reef Geological State Park	Monroe	32	11,087	36

Source: FPL 2014-TN4058

The Biscayne National Park is adjacent to FPL property and its visitor center and entrance are approximately 2 mi north of the site proposed for Units 6 and 7. The park covers an area of approximately 172,000 ac, 95 percent of which is water. Water areas of the park are just over 2,000 ft to the east of the proposed Units 6 and 7 plant area. Activities accessible to the public include wildlife viewing, snorkeling, scuba diving, canoeing, camping, hiking, and fishing. The park receives approximately 500,000 visitors per year (NPS 2012-TN465).

Also, 1.5 mi north of the proposed site for Turkey Point Units 6 and 7, and just next to Biscayne National Park is the Homestead Bayfront Park, including a public beach with picnic tables, barbeque grills, shelters, food/drink concession stands, restrooms, showers, and fishing (FPL 2014-TN4058). According to information obtained from a direct call to the park, days with most visitors are on weekends, when an average of 2,000 people visit the park (FPL 2014-TN4058).

The Homestead-Miami Speedway is located 5 mi from the proposed plant area in Homestead and hosts race car and motorcycle events throughout the year, including one of the region's major sporting events, the Grand Prix of Miami, which features an estimated 85,000 spectators over 3 days and capacity for 65,000 seated spectators (FPL 2014-TN4058).

2.5.2.5 Housing

Approximately 83.3 percent of FPL employees (814) reside in Miami-Dade County, of which over 98 percent (798) reside in Homestead (391), Florida City (27), or Miami (380). Another 6.4 percent (63) reside in Broward County and 4.8 percent (47) in Monroe County, and about 5 percent (51) resided in other counties or out of state (Table 2-34).

Table 2-46 provides the number of housing units and vacancies in Miami-Dade County and the Cities of Homestead and Florida City. In 2000, there were a total of 852,278 housing units in Miami-Dade County. This number grew by an estimated 16 percent to reach an estimated 989,364 housing units in 2012. Vacancy rates grew considerably in the same period and were estimated to be 16.5 percent in 2012, compared to the 8.9 percent vacancy rate of 2000. Of the occupied housing units in Miami-Dade County in 2012, 56.8 percent of the units were owner-occupied and 43.2 percent of them were renter-occupied. Of the 163,185 vacant housing units in Miami-Dade County in 2012, 22.0 percent (35,884) were for rent; 11.2 percent (18,325) were for sale; 40.0 percent (66,346) were for seasonal, recreational, and occasional use; and 0.2 percent (290) were for migrant workers; the remaining units were rented or sold but not occupied or for other uses (USCB 2012-TN4089).

Table 2-46. Baseline Housing Information

Place	Total Housing Unit	Occupied	Owner-Occupied	Renter-Occupied	Vacant Housing	Percent Vacant
Miami-Dade County (2000)	852,278	776,774	449,325	327,449	75,504	8.9%
Miami-Dade County (2012)	989,364	826,179	468,997	357,182	163,185	16.5%
Homestead (2012)	22,825	18,567	7,635	10,932	4,258	18.7%
Florida City (2012)	3,390	2,720	1,027	1,693	670	19.8%

Source: USCB 2012-TN4089 and USCB 2000-TN470

In Homestead and Florida City there were a total of 26,215 housing units in 2012. Approximately 18.8 percent (4,928) of these units were vacant. Of the vacant units, approximately 37.0 percent (1,821) were for rent, 21.8 percent (1,072) were for sale, 8.1 percent (339) were for seasonal or recreational use, and 2.4 percent (118) were for migrant workers; the remaining units were rented or sold but not occupied or for other uses (USCB 2012-TN4089).

There are 9 recreational vehicle parks or campgrounds in Miami-Dade County, including 1,587 spaces with full hookups (water, sewer, and electricity) for private recreational vehicles. Approximately 68 percent of these spaces are in the Homestead and Florida City area (FPL 2014-TN4058).

In 2011, there were 361 hotels/motels with approximately 47,642 rooms available in Miami-Dade County. In the South Dade region, which includes the Homestead and Florida City area, 27 hotels/motels with approximately 1,928 rooms were available in 2011. The average room rate for South Dade in 2011 was $75.76 (FPL 2014-TN4058).

2.5.2.6 Public Services

Water Supply and Waste Treatment

There are five major public water-supply systems in Miami-Dade County, as listed in Table 2-47: the MDWASD, Florida City, Homestead, North Miami, and North Miami Beach systems. MDWASD is the main supplier in the county and includes Homestead among its wholesale customers. It is formed by three water-treatment plants: Alexander Orr, Hialeah Preston, and South Dade. Table 2-47 shows the daily average demand in 2007, facility capacity, and daily demand as percent of capacity for public water suppliers. In the Homestead and Florida City area, the two water systems serve approximately 86,252 people, meeting a daily average demand of 14.80 Mgd with a combined capacity of 20.90 Mgd.

Current water demand from major public suppliers in Miami-Dade County is below capacity. If demand grew at the rate of 33 percent in 20 years, as predicted for total water demand by SFWMD, demand for water from public suppliers would still be below capacity after the 20-year period (from Table 2-47). Current water-management strategies for the Miami-Dade County plan include a more coordinated use of conservation and alternative water-supply projects, such as reverse osmosis plants, and reclaimed wastewater systems. In total, these strategies could provide 98.3 Mgd of additional water supply to Miami-Dade County by the year 2025 (FPL 2014-TN4058).

The major water-supply sources for all of the existing water-treatment systems in Miami-Dade County are the Biscayne and Floridan aquifers. Groundwater from the Floridan aquifer is used to blend brackish water and freshwater at water-treatment plants to extend the water supply (FPL 2014-TN4058). In 2005–2006, the SFWMD analyzed water use by type and projected Miami-Dade total water demand to increase by 33 percent, from 526.22 Mgd in 2005 to 699.1 Mgd in 2025. In 2005, 72 percent of overall demand came from public water utility and domestic self-supply, while thermoelectric power use is approximately one-half of 1 percent. Thermoelectric demand for power use is projected to increase from 2.1 Mgd (four-tenths of one percent of total demand) to 69.8 Mgd (about 10 percent of total demand) from 2005 to 2025, respectively (FPL 2014-TN4058). Table 2-48 shows projected demands for water to 2025.

Table 2-47. Major Public Water Suppliers in Miami-Dade County, 2007

System Name	Population Served	2007 Daily Average Demand (Mgd)	Facility Capacity (Mgd)	Daily Demand as Percent of Capacity, 2007
Total from Major Suppliers, Miami-Dade County	2,621,700	393.03	545.81	72.93
MDWASD	2,250,944	347.81	483.61	71.92
Florida City	15,000	2.33	4.00	58.13
Homestead	71,252	12.47	16.90	73.78
North Miami	97,504	8.50	9.30	91.40
North Miami Beach	187,000	26.93	32.00	84.15

Sources: FPL 2014-TN4058; CDM 2008-TN442

Table 2-48. Miami-Dade County Projected Water Demands, 2005−2025

Selected Categories	2005 (Mgd)	2025 (Mgd)	Percent of Overall Demand in 2005	Percent of Overall Demand in 2025
Public Water Utility and Domestic Self-Supply	380.92	483.10	72.39	69.10
Commercial/Industrial Self-Supply	41.70	41.70	7.92	5.96
Recreational Self-Supply	8.80	15.10	1.67	2.16
Thermoelectric Power Self-Supply	2.1	69.8	0.40	9.98
Agricultural Self-Supply	92.70	90.20	17.62	12.90
Total	**526.22**	**699.10**	**100**	**100**

Source: FPL 2014-TN4058

Reclaimed Water Baseline

The wastewater created in Miami-Dade County is either treated at public wastewater-treatment facilities, or is handled by privately owned and operated septic systems (FPL 2014-TN4058). MDWASD is divided into two wastewater districts, north and south. The proposed new nuclear units will be a served by the MDWASD SDWWTP. Table 2-49 summarizes current treatment capacities and flows.

Table 2-49. Wastewater-Treatment Systems in Miami-Dade County

Selected Categories	Plant Capacity (Mgd)	Daily Average Annual Flow (Mgd)	Flow as Percent of Design Capacity
MDWASD South District	112.5	98.53	88%
MDWASD North District	112.5	91.39	81%
Central District	143	115	80%
City of Homestead	6.0	6.13	102%

Source: FPL 2014-TN4058

The wastewater-treatment facility for Homestead is at 102 percent capacity and Homestead uses the MDWASD system as backup. Homestead's proposed 10-Year Water Supply Facilities Work Plan identifies and details the construction of a 3.45 Mgd high-level disinfectant wastewater-treatment plant upgrade (SFRPC 2008-TN1497). The proposed expanded wastewater-treatment plant would have the capacity to handle 9.45 Mgd, which would provide capacity to satisfy the projected demand through at least 2030 (FPL 2014-TN4058). MDWASD SDWWTP handles Florida City's wastewater and it is currently at 88 percent capacity (FPL 2014-TN4058).

Miami-Dade County is currently assessing the large-scale use of treated wastewater (reclaimed water) for various purposes (e.g., industrial, agricultural). As of 2007, approximately 16.2 Mgd of wastewater were reused in MDWASD's system, mostly for process water and irrigation at the existing wastewater-treatment plants (Miami-Dade County 2007-TN1496). Miami-Dade County is currently expanding its water-reclamation program and evaluating several water-reclamation projects, including a high-level disinfection project and a SDWWTP (Miami-Dade County 2011-TN461). A 2007 reuse feasibility study projected approximately 374 Mgd of wastewater to be generated by 2025 in Miami-Dade County. In analyzing the feasibility of several bundles of potential projects for the use of reclaimed water in Miami-Dade County, the study concluded that the projects analyzed that were considered technically feasible could use between 25 percent and 33 percent (93.5 Mgd to 123 Mgd) of the projected wastewater generated in 2025 (Miami-Dade County 2007-TN1496). These estimates did not include use of reclaimed water by nuclear facilities.

Police, Fire, and Medical Services

The Miami-Dade County Police Department serves the entire county including all the municipalities. In 2010, 2,980 total sworn officers and 1,383 civilians were employed in the Miami-Dade County Police Department for a total of 4,363 total law enforcement employees (FPL 2014-TN4058). In 2009, the national average was 3.5 law enforcement employees (including civilians) per 1,000 residents (FBI 2009-TN4082). Miami-Dade County has approximately 1.8 law enforcement employees (including civilians) per 1,000 residents. In 2010, 135 total sworn officers and 53 civilians were employed by police departments in the Homestead and Florida City areas for a total of 191 total law enforcement employees. The Homestead and Florida City area has approximately 2.6 law enforcement employees (including civilians) per 1,000 residents (FPL 2014-TN4058). Table 2-50 summarizes the number of law enforcement personnel in Miami-Dade County, Homestead, and Florida City.

Table 2-50. Law Enforcement and Fire Protection in Miami-Dade County and the Homestead and Florida City Area, 2010

Selected Categories	Miami-Dade County	Homestead and Florida City Area
Law Enforcement Personnel	4,363	188
Officers	2,980	135
Civilians	1,383	53
Fire Protection Personnel	3,500	
Active Firefighters	3,500	69
Civilians	0	
Fire Stations	96	

Source: FPL 2014-TN4058

In Miami-Dade County, there are 3,500 total active firefighters and 718 residents per active firefighter (FPL 2014-TN4058). The Homestead and Florida City area is served by Miami-Dade County Fire and Rescue. As of 2010, approximately 69 firefighters were active throughout three fire stations located in the area of Homestead and Florida City (FPL 2014-TN4058). Table 2-51 provides fire protection personnel data for Miami-Dade County as of 2010.

The Insurance Services Office, an advisory organization that serves the property and casualty insurance industry, uses a fire-suppression rating schedule to grade the public fire protection of a city, town, or area. The rating schedule classifies communities from 1 (the most preferred) to 10 (the least preferred). Communities are graded on water distribution, fire department equipment and manpower, and fire alarm facilities, among other things. The overall public protection classification rating for Miami-Dade County is 4, as is the overall public protection classification for the Homestead and Florida City area (FPL 2014-TN4058).

Table 2-51 presents hospital-use data for Miami-Dade County. Miami-Dade County has 10,497 physicians, 31 hospitals, and 8,420 staffed beds. Most (23) of the hospitals located in Miami-Dade County are classified as “General and Surgical” hospitals. Three hospitals are listed as rehabilitation hospitals, while two are long-term acute care hospitals. One hospital specializes in children’s general care, and one in eye, ear, nose, and throat care.

Education

The State of Florida divides the school districts by county. The Miami-Dade Public School District (M-DCPS) has a total of 450 schools that supported a 2011–2012 enrollment of 349,945 students (Table 2-52) (Miami-Dade County Public Schools 2012-TN463). Student public school enrollment has consistently decreased since 2002-2003, but there has been a reversal in the last two school years (2010-11 and 2011-12). Annual changes in enrollment between 2002-2003 and 2011-2012 have averaged 3891 students, or approximately 1 percent of enrollment in the previous year (Miami-Dade County Public Schools 2012-TN463). There are also 272 private schools covering pre-kindergarten through 12th grade where 61,597 students were enrolled in 2007–2008. There are 35 colleges or universities that are accredited to award various certificates and degrees ranging from associate to doctoral and there are also a large number of vocational schools that offer professional and paraprofessional training (FPL 2014-TN4058).

An amendment to the Florida Constitution approved in 2002 set limits to the number or students in core classes (e.g., math, science) in public schools. These limits are shown in Table 2-53 below. Florida Law requires that these class sizes be met for core courses by the average district class size in FY 2003-2004 through 2005-2006, by the average school class size in FY 2006-2007 and 2007-2008; and by each individual classroom from FY 2008-2009 onwards (FLDOE 2012-TN1490). Mandated class sizes are met by Miami-Dade County public schools on average, with a very small share of full-time equivalent (FTE) students in classes over the mandated size (Table 2-53).

Currently, portable units are often used by public schools in Miami-Dade County to supplement permanent school facilities. Miami-Dade County’s 2012-2013 Work Plan lists capital outlay projects needed to ensure availability of classrooms to accommodate projected school enrollments through 2016-2017 school year. These projects include the addition of 110 classrooms and 2,440 student stations (M-DCPS 2012-TN1493).

Table 2-51. Medical Facilities and Personnel in Miami-Dade County, 2006

Facility Name	Staffed Beds	Admissions[a]	Census[b]	Outpatient Visits[c]	Personnel[c]	Service Classification
Aventura Hospital and Medical Center	390	15,956	246	76,540	892	General & Surgical
Coral Gables Hospital	188	NA	NA	NA	NA	General & Surgical
Doctors Hospital	148	6,994	105	61,204	740	General & Surgical
Kindred Hospital South Florida – Coral Gables	53	NA	NA	NA	NA	Other Specialty
Hialeah Hospital	220	NA	NA	NA	NA	General & Surgical
Palm Springs General Hospital	190	NA	NA	NA	NA	General & Surgical
Palmetto General Hospital	190	NA	NA	NA	NA	General & Surgical
Homestead Hospital	116	7,284	86	68,452	631	General & Surgical
Baptist Hospital of Miami	551	NA	NA	NA	NA	General & Surgical
Bascom Palmer Eye Institute – Anne Bates Leach Eye Hospital	22	174	2	186,118	570	Eye, Ear, Nose & Throat
Cedars Medical Center	350	17,933	301	51,153	1,179	General & Surgical
Healthsouth Rehabilitation Hospital	60	NA	NA	NA	NA	Rehabilitation
Jackson Memorial Hospital	1,776	66,192	1,472	626,140	11,193	General & Surgical
Jackson South Community Hospital	233	NA	NA	NA	NA	General & Surgical
Kendall Regional Medical Center	296	16,428	210	80,098	1,217	General & Surgical
Meadowbrook Rehabilitation Hospital of West Gables	60	NA	NA	NA	NA	Rehabilitation
Mercy Hospital	367	19,790	291	93,699	2,065	General & Surgical
Miami Children's Hospital	252	13,297	195	266,010	2,266	Children's General
Miami Jewish Home and Hospital for the Aged	32	NA	NA	NA	NA	General & Surgical
North Shore Medical Center	357	NA	NA	NA	NA	General & Surgical
Pan American Hospital	146	NA	NA	NA	NA	General & Surgical
Select Specialty Hospital of Miami	40	NA	NA	NA	NA	Long-Term Acute Care
Sister Emmanuel Hospital for Continuing Care	29	NA	NA	NA	NA	Long-Term Acute Care
South Miami Hospital	324	21,062	233	180,214	1,813	General & Surgical
University of Miami Hospital and Clinics	40	1,428	24	175,234	757	General & Surgical

Table 2-51. (contd)

Facility Name	Staffed Beds	Admissions[a]	Census[b]	Outpatient Visits[c]	Personnel[c]	Service Classification
Veterans Affairs Medical Center	347	6,623	270	542,111	2,402	General & Surgical
Westchester General Hospital	172	5,976	142	22,129	561	General & Surgical
Mount Sinai Medical Center	685	24,319	433	173,691	2,837	General & Surgical
St. Catherine's Rehabilitation Hospital	272	NA	NA	NA	NA	Rehabilitation
Parkway Regional Medical Center	392	NA	NA	NA	NA	General & Surgical
Larkin Community Hospital	122	NA	NA	NA	NA	General & Surgical
Total	**8,420**	**223,456**	**4,010**	**2,602,793**	**29,123**	NA

(a) Total during a recent 12-month period (2005-2006).
(b) Average daily census during a recent 12-month period.
(c) Hospital personnel list does not include doctors that serve patients in the hospital, but are employed by the hospital.

Source: FPL 2014-TN4058

Table 2-52. Public School Statistics in Miami-Dade County and Homestead and Florida City

	Miami-Dade County		Homestead and Florida City	
Grade Levels	**Schools**	**Enrollment**	**Schools**	**Enrollment**
Elementary	205		10	
Middle Schools	80		4	
K-8 Schools	68		1	
High Schools	73		2	
Other[(a)]	24		-	
Total	450	349,945	17	14,884

(a) Special and combined schools

Source: Miami-Dade County Public Schools 2012-TN463

Table 2-53. Class Sizes in Miami-Dade County, 2010-2011

Grade Levels	Florida Department of Education Mandated Size (a)	Average Class Size (b)	FTE[(a)] Over Capacity (b)	FTE* (c)	Percentage of FTEs over Capacity
Pre-K − 3	18	13.9	909.1	106,354.1	0.9%
4 − 8	22	16.6	656.4	136,193.4	0.5%
9 − 12	25	20.2	630.0	102,828.1	0.6%

(a) FTE stands for full-time equivalent and is a measure of enrollment based on the number of full-time students that it would take to fulfill the number of classes offered

Sources: a − FLDOE 2012-TN1490; b − FLDOE 2011-TN1491; c −FLDOE 2012-TN1492.

In the Homestead and Florida City area, 17 traditional (non-Charter) public schools supported an enrollment of 14,884[(5)] students in 2011-2012 (M-DCPS 2012-TN1493). FTE students in classes over the mandated size were 123.26 in that same year (FLDOE 2012-TN1490), or less than 0.8 percent of those actually enrolled in that school year. No new student stations or classrooms are proposed for the Homestead and Florida City Area in Miami-Dade County School District's 2011-2012 Work Plan (M-DCPS 2012-TN1493). In addition, there were 8,373 students attending 27 charter schools (M-DCPS 2012-TN1493). There are also 16 private schools covering pre-kindergarten through grade 12 where 2,263 students were enrolled in 2009−2010 (FPL 2014-TN4058).

2.6 Environmental Justice

Environmental justice refers to a Federal policy established under Executive Order 12898 (59 FR 7629) (TN1450), which requires each Federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its

(5) Full-time equivalent

programs, policies, and activities on minority or low-income populations.(6) The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997-TN452). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040) (TN1009). The review team's environmental justice analysis is guided by the NRC's ESRP and the additional guidance document, Revision 1 of *Addressing Construction and Preconstruction Activities*, *Greenhouse Gas Issues*, *General Conformity Determinations*, *Environmental Justice*, *Need For Power*, *Cumulative Impact Analysis*, *and Cultural/Historical Resources Analysis Issues in Environmental Impact Statements* (NRC 2011-TN9).

This section describes the existing demographic and geographic characteristics of the proposed site and its surrounding communities. It offers a general description of minority and low-income populations within the region surrounding the site. The characterization in this section forms the analytical baseline from which potential environmental justice effects would be determined. The characterization of populations of interest includes an assessment of "populations of particular interest or unusual circumstances" (NRC 2000-TN614), such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations such as American Indian settlements.

2.6.1 Methodology

The review team first examined the geographic distribution of minority and low-income populations within 50 mi of the Turkey Point site. This information was obtained using ArcMap 10 software (ESRI 2012-TN1469) and the 2008–2012 United States Census Bureau American Community Survey Five-Year Summary Files (USCB ACS) to identify minority and low-income populations at the census block group level.(7) The review team also verified its analysis by conducting field inquiries of numerous agencies and groups (see Appendix B for list of organizations contacted).

The first step in the review team's environmental justice methodology was to examine each census block group that is fully or partially included within the 50 mi region surrounding the Turkey Point site to determine for each block group whether it should be considered an environmental justice (EJ) population of interest. If either of the two criteria discussed below was met for a census block group, that census block group was considered an EJ population of interest warranting further investigation. The two criteria are whether

- the minority or low-income population that resides in the block group exceeds 50 percent of the total population for that census block group, or

(6) Minority categories are defined as American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; or Hispanic ethnicity; and "other" may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty measure.

(7) A census block is the smallest geographic area that the U.S. Census Bureau collects and tabulates sample data. A block group is the next level above census blocks in the geographic hierarchy and is a subdivision of a census tract or block numbering area.

- the percentage of the minority or low-income population in the census block group is at least 20 percentage points greater than the same minority or low-income population's percentage in the respective state.

The identification of census block groups that meet at least one of the above two criteria is not sufficient for the review team to conclude that a disproportionately high and adverse impact exists. Likewise, the lack of a census block group meeting the above criteria cannot be construed as evidence of no disproportionately high and adverse impacts. To reach an environmental justice conclusion, the review team conducts an active public outreach and on-the-ground investigation in the region of the proposed site to determine whether any additional EJ populations of interest may exist in the region that are not identified in the census mapping exercise. In addition, starting with the identified populations of interest, the review team must investigate all populations in greater detail to reveal key pathways that may have disproportionately high and adverse impacts on EJ populations of interest. To determine whether disproportionately high and adverse effects may be present, the review team considers the following:

- Health Considerations
  1. Are the radiological or other health effects significant or above generally accepted norms?
  2. Is the risk or rate of hazard significant and appreciably greater than that for the general population?
  3. Do the radiological or other health effects occur in groups affected by cumulative or multiple adverse exposures to environmental hazards?
- Environmental Considerations
  1. Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
  2. Are there any significant adverse impacts on a group that appreciably exceed or [are] likely to appreciably exceed those on the general population?
  3. Do the environment effects occur in groups affected by cumulative or multiple adverse exposure to environmental hazards? (NRC 2007-TN4).

If this investigation in greater detail does not yield any pathways by which EJ populations of interest could be disproportionally affected by adverse impacts, the review team may conclude that there are no disproportionately high and adverse impacts. If the review team finds any potential pathways for disproportionately high and adverse impacts, the review team must characterize the nature and extent of that impact and consider possible mitigation measures that may be used to lessen that impact. The remainder of this section discusses the results of the search for potentially affected populations of interest.

2.6.1.1 Minority Populations

The minority population is expressed in terms of the number and/or percentage of people that belong to minority races or ethnicities in an area. Persons of Hispanic/Latino origin are

considered an ethnic minority and may be of any race, including white. The review team considers the aggregate minority population to be the sum of the white Hispanic/Latino and the racial minority populations.

U.S. Census Bureau data (USCB 2012-TN4098) present the Florida population as containing the following:

- 0.3 percent American Indian or Alaskan Native
- 2.5 percent Asian
- 0.1 percent Native Hawaiian or other Pacific Islander
- 15.9 percent Black or African American
- 2.6 percent other single race
- 2.2 percent multi-racial
- 22.5 percent Hispanic ethnicity
- 42.2 percent aggregate minority.

This provides the following threshold values for the second (20 percent) criterion:

- 20.3 percent American Indian or Alaskan Native
- 22.5 percent Asian
- 20.1 percent Native Hawaiian or other Pacific Islander
- 35.9 percent Black or African American
- 22.6 percent other single race
- 22.2 percent multi-racial
- 42.5 percent Hispanic ethnicity
- 62.2 percent aggregate minority.

2.6.1.2 Low-Income Populations

The low-income population is expressed in terms of the number and/or percentage of people that are at or below the poverty level. The share of Florida's total population at or below the poverty level in 2012 was 15.3 percent (USCB 2012-TN4098). Therefore, the low-income threshold level for this analysis is 35.3 percent.

Table 2-54 shows the overall representation of the populations of interest in the 50 mi region surrounding the Turkey Point site and the State of Florida as a whole. Because Hispanics/Latinos can be of any race, the sum of Hispanics/Latinos and all of the minority race categories will typically be more than the number of aggregate minorities.

Table 2-54. Regional Minority and Low-Income Populations by Block Group Analysis Results

Category	Number of Block Groups	Percent of Total
Total	2,116	100.0
Aggregate Minority	1,681	79.4
Hispanic or Latino	1,219	57.6
American Indian or Alaskan Native	2	0.1
Asian	10	0.5
Native Hawaiian or Other Pacific Islander	0	0.0
Black or African American	440	20.8
Persons Reporting Some Other Race	39	1.8
Two or More Races	4	0.2
Low-Income Population	240	11.3

Source: USCB 2009-TN1462

The review team identified 2,116 census block groups wholly or partially within the 50 mi region. Using the individual comparison criteria (comparing the block group to the State of Florida), GIS analysis found 1,219 block groups with Hispanic groups exceeding either the 20-percentage points or 50 percent criterion, 1,681 block groups with aggregate minority populations, 440 block groups with African-American populations, 10 block groups with Asian populations, and 240 with low-income populations. There were no block groups with Hawaiian and Pacific Islander populations and only two with American Indian or Alaskan Native populations. Figure 2-36 through Figure 2-39 illustrates the findings of the data.

Further research, phone and field consultations with local organizations (listed in Appendix B), and information in FPL's ER revealed additional information about the existence and location of minority and low-income groups.

There is a Seminole Tribe of Florida Reservation in Hollywood, Broward County, within the 50 mi region. The reservation includes various commercial enterprises, including a hotel and casino, a second casino and a recreational Indian Village area with various tourist attractions (Seminole Tribe of Florida 2012-TN466). Four Miccosukee Indian reservations −Tamiami Trail (Miami-Dade County), Alligator Alley (Broward County), and two at Krome Avenue (Miami-Dade County)—also lie within 50 mi of the site. There are approximately 650 people enrolled in the Miccosukee Tribe. The Tamiami Trail Reservation, which consists of four parcels of land, is 40 mi west of Miami and is now the site of most Tribal operations and the center of the Miccosukee Indian population. One parcel was under a NPS 50-year use permit, which expired on January 24, 2014. The other three parcels were originally dedicated to the Miccosukee by the State of Florida and have since acquired Federal reservation status. These areas are used for commercial development. The Tribe also has a perpetual lease from the State of Florida for 189,000 ac, which is part of the SFWMD's Conservation Area 3A South. The Tribe is allowed to use this land for hunting, fishing, frogging, subsistence agriculture, and to carry on the traditional Miccosukee way of life. Alligator Alley is the largest of the Miccosukee Tribe's reservations, comprising approximately 75,000 ac. This land consists of 20,000 ac with potential for

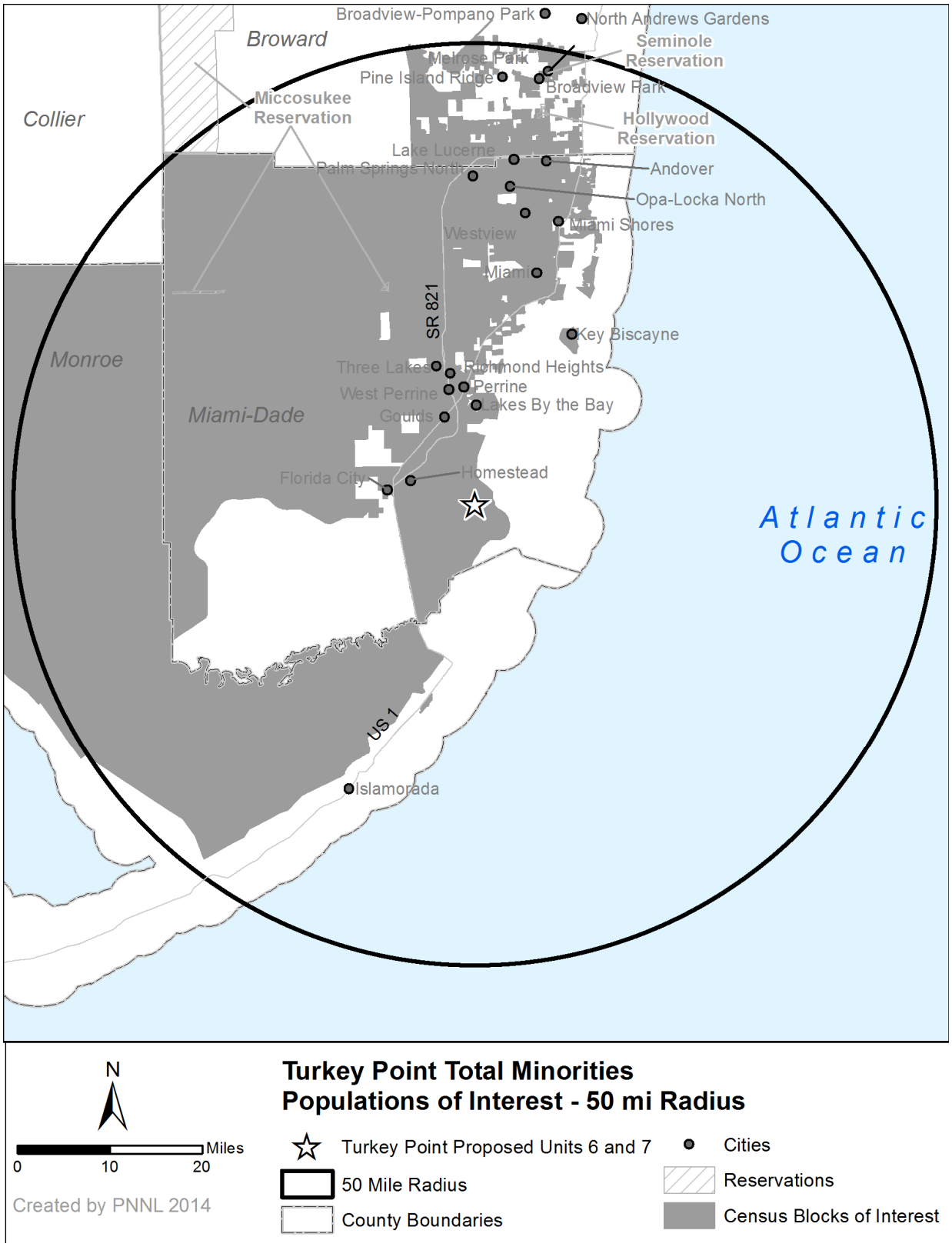


Figure 2-36. Aggregate Minority Populations in Block Groups that Meet the Environmental Justice Selection Criteria

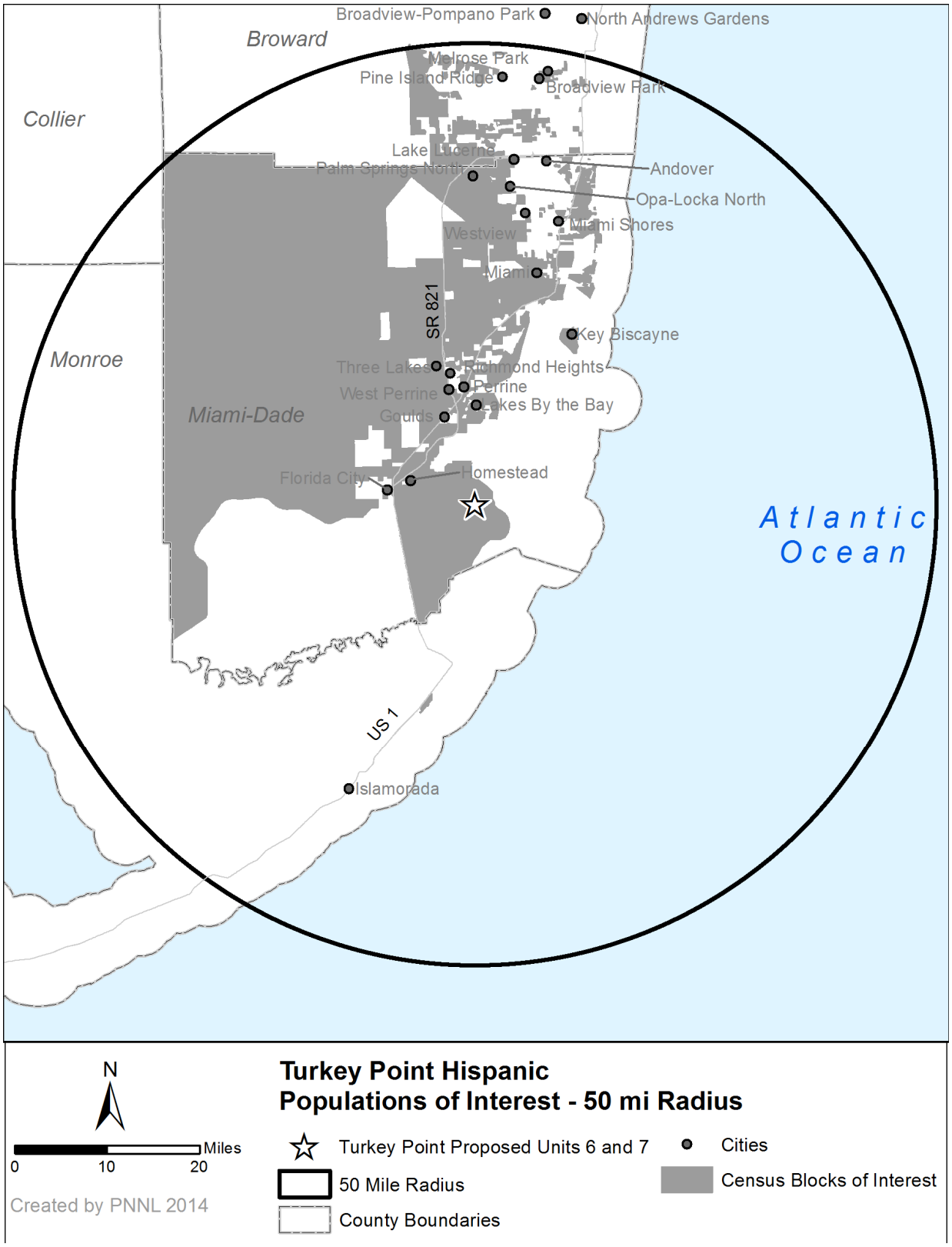


Figure 2-37. Hispanic Populations in Block Groups that Meet the Environmental Justice Selection Criteria

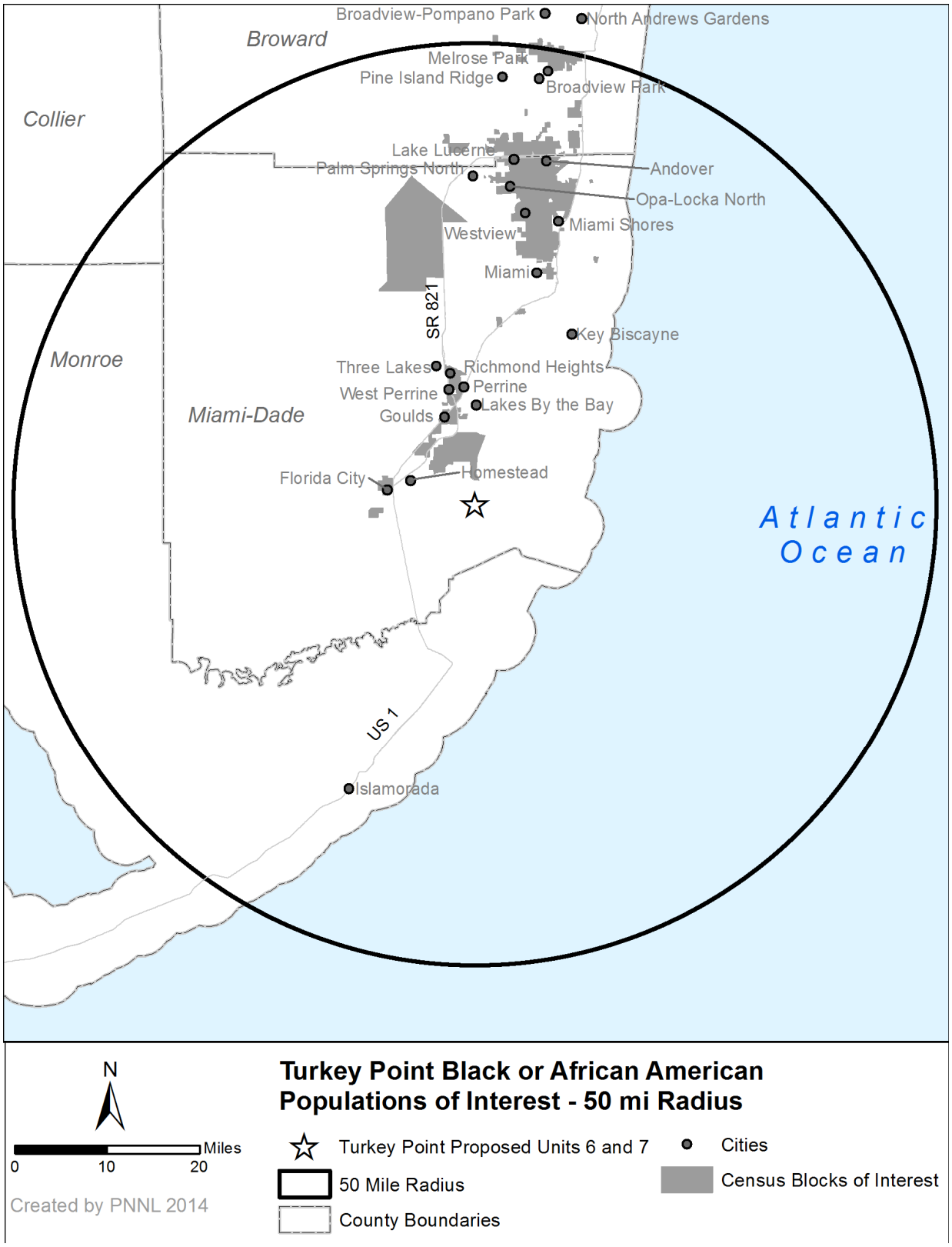


Figure 2-38. African-American Populations in Block Groups that Meet the Environmental Justice Selection Criteria

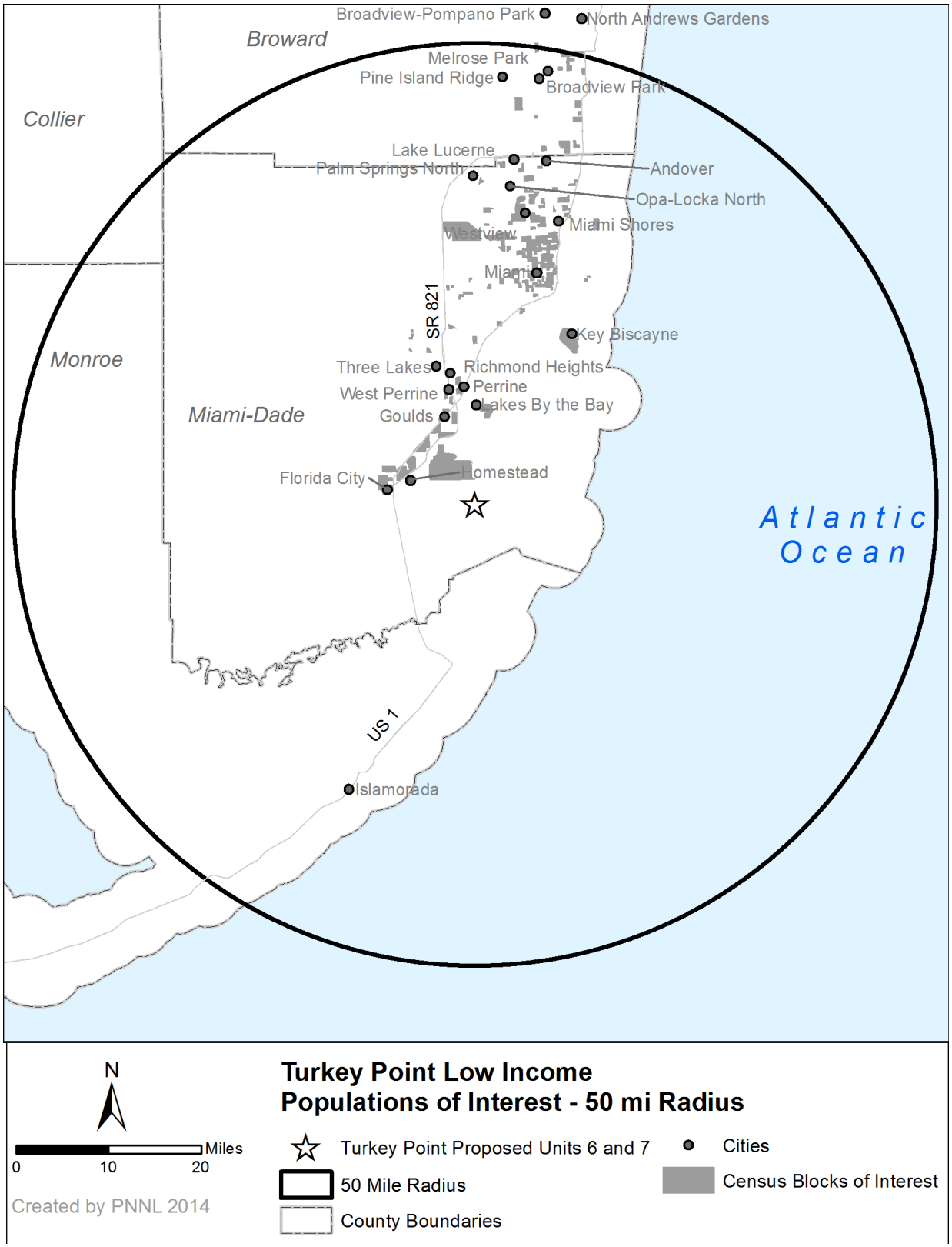


Figure 2-39. Aggregate Low-Income Populations in Block Groups that Meet the Environmental Justice Selection Criteria

development and 55,000 ac of wetlands. The reservation contains a modern service station plaza, a police substation, and 13,000 ac of land that is leased for cattle grazing. Two reservation areas are located at the intersection of Krome Avenue and Tamiami Trail. One (25 ac) is the site of the Miccosukee Indian gaming facility and the Miccosukee resort and convention center. The second reservation area (less than 1 ac) is the site of the Miccosukee tobacco shop (Miccosukee Tribe of Indians of Florida 2011-TN464; FPL 2011-TN435). Figure 2-36 displays the location of the Miccosukee Tribe's reservation in relation to the 50 mi region.

Migrant agriculture workers are also present and tend to be members of the minority and low-income communities (Hispanic). They are described in further detail in Section 2.6.4 below.

Based on the information above the review team determined that because there are minority and low-income communities in close proximity to the proposed site, impacts on these communities must be considered in greater detail, as discussed in Section 2.6.2. The result of the review team's analyses can be found in Sections 4.5 and 5.5 of this EIS.

2.6.2 Analysis

For each of the identified EJ populations of interest, the review team determined whether any of the populations appeared to have a unique characteristic that could cause a disproportionately high and adverse effect. Examples of unique characteristics include lack of vehicles, sensitivity to noise, close proximity to the plant, or subsistence activities. However, such unique characteristics need to be demonstrably present in the population and relevant to the potential environmental impacts of the plant. If the impacts from the proposed action would adversely affect an identified EJ population of interest more than the general population because of one of these or other unique characteristics, then a determination would be made whether the impact is disproportionately high when compared to the general population. Through phone and field consultations with local organizations and review of FPL's ER, the review team concluded that subsistence activities such as subsistence fishing are typically not conducted by any identified EJ group. The main low-income group identified with potentially unique pathways for exposure to environmental effects was migrant agricultural workers (see discussion in Section 2.6.4).

The review team assesses the impacts on the populations of interest in Sections 4.5.5 and 5.5.4 of this EIS.

2.6.3 Scoping and Outreach

During the development of its ER, FPL interviewed community leaders of the minority populations within the economic impact area. The review team built upon this base and performed additional interviews with local, State, and County officials, business leaders, and key members of minority communities within the economic impact area to assess the potential for disproportionately high and adverse socioeconomic effects that may be experienced by minority or low-income communities during construction and operation of a project with the magnitude of the proposed new Turkey Point Units 6 and 7. The review team also consulted with local Tribal governments in the region and is discussed in Section 2.7. In accordance with NRC guidance, the review team provided advance notice of public hearings for EIS scoping purposes (See

Appendix D). These activities did not identify any additional groups of minority or low-income persons not already identified in the GIS analysis of census data.

2.6.4 Migrant Populations

Available information about migrant populations in the area is described in Section 2.5.1.3. Based on phone and field consultations with local organizations (listed in Appendix B), the review team concluded that migrant agricultural workers tend to be Hispanic and spend most of the day outdoors, making them potentially more exposed to air and noise pollution during construction. Although members of this group would also seem to present unique characteristics that could make them disproportionately vulnerable to environmental impacts, they tend to be located in the more rural, agricultural areas of Miami-Dade County and not in proximity to the Turkey Point site.

2.6.5 Environmental Justice Summary

The review team found many low-income, Hispanic, and African-American minority populations that exceeded the percentage criteria established for EJ analyses within the 50 mi region. Further, the review team identified migrant agricultural workers as being present in the area, of low-income status, Hispanic, and potentially vulnerable to environmental air and noise pollution due to their extended presence outdoors. Therefore, the review team performed additional analyses before making a final EJ determination. The results of the analyses can be found in Sections 4.5.4 and 5.5.4.

2.7 Historic and Cultural Resources

At the outset of the COL review process, and in accordance with Title 36 of the *Code of Federal Regulations* Part 800, Section 8c (36 CFR 800.8(c) (TN513), the review team elected to use the process set forth in NEPA (42 USC 4321 et seq.) (TN661), to comply with the obligations imposed under Section 106 of the National Historic Preservation Act (NHPA) (54 USC 300101 et seq.) (TN4157). Subsequently, however, and as outlined in letters dated October 23, 2014 (NRC 2014-TN4055; NRC 2014-TN4057; NRC 2014-TN4059) the NRC and USACE determined that the USACE would be the lead Federal agency for Section 106 of the NHPA and for consultation with Federally Recognized Tribes. The NRC would continue to serve as lead agency for the NEPA review.

For the COL review under NEPA, the review team will use the Section 106 Area Of Potential Effect (APE) for the project. The direct-effects APE for the COL review is the area at the power plant site and the immediate environs that may be physically affected by land-disturbing activities associated with constructing and operating two new nuclear generating units. The indirect-effects APE for the Turkey Point site is the area that may be visually and/ or audio affected. The indirect-effects APE is determined by the maximum distance from which the tallest structures associated with proposed Units 6 and 7 can be seen from offsite locations. In the case of the Turkey Point site, the indirect-effects APE was determined to be one-half mile from the facility.

This section discusses the historic and cultural background in the region surrounding the Turkey Point site. It also details the efforts that have been taken to identify cultural resources in the

physical and visual APEs and the resources that were identified. A description of the consultation efforts is also provided. The assessments of effects from building and operating the proposed new units are found in Sections 4.6 and 5.6, respectively.

2.7.1 Cultural Background

This section provides an overview and summary of the cultural history of the Turkey Point site and region. The discussion of precontact[8] history is summarized from the cultural resources investigation completed for the Turkey Point site (FPL 2011-TN1512; FPL 2011-TN95). The region around the Turkey Point site has a rich cultural history and a record of significant prehistoric and historic resources with evidence of continuous settlement in the area for more than 12,000 years.

Prehistoric occupation of the area is typically divided into three periods, as summarized below:

- Paleoindian (12,000-7500 BC) – The prevailing view of Paleoindian culture is that of a nomadic hunting and gathering existence, in which now-extinct Pleistocene megafauna[9] were exploited. Settlement patterns were restricted by the availability of freshwater and access to high-quality stone from which the specialized Paleoindian tool assemblages were made. Most sites of this time period are found near karst sinkholes or spring caverns. The majority of Paleoindian sites in Florida consist of surface finds. The most widely recognized Paleoindian tool in Florida is the Suwannee point, typically found along the springs and rivers of northern Florida. Other points, including Simpson and Clovis points, are found in fewer numbers. Some of these, and other Paleoindian lanceolate points, were hafted by attaching them to an ivory shaft that was, in turn, attached to a wooden spear shaft. Other tools include Bifacial and hump-backed unifacial scrapers, blade tools, and retouched flakes.
- Archaic (7500-500 BC) – The Archaic period is divided into Early (7500–5000 BC), Middle (5000–3000 BC), and Late (3000–500 BC). The latter is subdivided into the Preceramic Late Archaic phase (3000-2000 BC) and the Orange phase (2000-500 BC). These phases are defined on the basis of increasingly sedentary settlement patterns and changing diagnostic projectile point typologies. During the Early phase, there is evidence of reduced nomadism and seasonal camp sites, often expressed by the presence of large middens (i.e., refuse piles of archaeological material). The Middle phase is marked by a noticeable change in lithic technology, an increase in overall population, and a shift to a more diverse subsistence base, and particularly a shift to fish and shellfish. The change in lithic technology is more noticeable from the Early to Middle Archaic phases than it is from the Paleoindian period to Early Archaic phase, likely representing a major change in the resources used. The Late Archaic phase is marked by an increased reliance on marine resources, and the first occurrence of pottery at the onset of the Orange phase (2000 BC). The presence of this pottery likely represents a shift to a more sedentary lifestyle with a need for food and material storage. This pottery was molded and fiber-tempered with vegetable fibers. The latter portion of the Archaic period is marked by the appearance of regional ceramics and evidence of increasingly larger village sites and associated middens.

(8) Of or related to the period before contact of an indigenous people with an outside culture.
(9) Large-bodied mammals weighing more than 100 pounds from the Pleistocene era.

- Formative (500 BC–1513 AD) – Locally, this period is known as the Glades culture, and it is divided into multiple phases based largely on changes in ceramic style. Although the terminus of this period is shown as 1513 AD, occurring with the arrival of Europeans, Glades culture persisted for several centuries beyond that. During the Formative Period, people appear to have become more sedentary and particularly adept at exploiting resources found within their environment, resulting in an overall increase in population growth. There is increased pottery production, showing regional or cultural affiliation. Post-Archaic cultures are distinguished by the use of burial mounds and cultivated plants to supplement wild foods. There is evidence of a decrease in stone tools and an increase in utilitarian tools, such as containers and ornaments fashioned from bone or shell.

The history of the East Coast of Florida from its discovery in 1513 to the end of World War II is summarized from the cultural resources investigation completed for the Turkey Point site (FPL 2011-TN1512; FPL 2011-TN95).

Official credit for the discovery of Florida by Europeans is credited to Juan Ponce de León, whose voyage of 1513 took him along the east coast of the peninsula. Other Spanish explorers followed, and over the next 50 years the Spanish government and private individuals financed expeditions in hopes of establishing a colony in Florida. Jesuit missions were established in the Central Peninsular Gulf Coast and Glades archaeological regions, but these efforts were abandoned in 1570s. Franciscan mission efforts began in the 1570s but focused predominantly on the northern areas of Florida. Consequently, for the remainder of the initial Spanish Period (up to 1763), the area surrounding the Turkey Point site and vicinity was virtually ignored as the Spanish concentrated their efforts in the northern half of the peninsula. Between 1500 and 1800 possession of Florida changed several times between Spain and Great Britain.

By the beginning of the eighteenth century, the Native American population of South Florida had declined considerably as a result of European colonization resulting in the loss of tribal lands due to disease, slave raids, and intertribal warfare. Many who survived integrated into the Seminole Tribe, the Seminoles were descendants of Creek Indians who moved into Florida during the early eighteenth century to escape the political and population pressures of the expanding American colonies to the north. Groups of fugitive African-American slaves had also settled among the Seminoles by the early nineteenth century.

In 1821, Spain ceded Florida Territory to the United States as a result of the Transcontinental, or Adams-Onis Treaty. The population of the territory at that time was still centered in the northern area of the state. As more North American settlers moved into the region, conflicts arose with the Seminole people over available land. Pressure was placed on the government to remove the Seminoles from North Florida and to relocate them further south. The Treaty of Moultrie Creek of 1823 restricted the Seminole people to approximately four million acres of land in the middle of the state. This treaty was unpopular with the Seminoles, because they were reluctant to move from their established homes to an area that they felt could not be cultivated. Equally unpopular among the Seminoles were the later treaties of Paynes Landing of 1832 and Fort Gibson of 1833, which called for Seminole migration to the western territories. These three treaties helped foster Seminole resentment of settlers and outbreaks of hostility that culminated in the Second Seminole War in 1835. At the beginning of the Second Seminole War, the conflict was centered in the central portion of the state, but soon expanded south to the

Lake Okeechobee and Everglades regions, and Fort Davis (located in present day Miami) became a base of operations.

The Second Seminole War had a detrimental effect on new settlement in Florida. To encourage settlement in the middle portion of the territory after the war, the Armed Occupation Act of 1842 (5 Stat. 502-TN4113) offered settlers 160 ac of land at no cost. This Act, plus the end of the Second Seminole War, created a small wave of immigration by settlers to central Florida, most of whom were farmers and cattle ranchers.

The onset of the Civil War disrupted development in Florida. Most of the state did not have daily contact with battles, but Florida contributed troops and supplies to the Confederate Army. Although Florida was not the site of many Civil War battles, Union forces established control of the Florida coastline in 1863. Like the other former Confederate States, Florida suffered economic devastation at the Civil War's end.

In the 1880s, interest in South Florida's resources intensified and outside businessmen saw Florida's potential and began purchasing the land for large projects. As a part of this land acquisition, projects were initiated to drain and reclaim land, and to dig canals between lake systems. This work helped change large portions of Florida from wilderness into an area ripe for investment, which enabled expansion of railroad lines and increased settlement.

The early twentieth century saw rapid and widespread growth in Florida. Large expanses of the Everglades were drained and thousands of miles of railroad tracks were laid at this time. While agriculture, especially the citrus industry, was the main source of Florida's economy, manufacturing and industry grew during the beginning of the century. Tourism, too, increased. The City of Homestead, the closest city to the Turkey Point site, was incorporated during this period, in 1913. The community served as a stop along a new rail line extending to Key West, and quickly became an important agricultural area.

During World War I, several training facilities were set up in the state and protecting the coastlines was a priority at this time. Although the conflict only lasted until November of 1918, the economy was boosted by the war, primarily through shipbuilding and industrialization of port cities. After World War I, Florida experienced unprecedented growth. Many people had relocated to Florida during the war to work in wartime industries or had been stationed in the state as soldiers. Bank deposits increased, real estate companies opened in many cities, and state and county road systems expanded quickly. Earlier land reclamation projects had created thousands of new acres of land to be developed. Real estate activity increased steadily after the war's end and drove up property values. Prices on lots were inflated to appear more enticing to out-of-state buyers. Every city and town in Florida had new subdivisions platted (platting is the splitting one larger piece of land into several smaller pieces of land) and lots were selling and reselling for quick profits. Southeast Florida, including cities such as Miami and Palm Beach, experienced the most activity, although the boom affected most communities in central and southern Florida.

This boom period began to decline in 1925, and by the time the stock market collapsed in 1929, Florida was already suffering from an economic depression, brought on by a grossly inflated real estate market, two hurricanes, and a fruit fly infestation that devastated the agricultural

industry. By 1929, construction activity had halted and industry had dramatically declined. Subdivisions platted several years earlier remained empty and buildings stood on lots partially finished and vacant. As a result of the hard economic times, President Franklin D. Roosevelt initiated several national relief programs. Important New Deal-era programs in Florida were the Works Progress Administration and the Civilian Conservation Corps. Their efforts included the construction or improvement of many roads, public buildings, parks, and airports in Florida, as well as improvement and preservation projects on forests, parks, and agricultural lands.

From the end of the Great Depression until after the close of the post-war era, Florida's history was inextricably bound to World War II and its aftermath. It became one of the nation's major training grounds for the various military branches including the Army, Navy, and Army Air Corps. Up until that time, tourism had been the State's major industry, but tourism ceased as tourist and civilian facilities such as hotels and private homes were placed into wartime service. The influx of thousands of servicemen and their families increased industrial and agricultural production in Florida and also introduced these new residents to the warm weather and tropical beauty of Florida. At the conclusion of World War II, Florida's economy was almost fully recovered. Tourism quickly rebounded and became the major source of the State's economy. In addition, former military personnel found the local climate amenable and remained in Florida permanently after the war. These new residents greatly increased the population during the late 1940s and 1950s. In 1947, immediately after the war, Everglades National Park was established, thereby increasing tourism to the area.

2.7.2 Historic and Cultural Resources at the Site and in the Vicinity

To identify the historic and cultural resources at the Turkey Point site, the staff reviewed the following information:

- Janus Research, Inc. Technical Report – Preliminary Cultural Resources Report for the Turkey Point 6 and 7 Associated Linear Facilities (FPL 2009-TN1513; FPL 2011-TN95)
- NRC Site Visit and Audit – NRC staff consulted with the Florida State Historic Preservation Office (SHPO) and also conducted an on-the-ground visit to the Turkey Point site in June of 2010 (NRC 2010-TN1457).
- Janus Research, Inc. Technical Report – Cultural Resources Assessment Survey for the Turkey Point Units 6 and 7 Site, Associated Non-Linear Facilities, and Spoils Areas on Plant Property (FPL 2011-TN1512; FPL 2011-TN95)
- FPL letter to NRC dated November 5, 2013 – Proposed Turkey Point Units 6 and 7 COLA ER Supplemental Transmission Corridor Information (FPL 2013-TN2941).
- Turkey Point Nuclear Plant COL ER (FPL 2014-TN4058).

The reports by Janus Research, Inc. (FPL 2009-TN1513; FPL 2009-TN1514; FPL 2009-TN1515; FPL 2011-TN1512; FPL 2011-TN95) are available at the Florida SHPO for qualified investigators.

The following sections describe archaeological resources, above-ground resources, and traditional cultural properties that are located within the indirect- and direct-effects APE for the

Turkey Point site. The APEs and research methodology have been generally defined by FPL in consultation with the Florida SHPO, included as Appendix 2.5A in the ER (FPL 2014-TN4058).

The direct-effects APE, which includes physical impacts on known resources resulting from the construction and operation of the Turkey Point site and is referred to as the Units 6 and 7 project area, was defined in the ER (FPL 2014-TN4058) and the Janus Research, Inc. report (FPL 2011-TN1512; FPL 2011-TN95) as follows:

- the Units 6 and 7 plant area
- administration and training buildings and a parking area
- radial collector wells
- FPL RWTF and delivery pipelines
- FPL-owned fill source
- equipment barge-unloading area
- heavy-haul road on the site
- spoils areas on the site.

The indirect-effects APE, which takes into account viewshed impacts on above-ground resources and traditional cultural properties, has been defined by FPL in consultation with the SHPO as a 0.5 mi APE from the project site (FPL 2011-TN1512; FPL 2011-TN95; FPL 2014-TN4058).

2.7.2.1 Archaeological Resources

Over the last 30 years, several archaeological investigations have been completed in the area around the proposed project direct-effects APE, as described by Janus Research, Inc. (FPL 2011-TN1512; FPL 2011-TN95). Between 1980 and 2005, five cultural resource studies were conducted within or within the vicinity of the Turkey Point site (not counting the studies conducted for the current project). Files maintained by the Florida Division of Cultural Resources, a department of the Florida SHPO, show that no cultural resources—including archaeological sites, above-ground resources, and traditional cultural properties—have been recorded within or within 100 ft of the APE (FPL 2011-TN1512; FPL 2011-TN95; FPL 2014-TN4058). Prior to 1963, the area surrounding the site was undeveloped and much of it was inundated.

A Phase I archaeological investigation of the above-listed APE areas was conducted for the application for the Turkey Point COL (FPL 2011-TN1512; FPL 2011-TN95). The investigation involved both systematic pedestrian surveys as well as limited subsurface test excavations. No archaeological sites were identified within the APE. Furthermore, both the field investigation and historical and paleoenvironmental research indicate that, in the past, the area was frequently inundated and has a low potential for containing archaeological resources. This assessment received Florida SHPO concurrence, as documented in a letter dated July 10, 2009, from Florida SHPO to FPL (FPL 2014-TN4058, Appendix 2.5A).

2.7.2.2 Above-Ground Resources

Background research for above-ground resources was completed by qualified staff (FPL 2011-TN1512; FPL 2011-TN95). This research included correspondence with the SHPO, a search of the Florida Master Site File database, review of historic aerial photographs and plat maps, a search of Government Land Office records, and a review of local historical site inventories (FPL 2011-TN1512; FPL 2011-TN95; FPL 2014-TN4058). An above-ground resources survey of the direct-effects and indirect-effects APE revealed no structures older than 50 years. This 50-year minimum age is necessary for eligibility of standing structures in the National Register.

2.7.2.3 Traditional Cultural Properties

No traditional cultural properties (TCPs) were identified in either the direct- or indirect-effects APE by the Phase I work (FPL 2011-TN1512; FPL 2011-TN95). In a letter to FPL dated July 10, 2012, the Florida SHPO concurred with FPL's conclusion concerning the Turkey Point site (FPL 2014-TN4058). By letters dated December 15, 2009, the Miccosukee Tribe of Indians of Florida, the Muscogee (Creek) Nation of Florida, the Seminole Tribe of Florida, the Poarch Band of Creek Indians, and the Seminole Nation of Florida were contacted by FPL describing the proposed Turkey Point project and requesting input (FPL 2014-TN4058). These five tribes were also contacted by the NRC through letters and phone calls regarding the proposed project to invite them to participate in the identification of historic and cultural properties (see Appendix C). The Seminole Tribe of Florida responded to both the NRC (Seminole Tribe of Florida 2010-TN1452) and FPL (2014-TN4058) stating it had no objection to the findings at that time, but requested that it be kept apprised of the project's status and be informed if cultural resources relevant to the Tribe were discovered during the construction process. Because no TCPs have been located or identified, none are likely to be affected. The USACE is the lead Federal agency for Section 106 of the NHPA and for consultation with Federally recognized tribes. The USACE's NHPA Section 106 consultation for this project is ongoing.

2.7.3 Historic and Cultural Resources in Transmission-Line Corridors and Offsite Areas

A description of the transmission line corridors, offsite water pipeline corridors, and associated access roads is included in Section 2.2.2. The direct-effects APE for these offsite linear facilities consists of a 200 ft corridor. The indirect-effects APE, which only applies to the transmission lines because the other facilities would be at or below the ground surface, has been set at 500 ft on either side of the centerline of the alignment, for a total of 1,000 ft. A work plan for a Phase I investigation of these facilities and a schedule for this Phase I work, as well as desktop cultural resources investigations have been completed for the proposed transmission lines (FPL 2009-TN1513; FPL 2009-TN1515; FPL 2011-TN95; FPL 2013-TN2941).

A search of the records at the Florida SHPO showed that numerous cultural and historic resources are recorded in the area. For the eastern transmission line corridor, 25 previous cultural resources studies have been conducted within the direct- and indirect-effects APEs. Two archaeological sites, 191 historic structures, 2 bridges, and 13 resources groups occur in or adjacent to the APE. One of the archaeological sites has been determined ineligible for the

National Register of Historic Places (NRHP), while the other has not been evaluated. Of the 191 buildings, 3 have been listed on the NRHP, 9 have been found ineligible, and the rest of the buildings have not been evaluated for significance. Two of the resource groups—Calle Ocho and the MacFarlane Homestead Historic District—are listed on the NRHP. Three of them have been determined ineligible for the NRHP, and the rest of the 13 groups have not been evaluated (FPL 2009-TN1513; FPL 2011-TN95).

For the original West Preferred transmission line corridor, 25 previous cultural resources studies have been conducted within the direct- and indirect-effects APE. Three archaeological sites, two historic structures, and three resources groups occur in or adjacent to the APE. The two structures and one of the archaeological sites have been found ineligible for the NRHP, while the remaining resources have not been evaluated (FPL 2009-TN1513; FPL 2011-TN95). The analysis of the revised West Consensus corridor (FPL 2013-TN2941), which includes a small shift in a portion of the transmission line route, shows similar results. Indeed, three resources, an archaeological site and two linear resource groups, occur in both. In addition, the APE for the West Consensus corridor contains three additional archaeological sites (for a total of six archaeological sites). One of these is part of an archaeological zone designated by Miami-Dade County. The other two have not been evaluated for NRHP eligibility. The West Consensus corridor also contains those resources present within the portion of the West Preferred corridor that is identical to the West Consensus corridor, including the two historic structures and the remaining resource group (for a total of three resource groups).

For the remaining offsite linear facilities—the reclaimed wastewater and potable water pipeline corridors and the haul road rights-of-way—a total of 12 cultural resources studies have been conducted in the APE and no cultural resources have been identified (FPL 2009-TN1513; FPL 2011-TN95).

In addition to the desktop research for the transmission line APE, FPL also conducted a search of the National Register and Florida SHPO site files for a distance of 1.2 mi from the eastern and western transmission line corridors. The research for the offsite linear facilities identified 359 resources and 16 resource groups located with 1.2 mi of these facilities. Fifty-eight of these resources are archaeological sites, of which six have been destroyed. Forty-two are prehistoric sites, three are historic sites, four are multicomponent prehistoric and historic sites, and nine are unidentified. Site types include prehistoric artifact scatters, prehistoric habitation sites, a quarry, human burial sites, and historic road segments. Fifteen of the sites, 13 prehistoric and 2 multicomponent, contain known human remains (FPL 2009-TN1513; FPL 2011-TN95).

Most of the archaeological sites are located in the northern portion of the offsite area, near the northern segment of the proposed transmission line. Many of these also occur in the indirect-effects APE. This area falls in unincorporated Dade County west of the developed metropolitan area from Everglades National Park in the south, and north to the area around Pennsuco substation. Other archaeological sites are found in Aladdin City, Florida City, Goulds, Hialeah, Hialeah Gardens, Homestead, Medley, Miami, and Pennsuco. In addition, the northern-most portion of the eastern transmission line is located within the North Bank and West Bank Archaeological zones, and within 500 ft of the South Bank Archaeological Zone, as designated by the City of Miami (FPL 2009-TN1513; FPL 2011-TN95).

Of the 58 archaeological sites, 3 are ineligible for the NRHP and the rest have not been evaluated, although 5 are noted by the Florida SHPO as potentially eligible. In addition, nine of the sites are listed as significant by the Miami-Dade Historic Preservation Board (FPL 2009-TN1513; FPL 2011-TN95).

The FPL search of this larger 1.2 mi study area also identified 303 historic structures, one of which has been destroyed, likely by hurricanes. Based on available information, most of the historic structures are residences, although public and commercial buildings are present as well. Four of the structures are listed on the NRHP, and 21 are listed by the Miami-Dade Historic Preservation Board. In addition, one historic cemetery—an early twentieth century African-American cemetery located in Miami—falls within 1.2 mi of the offsite area. The cemetery is included on a list of significant resources by the Miami-Dade Historic Preservation Board (FPL 2009-TN1513; FPL 2011-TN95).

There also are 16 resource groups within the 1.2 mi search area. Ten of the groups are linear resources, primarily roads that extend through multiple towns. One of these is listed on the NRHP, three are ineligible for listing, and the remaining six have not been evaluated for significance. Four of the resource groups are historic districts. One is listed on the NRHP and one is listed by the Miami-Dade Historic Preservation Board. The remaining two resource groups consist of a mixed period district and a multiple property submission. Neither has been evaluated for significance (FPL 2009-TN1513; FPL 2011-TN95).

In addition to the desktop studies, FPL provided a separate work plan that describes the additional work that would be required once a transmission line corridor is selected (FPL 2009-TN1515; FPL 2011-TN95). SHPO has concurred with the adequacy of this work plan, which stipulates coordination with appropriate local government representatives, additional Tribal coordination, development of an unanticipated finds plan (including personnel training), and archaeological and architectural resource surveys. If resources cannot be avoided, including those identified in the desktop study and any additional resources that might be identified during future survey efforts, then appropriate minimization or mitigation measures would need to be developed in coordination with the SHPO.

2.7.4 Consultation

In June of 2010, the NRC initiated consultation on the proposed action by writing to the Florida SHPO (NRC 2010-TN1453) and the Advisory Council on Historic Preservation (ACHP) (NRC 2010-TN1454). The NRC received a reply from the Florida SHPO on July 28, 2010 (FDHR 2010-TN1455), which indicated that the office received the cultural resource assessment from FPL and that, for the Units 6 and 7 project area, no historic or cultural resources had been identified to date. The NRC received correspondence from the ACHP on July 8, 2010 (ACHP 2010-TN1456), which summarized NRC's requirements under Section 106 of the NHPA and 36 CFR Part 800 (TN513). In addition, the NRC met with Florida SHPO staff on June 10, 2010, at which time the SHPO concurred with the adequacy of Tribal consulting parties identified by the NRC and the cultural resources survey work performed by FPL to that point, but stressed the need for an inadvertent discovery plan for the treatment of unanticipated resources that might be discovered during construction of the project (NRC 2010-TN1457). The SHPO indicated that, while the proposed Units 6 and 7 project site has a low potential for

encountering cultural resources, the routes of the proposed transmission line corridors and other offsite facilities occur in areas containing historical districts and other sensitive resources. The SHPO also recommended coordination with the Miami-Dade County Office of Historic and Archaeological Resources for the identification and treatment of resources.

The NRC sent a letter to the Miami-Dade County Office of Historic and Archaeological Resources on July 1, 2010 (NRC 2010-TN1458), inviting them to participate as a consulting party (see Appendix C). The Office of Historic and Archaeological Resources responded by letter dated August 12, 2010 (Miami-Dade County 2010-TN1459), acknowledging their willingness to participate in the project, and requesting the opportunity to participate in and provide input on historical resources studies for the project. The NRC also sent scoping letters to the Archaeological and Historical Conservancy, Inc., the Historic Preservation Officer of the City of Miami, the Historic Preservation Administrator of the City of Coral Gables, the Assistant Director, Community Redevelopment Agency of the City of Homestead, and the Director of Planning and Zoning of the City of South Miami (see Appendix C for scoping letters) On July 15, 2010, the NRC conducted public scoping meetings in Homestead, Florida, at which no comments or concerns regarding historic and cultural resources were made.

By letters dated June 24, 2010, the NRC initiated consultations with five Federally recognized tribes—the Miccosukee Tribe of Indians of Florida, the Muscogee (Creek) Nation of Florida, the Seminole Tribe of Florida, the Poarch Band of Creek Indians, and the Seminole Nation of Florida—regarding the proposed COL application (see Appendix C for complete listing). In the letter, the NRC provided information about the proposed action and indicated that review under the NHPA would be integrated with the NEPA process in accordance with 36 CFR 800.8(c) (TN513). The letter also provided the recipients with an opportunity to identify concerns and provide advice on the evaluation of historic properties, including those of traditional, religious, and cultural importance, and to participate in any necessary resolution of adverse effects to such properties. On July 29, 2010, the NRC also conducted follow-up calls to the tribes.

The Seminole Tribe of Florida responded by letter on September 14, 2010 (Seminole Tribe of Florida 2010-TN1452), stating that the project occurs in its geographic area of interest. The Tribe requested that surveys be conducted in all unsurveyed portions of the project, including transmission line corridors, and that it be kept informed of any future studies or identified cultural resources.

On October 20, 2010, the NRC and the USACE met with the Seminole Tribe of Florida to discuss the Turkey Point project (NRC 2010-TN1460). During the meeting, the NRC presented a summary of the project and a review of NRC's role. The Tribal Historic Preservation Officer (THPO) for the Seminole Tribe of Florida stressed that the THPO's role is limited to review under the NHPA. The THPO also requested participation in the development of any work plans and future studies, and stressed the possibility of encountering both historic resources important to the Tribe as well as deeply buried resources that might be unearthed during construction, particularly in regard to the offsite facilities such as the transmission lines.

In letters dated October 23, 2014 (NRC 2014-TN4055; NRC 2014-TN4056; NRC 2014-TN4057; NRC 2014-TN4059; NRC 2014-TN4060; NRC 2014-TN4061; NRC 2014-TN4062; NRC 2014-TN4065; NRC 2014-TN4066), the NRC provided an update of the status of the COL review to the Florida SHPO, the ACHP, the Miami-Dade County Office of Historic and Archaeological

Resources, the Archaeological and Historical Conservancy, Inc., the Historic Preservation Officer of the City of Miami, the Historic Preservation Administrator of the City of Coral Gables, the Assistant Director, Community Redevelopment Agency of the City of Homestead, and the Director of Planning and Zoning of the City of South Miami. The primary purpose of the letters was to inform the agencies that, following discussions between the NRC and the USACE, the NRC and USACE determined that the USACE would be the lead Federal agency for Section 106 of the NHPA for the project and for consultation with Federally recognized tribes. The NRC would continue in its role as lead agency in the production of the draft EIS.

Also in letters dated October 23, 2014 (NRC 2014-TN4063; NRC 2014-TN4064) the NRC informed the Muscogee (Creek) Nation of Florida and the Seminole Tribe of Florida of this change in lead agency for Section 106 of the NHPA. The NRC also informed the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida of a request for a consultation meeting with the NRC, the USACE, and the tribes prior to the publication of the draft EIS.

2.8 Geology

A summary of the geology of the Turkey Point site is provided in Section 2.6 of the ER (FPL 2014-TN4058). The geology and associated seismological and geotechnical conditions at the Turkey Point site are described in greater detail in Section 2.5 of the FSAR (FPL 2014-TN4069). Both the ER and the FSAR incorporated information obtained from onsite subsurface investigations performed in support of the COL application. The NRC staff also used information from exploratory well EW-1 (FPL 2012-TN1577) drilled by FPL in support of the UIC injection permit, and other publicly available documents on the geology of the site. The NRC staff's description of the geological features and the technical analyses related to safety issues will be presented in the Safety Evaluation Report.

The Turkey Point site lies near the southern end of the Atlantic Coastal Plain physiographic province of North America (Miller 1990-TN550). The site is within the "Coastal Marshes and Mangroves" subprovince and just east of a higher elevation area called the "Atlantic Coastal Ridge" subprovince (Renken et al. 2005-TN110). The geologic setting is near the eastern edge of the South Florida Basin, where up to 20,000 ft of rock was deposited during the Mesozoic and Cenozoic eras in a shallow sea environment with a slowly subsiding landmass (Pressler 1947-TN2472; Palacas 1978-TN2473).

The carbonate formations underlying southeastern Florida are predominantly limestone with dolomitic limestone and dolomite being common in the lower sections below about 1,000 ft deep (Reese 1994-TN1439). Figure 2-40 shows the generalized geologic formations and corresponding hydrostratigraphy at the Turkey Point site. Aquifers are defined based on their permeability with the productive zones classified as aquifers and the low-permeability intervals classified as confining or semi-confining units. Two major aquifer systems are found within the Cenozoic sediments that underlie the Turkey Point site. The surficial aquifer system (Biscayne aquifer) is separated from the deeper Floridan aquifer system by the low-permeability sediments of the Hawthorn group, which form a confining unit above the Floridan aquifer system. Permeable zones are found in some places in Florida within the Hawthorn confining unit and form local aquifers that are collectively called the intermediate aquifer system. However, these permeable zones and the intermediate aquifer system are not present in southeastern Florida (Miller 1990-TN550).

SERIES	STRATIGRAPHIC UNIT		LITHOLOGY	TOP DEPTH (ft)	THICK-NESS (ft)	HYDRO-GEOLOGIC UNIT	TOP DEPTH (ft)
HOLOCENE	organic muck		organic soil and silt	0	3	Biscayne Aquifer	0 - 3
PLEISTOCENE	Miami Formation		sandy, oolitic limestone	3	25		
	Key Largo Limestone		well indurated, vuggy, coraline limestone	28	22		
	Ft Thompson Formation		poor/well indurated fossiliferous limestone	50	65		
PLIOCENE	Tamiami Formation		sand and silt with calcarenite limestone	115	105		
						Intermediate Confining Unit	140
MIOCENE	Hawthorne Group	Peace River Formation	silty calcareous sand and silt	220	235		
		Arcadia Formaion	calcareous wackestone with indurated limestone, sandstone and sand	455	555		
OLIGO-CENE	Suwannee Limestone		fine-grained limestone and dolomitic limestone	1010	245	Upper Floridan Aquifer (USDW)	1010
EOCENE	Avon Park Formation		fine-grained limestone and dolomite	1255	(~445)	Middle Floridan Confining Unit	1450
			permeable limestone	(~1700)	(~75)	APPZ (?)	(1700)
			fine-grained limestone and dolomite	(1775)	745	Middle Floridan Confining Unit	1930
	Oldsmar Formation		limestone, dolomitic limestone and dolomite	2580	450		
						Lower Floridan Aquifer	2915
			Boulder Zone	3030	>200	Boulder Zone	3030
PALEO-CENE	Cedar Keys Formation		dolomite and dolomitic limestone	?	?		
			massive anhydrite beds	?	1200 ?	Sub-Floridan Confining Unit	?

(?) denotes uncertainty

Figure 2-40. The Generalized Stratigraphy and Corresponding Hydrogeologic Units at the Turkey Point Site (FPL 2012-TN1577, Reese and Richardson 2008-TN3436, and FPL 2014-TN4069).

The uppermost part of the surficial aquifer beneath the Turkey Point site is called the Biscayne aquifer; it is composed of the Miami Limestone, Key Largo Limestone, and Fort Thompson Formation. The Biscayne aquifer is about 110 ft thick at the Turkey Point site (FPL 2014-TN4058). The Floridan aquifer system occurs at a depth of approximately 1,000 ft in the Miami-Dade County area and is separated from the surficial aquifer system by approximately 600 ft of Intermediate Confining Unit (Reese 1994-TN1439). The Floridan aquifer system consists of two

main permeable sequences, the Upper Floridan and Lower Floridan aquifers, separated by a less permeable MCU. The Upper Floridan aquifer includes the Suwannee and Ocala limestones and the upper part of the Avon Park Formation. The Floridan aquifer system occurs under confined conditions at the Turkey Point site and throughout southeastern Florida.

The Lower Floridan aquifer includes the lower part of the Avon Park Formation, the Oldsmar Limestone, and the upper part of the Cedar Keys Formation. Much of the Lower Floridan aquifer contains saltwater. An extremely permeable zone called the Boulder Zone is present within a karstic fractured dolomite layer within the Lower Floridan aquifer in southeastern Florida. The Boulder Zone contains water the salinity and temperature of which is similar to modern seawater (Miller 1990-TN550). The top of the Boulder Zone was identified at 3,030 ft below the surface at the Turkey Point site and is separated from the Upper Floridan aquifer by more than 750 ft of low-permeability confining unit (FPL 2009-TN2474). Within the Boulder Zone, seawater is thought to move westward from a connection with the Atlantic Ocean and migrate very slowly upward through the MCU (Meyer 1988-TN2475).

FPL's investigation of the site revealed no features or lineaments associated with faulting on the site and determined that a continuous horizontal stratigraphy is present with no faults or folds related to tectonic deformation within a 25 mi radius (FPL 2014-TN4058).

2.9 Meteorology and Air Quality

The following sections describe the climate and air quality at the Turkey Point site. Section 2.9.1 describes the climate of the region and area in the immediate vicinity of the Turkey Point site, Section 2.9.2 describes the air quality of the region, Section 2.9.3 describes atmospheric dispersion at the site, and Section 2.9.4 describes the meteorological monitoring program at the site.

2.9.1 Climate

The Turkey Point site is located in Miami-Dade County, on the lower east coast of Florida close to the Atlantic Ocean. The climate at this location is best classified as subtropical maritime, and it is characterized as having two principal seasons—a relatively short, dry, and mild winter, and a long warm summer season with abundant rainfall (NCDC 2008-TN540). The Azores-Bermuda high-pressure system dominates the circulation pattern for most of the year causing a tropical air mass to prevail most of the year. Occasional cold continental air masses displace the maritime air during winter.

The closest first-order National Weather Service station is at the Miami International Airport, about 25 mi north of the site. This station represents the general climate at the Turkey Point site. The climatological cooperative observing station at Miami 12° SSW about 16 mi north-northeast of the site is also representative of the site, and is more indicative of the diurnal variation of precipitation and temperature at the site because of its proximity to the coast. However, the Miami 12° SSW site only records daily maximum and minimum temperature and precipitation data. Other sites within 50 mi of the Turkey Point site were also included in the assessment to characterize potential extremes in precipitation, wind, and temperature.

The following climatological statistics are derived from local climatological data collected at Miami International Airport. Temperatures are more variable in the winter than in the summer because of the strong differences in source regions from which the seasonal air mass originates. Daytime maximum temperatures range from about 77°F in January to about 91°F in July and August; nighttime minimum temperatures range from about 60°F in January to about 77°F in July and August. At the Turkey Point site these maximum and minimum averages are moderated due to the ocean's moderating influence. At Miami International Airport the monthly average wind speeds range from about 10 mph in March to about 8 mph in July and August. At Turkey Point site, monthly average wind speeds are slightly lower, averaging about 9 mph in March to about 7.5 mph in July and August. The normal amount of annual precipitation received at Miami International Airport is 58.53 in. The majority (about 53 percent) of the annual rainfall is associated with thunderstorms that frequently occur from June through September. On average during this period, thunderstorms occur on between 12 and 16 days per month. Average precipitation ranges from about 2 in. per month in January and February and peaks at about 8.5 in. per month in August. The only observation of frozen precipitation near the Turkey Point site was a trace (0.05 in.) observed at Homestead, Florida, on January 19, 1977. The Turkey Point site is flat with no topographical features that should cause the climate to deviate significantly from this general regional climate.

Recent improvements in the emissions and the science of climate change have enabled the U.S. Global Change Research Program (GCRP) to estimates regional climate changes in the United States (GCRP 2014-TN3472). The projected change in temperature by 2100, which encompasses the period of the licensing action in the southeastern United States. is a regional average increase of between 4°F to 8°F in the annual average temperature. While the GCRP has not incrementally forecasted the change in precipitation by decade to align with the licensing action, the projected change in precipitation in spring and summer rainfall is projected to decline in South Florida during this century (GCRP 2014-TN3472).

Based on the assessments of the GCRP and the National Academy of Sciences' National Research Council, the EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare (74 FR 66496) (TN245). The EPA indicated that, while ambient concentrations of GHGs do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. As a result of the determination by the EPA and the recognition that mitigative actions are necessary to reduce impacts, the effects of GHG on the climate and the environment is already noticeable, but not yet destabilizing. In CLI-09-21, the Commission provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its NEPA reviews and directed that it should encompass emissions from constructing and operating a facility as well as from the fuel cycle (NRC 2009-TN539). Further, the President's CEQ (2010-TN281) has provided draft guidance on how the Federal government should analyze the environmental effects of GHG emissions and climate change when it describes the environmental effects of a project under NEPA. The review team characterized the affected environment and the potential GHG impacts of the proposed action and alternatives in this EIS. Consideration of GHG emissions was treated as an element of the existing air quality assessment that is essential in a NEPA analysis. In addition, where it was important to do so,

the review team considered the effects of the changing environment during the period of the proposed action on other resource assessments.

2.9.1.1 Wind

Wind at the Turkey Point site is consistent with the dominant influence of the Azores-Bermuda high and the coastal location of the site. The seasonal variation of the prevailing directions shows a predominance of east-southeast winds except in December, January, and February when north-northwesterly winds prevail, and in September, October, and November when easterly winds prevail (FPL 2014-TN4058). The coastal location of the site experiences typical onshore (east-southeast) winds during the day and offshore land-breeze winds during mid-morning hours. However the review team's analysis of the Turkey Point site data showed that wind reversal was a moderately frequent event and that the dominate wind direction is from the east-southeast regardless of the time of day. Wind direction persistence is generally limited to 4 hours or less; persistence of 8 hours or longer occurs less than 9 percent of the time, and persistence of 12 hours or longer occurs about 3 percent of the time based on the Turkey Point onsite 10 m wind data.

2.9.1.2 Temperature

The period of record for the onsite temperature data does not cover multiple decades. Consequently, it was determined that the average temperature at the Turkey Point site is most likely consistent with the temperature data from the Miami 12 SSW station (period of record 1958–1988) based on its relative proximity to the Turkey Point site and its near-coastal location. Based on data in Table 2.7-4 of the FPL ER (FPL 2014-TN4058) for observations at 13 National Weather Service (NWS) and cooperative observing stations and the climatological record for the Miami International Airport NWS station, the temperature extremes at the site are between 25°F and 97°F. The mean monthly maximum temperature is 83°F and the mean monthly minimum is 66°F.

2.9.1.3 Atmospheric Moisture

The Turkey Point meteorological system does not measure any parameters related to atmospheric moisture. Consequently, the review team determined the relative humidity data for Miami International Airport is representative of the Turkey Point site. Relative humidities for 0700 local standard time (LST) approximate the daily maximum values. Monthly average 0700 LST relative humidities range from about 85 percent in January to about 79 percent in April. Relative humidities for 1,300 LST approximate the daily minimum relative humidity. Monthly average 1,300 LST relative humidities range from a high of about 66 percent in September to a low of about 54 percent in April. Climatological statistics for Miami International Airport indicate that the Turkey Point site could expect heavy fog about 5 days per year. The likelihood of fog is greatest from December through February and least from May through September.

2.9.1.4 Severe Weather

The Turkey Point site can experience severe weather in the form of thunderstorms, tornadoes, and tropical storms. Thunderstorms are the most frequent severe weather events. They occur

on an average about 73 days per year at Miami International Airport. About three-fourths of the thunderstorms occur in the period of June through September. Fifty hurricanes have made landfall within 100 mi of Turkey Point since 1851 or about three every 10 years. Three of these tropical cyclones have had sustained wind speeds in excess of 155 mph that have tracked within 100 nautical mi of the Turkey Point site; the most recent being hurricane Andrew in 1992 (NOAA 2011-TN541; Jarvinen et al. 1984-TN276). Hurricane Andrew was historic because it was the first time that a hurricane significantly affected a commercial nuclear power plant. The eye of the storm, featuring sustained winds of up to 145 mph and gusts of 175 mph, passed over the Turkey Point site and caused extensive onsite and offsite damage. However, there was no damage to the safety-related systems of Units 3 and 4 except for minor water intrusion and some damage to insulation and paint (NRC 1993-TN542). Tornadoes are the least frequent of these extreme weather events. Using tornado statistics from 1950 through 2003 and the methodology outlined in NUREG/CR–4461, *Tornado Climatography of the Contiguous United States* (Ramsdell and Rishel 2007-TN277), the probability of a tornado striking the nuclear island at the Turkey Point site is about 2×10^{-4}/yr.

2.9.1.5 Atmospheric Stability

Atmospheric stability is a derived meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined for the lowest layer of the atmosphere by the difference in temperature between two heights separated by at least 30 m. A seven-category atmospheric stability classification scheme based on temperature differences is set forth in Regulatory Guide 1.23, Revision 1 (NRC 2007-TN278). When the temperature decreases rapidly (<-1.5°C per 100 m) with height, the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height, the atmosphere is stable and dispersion is more limited. Typically, the atmospheric stability is neutral to unstable during the day and neutral to stable at night. Cloudiness and high winds tend to decrease both stability and instability, thereby resulting in more nearly neutral conditions.

Measurements at the 10 and 60 m levels of the Turkey Point meteorological tower are used to determine atmospheric stability for the Turkey Point site. On an annual basis, the atmosphere at the Turkey Point site is stable about 53 percent of the time, neutral about 28 percent of the time, and unstable about 19 percent of the time. These percentages vary seasonally with more frequent unstable conditions in the spring and winter, and more frequent neutral conditions in the summer and fall (FPL 2014-TN4058).

2.9.2 Air Quality

The discussion of air quality includes the six common “criteria pollutants” for which the EPA has set National Ambient Air Quality Standards (NAAQSs) (ozone [O_3], particulate matter [PM_{10} and $PM_{2.5}$; particulate matter with a mean aerodynamic diameter of less than or equal to 10 microns and 2.5 microns; respectively], carbon monoxide [CO], nitrogen dioxide [NO_2], sulfur dioxide [SO_2], and lead [Pb]). The air-quality discussion also includes heat-trapping GHGs (primarily carbon dioxide [CO_2]), which have been the principal factor causing climate change over the last 50 years (GCRP 2014-TN3472).

Climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the GCRP has been considered in preparation of this EIS. The GCRP report (GCRP 2014-TN3472) synthesizes the work of the Federal government on climate change. Climate-related changes include rising temperatures and sea levels; increased frequency and intensity of extreme weather (e.g., heavy downpours, floods, and droughts); earlier snowmelts and associated frequent wildfires; and reduced snow cover, glaciers, permafrost, and sea ice. GHGs are transparent to incoming short-wave radiation from the sun but opaque to outgoing long-wave (infrared) radiation from the Earth's surface. The net effect over time is a trapping of absorbed radiation and a tendency to warm the Earth's atmosphere, which together constitute the "greenhouse effect."

The Turkey Point site is in southeast Miami-Dade County, Florida, which is part of the Southeast Florida Intrastate Air Quality Control Region. All of the counties (Broward, Miami-Dade, Indian River, Martin, Monroe, Okeechobee, Palm Beach, and St. Lucie) within this control region are in attainment of the NAAQSs (40 CFR 81.310) (TN255). There is one Class I Federal Area where visibility is an important value within 100 mi of the Turkey Point site. This is the Everglades National Park located approximately 13 mi west of the site of proposed Units 6 and 7 (40 CFR 81.407) (TN255).

2.9.3 Atmospheric Dispersion

As described in Section 2.9.4, the NRC staff visited the meteorological measurement system at the Turkey Point site, reviewed the available information about the design of the meteorological measurement program, and evaluated data collected by the program. Based on this information, the NRC staff concludes that the program provides data that represent the affected environment onsite meteorological conditions as required by 10 CFR 100.20 (TN282). The data also provide an acceptable basis for estimating atmospheric dispersion for the evaluation of the consequences of routine and accidental releases as required by 10 CFR 50.34 (TN249), 10 CFR Part 50 (TN249), Appendix I, and 10 CFR 52.79 (TN251).

2.9.3.1 Short-Term Dispersion Estimates

FPL calculated short-term dispersion estimates for the Turkey Point site using 3 years of onsite meteorological data for the years 2002, 2005, and 2006. These estimates, which were provided in ER Section 2.7.5, were based on distances to the exclusion area boundary (EAB) and outer boundary of the low-population zone (LPZ) in ER Table 2.7-12. The exclusion area and LPZ are defined in 10 CFR 50.2 (TN249). The NRC staff reviewed these data and calculations to determine whether the short-term dispersion estimates were appropriate for use in the EIS design basis accident (DBA). The short-term dispersion estimates for use in the DBA calculations are listed in Table 2-55. They are based on the PAVAN computer code (Bander 1982-TN538) calculations of 1-hour and annual average atmospheric dispersion factor (χ/Q) values from a joint frequency distribution of wind speed, wind direction, and atmospheric stability. These values were calculated for the shortest distances from a release boundary envelope that encloses the proposed Turkey Point Unit 6 or Unit 7 release points to the EAB and to the LPZ. The 50 percent EAB χ/Q value listed in Table 2-55 is the median 1-hour χ/Q, which is assumed to persist for 2 hours. The 50 percent LPZ χ/Q values listed in Table 2-55 were determined by logarithmic interpolation between the median 1-hour χ/Q, which was

assumed to persist for 2 hours, and the annual average χ/Q. This approach is consistent with the procedure described in Regulatory Guide 1.145 (NRC 1983-TN279), and the NRC staff concluded that the site-specific short-term dispersion estimates are appropriate for use in the EIS DBA review.

Table 2-55. Atmospheric Dispersion Factors for Proposed Units 6 and 7 Design Basis Accident Calculations

Time Period	Boundary	χ/Q (s/m^3)
0 to 2 hours	exclusion area boundary	1.89×10^{-4}
0 to 8 hours[(a)]	low-population zone	5.29×10^{-6}
8 to 24 hours[(a)]	low-population zone	4.02×10^{-6}
1 to 4 days[(a)]	low-population zone	2.21×10^{-6}
4 to 30 days[(a)]	low-population zone	9.39×10^{-7}

(a) Times are relative to the beginning of the release to the environment.

2.9.3.2 Long-Term Dispersion Estimates

Long-term dispersion estimates for use in evaluation of the radiological impacts of normal operations were calculated by FPL using the XOQDOQ computer code (Sagendorf et al. 1982-TN280). This code implements the guidance set forth in Regulatory Guide 1.111 (NRC 1977-TN91) for estimation of χ/Q and atmospheric deposition factors (D/Q) for use in evaluation of the consequences of normal reactor operations. The XOQDOQ model uses the diffusion parameters as specified in Regulatory Guide 1.145 (NRC 1983-TN279). The NRC reviewed the model inputs and distances from the release point to the nearest residence, EAB, school, vegetable garden, and meat animal. No residential milk cows were identified with 5 mi of the Turkey Point site and no dairies within 50 mi. Site-specific meteorological data covering the 3-year period (2002, 2005, and 2006) were used to determine the diffusion estimates.

Table 2-56 summarizes the results of the maximum annual average χ/Q and D/Q predicted by XOQDOQ for the sensitive receptors of interest in the area as a result of routine releases of effluents. The listed maximum values are results for several plume depletion scenarios that account for radioactive decay: no decay, half-life decay of 2.26 and 8 days. Table 2-56 also includes χ/Q and D/Q estimates at the proposed Unit 7 location for releases from proposed Unit 6 for use in estimating Unit 7 construction worker doses after Unit 6 begins operation.

2.9.4 Meteorological Monitoring

There has been a meteorological monitoring program at the Turkey Point site since the early 1970s. The initial measurements were to provide the onsite meteorological information required for licensing of existing Turkey Point Units 3 and 4. Measurements have continued in support of existing Turkey Point Units 3 and 4 operations. The meteorological system was last upgraded to enhance its reliability in 2007 in support of the proposed new Units 6 and 7 Distributed Control System installation (FPL 2014-TN4058). These improvements were directed at improving reliability, maintainability, and communication.

Table 2-56. Maximum Annual Average Atmospheric Dispersion and Deposition Factors for Evaluation of Normal Effluents for Receptors of Interest

Receptor	Downwind Sector	Distance (mi)	No Decay χ/Q (s/m^3)	2.26-Day Decay χ/Q (s/m^3)	8-Day Decay χ/Q (s/m^3)	D/Q (1/m^2)
EAB	W	0.49	1.7×10^{-5}	1.7×10^{-5}	1.6×10^{-5}	1.4×10^{-7}
EAB	SE	0.36	1.7×10^{-5}	1.7×10^{-5}	1.6×10^{-5}	5.2×10^{-8}
Property Boundary	SSE	0.35	3.4×10^{-5}	3.4×10^{-5}	3.2×10^{-5}	1.2×10^{-7}
Residence	N	2.7	1.4×10^{-7}	1.3×10^{-7}	1.1×10^{-7}	7.5×10^{-10}
Satellite School	NW	2.0	5.2×10^{-7}	5.2×10^{-7}	4.3×10^{-7}	2.9×10^{-9}
Meat Animal	NW	4.0	1.3×10^{-7}	1.3×10^{-7}	1.0×10^{-7}	5.8×10^{-10}
Veg. Garden	NW	4.8	9.6×10^{-8}	9.4×10^{-8}	7.2×10^{-8}	3.8×10^{-10}
Unit 7 Reactor	W	0.13	1.6×10^{-4}	1.6×10^{-4}	1.5×10^{-4}	1.0×10^{-6}

The instrument systems are described in Section 6.4 of the FPL ER (FPL 2014-TN4058). The primary meteorological tower (South Dade) is situated about 5.8 mi southwest of the location of proposed Units 6 and 7. The primary meteorological tower instruments include sensors to measure wind speed and direction, temperature, and sigma theta (standard deviation in wind direction) at 10 m and 60 m above ground, precipitation, barometric pressure, and solar radiation. A 10 m backup meteorological tower is located about 0.4 mi northwest of the location of proposed Units 6 and 7. Instrumentation on the backup tower consists of sensors to measure wind speed and direction and sigma theta at 10 m and precipitation near ground level. Table 6.4-4 of FPL's ER (FPL 2014-TN4058) lists the instrumentation in the current measurement system and compares instrument specifications with criteria set forth in NRC guidance and industry standards.

The NRC staff viewed the meteorological site and instrumentation and reviewed the available information about the meteorological measurement program, which included maintenance, calibration, and audit records. The NRC staff then evaluated the data-collection program and then, based on this information, concluded that the program provides data that represent the affected environment onsite wind and stability conditions as required by 10 CFR 100.20 (TN282). The NRC staff did note however, that for certain wind directions the South Dade tower monitoring building interferes with wind data collection, but only for a small percentage of time due to the prevailing wind direction pattern. The data also provide an acceptable basis for making estimates of atmospheric dispersion for the environmental review evaluation of the consequences of routine and accidental releases required by 10 CFR 50.34 (TN249), 10 CFR Part 50 (TN249), Appendix I, and 10 CFR 52.79 (TN251).

2.10 Nonradiological Health

This section describes aspects of the environment at the Turkey Point site and within the vicinity of the site that are associated with nonradiological human health impacts. It provides the basis for evaluation of impacts on human health from site preparation, construction, operation, and decommissioning of proposed Turkey Point Units 6 and 7. Building activities, noise, and the transportation of construction materials and personnel to the Turkey Point site all have the

potential to affect the health of the public and/or workers. Operation of proposed Units 6 and 7 has the potential to affect the public and workers at the Turkey Point site through operation of the cooling system, noise generated by operations, electromagnetic fields generated by transmission systems, and transportation of operations and outage workers to and from the Turkey Point site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the Turkey Point site and vicinity associated with air quality, etiological agents (i.e., disease-causing microorganisms), and occupational injuries.

2.10.1.1 Air Quality

Public and occupational health can be affected by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996-TN288). The potential impact of these changes on compliance with air-quality standards for the Turkey Point site and Miami-Dade County are discussed in Section 2.9.2. Air-quality measures include particulate matter, such as fugitive dust and selected gaseous pollutants. Particulates can be released into the atmosphere during excavation of muck, backfilling, grading and compacting, concrete batching, and vehicular travel over paved and unpaved roads. Particulates and other emissions can be released by construction equipment and vehicles used for hauling debris, soil, construction equipment, and supplies. Smoke would be released if open burning is conducted during site-clearing and site-preparation activities.

Exhaust emissions during normal plant operations associated with onsite vehicles and equipment as well as from commuter traffic also can affect air quality and human health. Nonradiological supporting equipment (e.g., diesel generators, fire pump engines) and other nonradiological emission-generating sources (e.g., storage tanks) and activities are expected to be a source of pollutant emissions. Diesel generators and supporting equipment would be in place for emergency use only but would be started regularly to verify that the systems are operational.

Recirculating mechanical draft wet cooling is a typical cooling method for power plants that also is associated with air emissions. Unit 5 uses this method, supplied with cooling-tower makeup water from the Upper Floridan aquifer. The blowdown (or draw-off), used principally to control the buildup of minerals in the water, is routed to the IWF. Most of the water typically leaves the plant via the cooling towers by evaporation and aerosolization, often referred to collectively as “drift” (although technically drift generally refers only to the aerosolized portion). The evaporated portion includes gaseous forms of chemicals, including volatile “contaminants of emerging concern”, or CECs (EPA 2012-TN1018), which can be inhaled by plant workers and the public. Aerosol drift results in particulate matter that is formed as the salts and chemicals, including CECs, precipitate. Furthermore, aerosol drift can contain etiological agents, depending on the degree of disinfection used (and as described in the next section). If exposure to any of these hazards is greater than health-based thresholds, such as minimum infective doses for pathogens, particulate matter standards, or minimal risk levels for chemicals,

then risks could be considered significant and thus require mitigation such as additional treatment or setback distances from the towers.

As noted in the ER (FPL 2014-TN4058) and SCA (FPL 2009-TN1246), and as illustrated in Figure 2-41, the nearest receptors to proposed Units 6 and 7, as measured from the center of the proposed site area, are as follows:

- The nearest school (day-care center) is 2 mi northwest.
- The nearest transient residence is 2.7 mi north (in Homestead Bayfront Park).
- The nearest known food (meat) animal is 2.7 mi north.
- The nearest permanent residence is 3.9 mi northwest.
- The nearest known vegetable garden is 4.8 mi northwest (not shown).

Emissions from nonradiological air pollution sources, including the "criteria pollutants," i.e., sulfur dioxide, particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}), particulate matter with aerodynamic diameters of 2.5 microns or less ($PM_{2.5}$), carbon monoxide, nitrogen dioxide, lead, and ozone, are controlled through compliance with Federal, State, and local regulations. Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being "better than," "unclassifiable/attainment," or "cannot be classified or better than national standards" (depending on the pollutant and other factors). FPL notes that the Southeast Florida Intrastate Air Quality Control Region (AQCR), which includes Miami-Dade County, was in attainment for these pollutants in 2008 (FPL 2014-TN4058). The AQCR was still in attainment in 2011 (40 CFR 81.310) (TN255).

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation, and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. The U.S. Bureau of Labor Statistics provides reports that account for occupational injuries and illnesses as total recordable cases (TRC), which includes those cases that result in death, loss of consciousness, days away from work, restricted work activity or job transfer, or medical treatment beyond first aid (BLS 2011-TN668). The State of Florida also tracks the annual incidence rates of injuries and illnesses for electric power generation, transmission, and distribution workers (BLS 2012-TN669). These records of statistics are used to estimate the likely number of occupational injuries and illnesses for operation of the current units and predict the likely number of cases for the proposed new units.

The average TRC incidence rate for the Turkey Point Units 3 and 4 workforce for 2004 through 2008 was reported to be 0.4 cases per 100 workers (FPL 2014-TN4058). These rates are substantially lower than expected based on data for the industry overall. As seen in Table 2-57, rates of injuries and illnesses per 100 full-time workers for years 2003-2010 in the heavy and civil engineering construction sector – an important sector baseline for assessing building impacts (Chapter 4) – ranged from 3.8 to 5.9 for the United States and 2.4 to 7.0 for Florida. While some reduction in TRC incidence rate over time is seen for the United States as a whole, other than the period from 2003 to 2004, there is a clearer and more substantial reduction over time for

Florida. For the same years, rates of injuries and illnesses in the electric power generation, transmission, and distribution sector – an important sector baseline for assessing operational impacts (Chapter 5) – ranged from 2.8 to 5.0 for the United States and 2.1 to 3.9 for Florida. Reductions over time are apparent in this sector for both the United States and Florida.

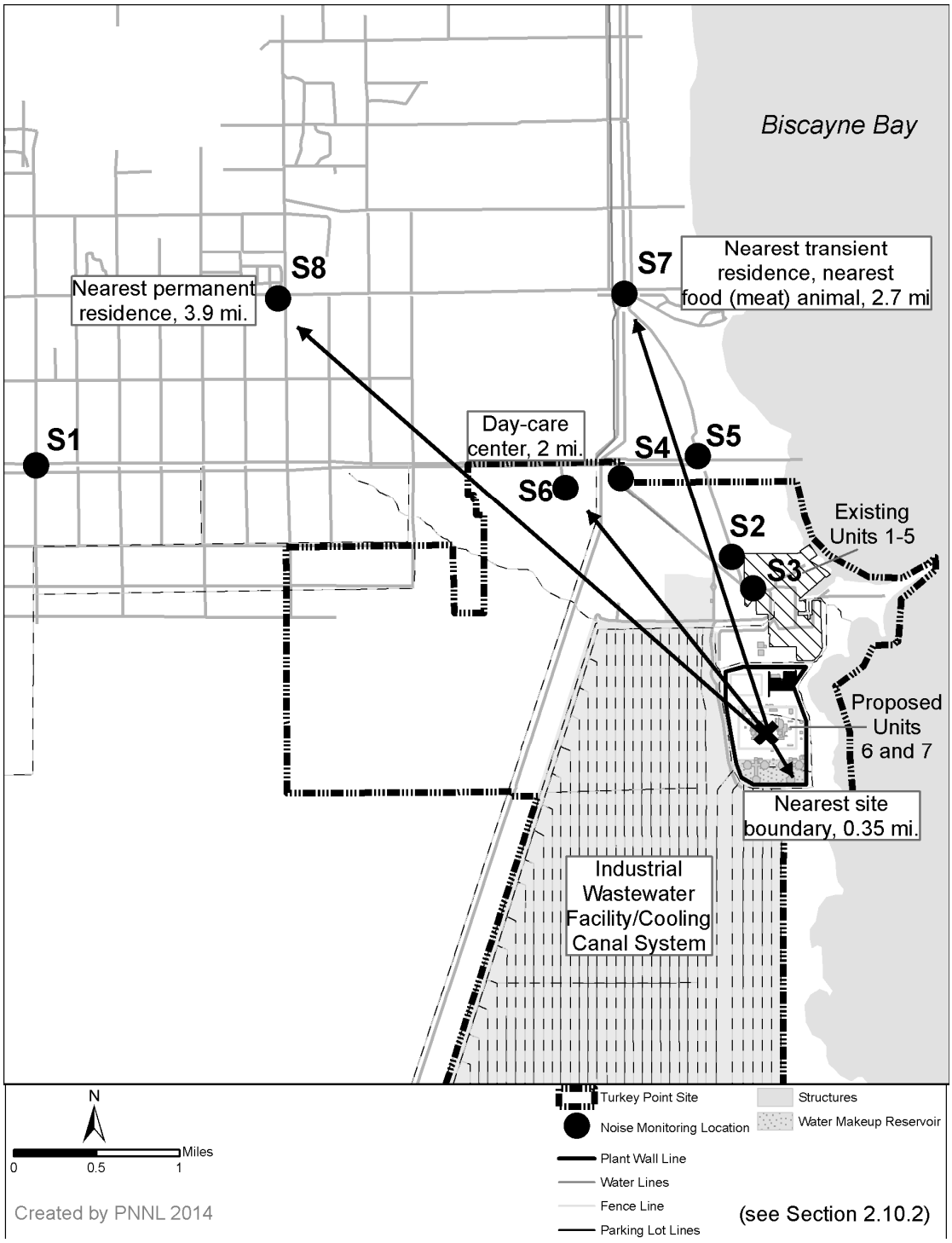


Figure 2-41. Nearest Actual and Potential Receptors

Table 2-57. Injuries and Illnesses by Industry and Area (per 100 full-time workers per year)

	Heavy and Civil Engineering Construction		Electric Power Generation, Transmission, and Distribution	
Year	U.S.	Florida	U.S.	Florida
2003	4.0	7.0	5.0	3.3
2004	5.9	7.0	4.5	3.3
2005	5.6	5.6	4.0	2.0
2006	5.3	6.3	3.8	3.9[(a)]
2007	4.9	4.9	3.6	2.8
2008	4.2	3.8	3.2	2.1
2009	4.2	3.6	3.5	2.7
2010	3.8	3.4	2.8	2.4

(a) For 2006, data were only available for utilities overall.

Fatal injury rate data are available from the above sources for 2003–2007. As seen in Table 2-58, rates of fatal injuries per 100,000 workers for the years 2003–2007 in the United States construction sector ranged from 10.4 to 12.0. As with non-fatal injuries and illnesses, these data show some reduction over time, although the trend is weaker and the change smaller for fatal injuries compared to non-fatal injuries and illnesses. One caveat related to these data is that fatal injury rates in the utility construction sector likely are lower than the rates shown here for the general construction sector. This is based on lower non-fatal injury and illness rates in the utility construction sector compared to the overall construction sector. For example, the non-fatal injury and illness rate for the utility construction sector for 2007 is 4.7 per 100 full-time workers, while the non-fatal injury and illness rate for the general construction sector is 15 percent higher, at 5.4 per 100 full-time workers.

Table 2-58. Fatal Injuries by Industry in the United States (per 100,000 workers per year)

Year	Construction	Utilities
2003	11.7	3.7
2004	12.0	6.1
2005	11.1	3.6
2006	10.9	6.3
2007	10.4	4.0

As seen in Table 2-58, fatal injury rates for utility operations ranged from 3.6 to 6.1 per 100,000 workers. While this range is relatively large, no discernible trend over time is apparent.

Occupational injury and fatality risks are reduced by adherence to NRC and Occupational Safety and Health Administration safety standards, practices, and procedures to minimize worker exposures. Appropriate State and local statutes also must be considered when assessing the occupational hazards and health risks associated with the Turkey Point site. Currently, the Turkey Point site has programs and personnel to promote safe work practices and respond to occupational injuries and illnesses for existing units (FPL 2014-TN4058). Procedures are in place with the objective to provide personnel who work at the Turkey Point site with an effective

means of preventing accidents due to unsafe conditions and unsafe acts. They include safe work practices to address hearing protection, confined space entry, personal protective equipment, heat stress, electrical safety, ladders, and chemical handling, storage, and use, as well as other industrial hazards. Personnel are provided training on FPL safety procedures. In addition, FPL requires contractors to develop and implement safety procedures with the intent of preventing injuries, occupational illnesses, and deaths.

2.10.1.3 Etiological Agents

Public and occupational health can be compromised by activities at nuclear power sites that encourage the growth of disease-causing microorganisms (etiological agents). The types of organisms of concern for public and occupational health include enteric pathogens (such as *Salmonella* spp. and *Pseudomonas aeruginosa*), thermophilic fungi, bacteria (such as *Legionella* spp. and *Vibrio* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could result in potentially serious human health concerns, particularly at high exposure levels (NRC 2013-TN2654). For proposed Units 6 and 7 at the Turkey Point site, exposure could occur from cooling-tower evaporation and aerosol drift and thermal discharges onsite. In contrast to other units at the site, however, as well as to most other nuclear power plants, the thermal discharges would be collected in a common blowdown sump and injected underground via UIC wells. These waste streams thus are not expected to be discharged to waters that have the potential for direct contact by members of the public (FPL 2014-TN4058), and therefore the following information about etiological agents is largely for providing a baseline for the potential aerosol drift and onsite waste-treatment exposure pathways.

Vibrio spp. are a concern for human health because these theromophilic bacteria are commonly found in coastal marine waters such as those at the Turkey Point site and can be associated with filter-feeding shellfish (e.g., oysters). People can be exposed to the bacteria through activities such as swimming, diving, or wading in the water, as well as through consumption of contaminated shellfish. *Vibrio cholera*e causes the disease cholera, which is an acute, diarrheal illness. Other *Vibrio* species do not cause cholera (e.g., *V. vulnificus* and *V. parahaemolyticus*), but exposure to the bacteria can cause watery diarrhea and abdominal cramps as well as skin infections. Cholera and non-cholera illnesses caused by *Vibrio* spp. can be fatal. During 2007-2008, a total of 236 individual vibriosis cases associated with water exposure (recreational or flood water) were reported by 25 states (CDC 2011-TN558). Of these, 74 (31 percent) were hospitalizations, and nine (4 percent) were fatal. During 2005-2006, a total of 189 vibriosis cases associated with water exposure were reported, and during 2003-2004 a total of 142 cases were reported (CDC 2008-TN557). Vibriosis cases were not routinely reported prior to 2003, so data are not readily available for prior years. Nearly all vibriosis patients reported that they were exposed to recreational water in coastal states. The most frequently reported exposure State for all reporting periods was Florida.

Naegleria fowleri is a free-living amoeba that proliferates in warm freshwater and hot springs. Primary amebic meningoencephalitis (PAM) occurs when the amoeba coincidentally enters the nasal passages, travels to the olfactory lobe of the brain, and infects brain tissue. This rare disease is of public health importance because of the high (>99 percent) fatality rate associated with infection. In 2009, three cases of PAM, all fatal, were reported from Madison, Orange, and

Polk Counties in Florida (Terzagian 2011-TN998). No data were found on cases from other states for 2009. In 2008, no PAM cases were reported in the United States. In 2007-2008, eight individual cases of PAM were reported in the United States (CDC 2011-TN558). All were fatal, and the largest number of cases, three (38 percent), occurred in Florida. In 2005-2006, five cases of PAM were reported in the United States; all were fatal, but none occurred in Florida (CDC 2008-TN557).

Cryptosporidium is a parasite that can survive outside the body for long periods of time and is very tolerant to chlorine disinfection. It has emerged as the single most important etiologic agent of recreational water-associated outbreaks. In 2007-2008, of 81 outbreaks of acute gastrointestinal illness, 60 (74 percent) were caused by *Cryptosporidium* and resulted in 12,154 cases (CDC 2011-TN558). In 2005–2006, of 48 outbreaks of acute gastrointestinal illness, 31 (65 percent) were caused by *Cryptosporidium* and resulted in 3,751 cases (CDC 2008-TN557).

Legionella is a bacterium that can cause a type of pneumonia called legionellosis, more commonly known as Legionnaires' disease, which is sometimes fatal. Approximately 8,000-18,000 cases of legionellosis occur each year in the United States (CDC 2011-TN558). In 2007-2008, three outbreaks were reported that resulted in 16 cases known to be associated with cooling towers (CDC 2011-TN558). In 2005-2006, three outbreaks also were reported associated with cooling towers, which resulted in 52 cases and 6 deaths (CDC 2008-TN557).

The Florida Department of Health's Food and Waterborne Disease Program is responsible for the surveillance, investigation, reporting, and prevention of food and waterborne diseases within the state. Each year, the program publishes an annual report that summarizes food and waterborne disease outbreaks in the state. Annual reports dating back to 1997 are available from the Florida Department of Health (FDOH 2012-TN667). Table 2-59 summarizes these data and shows total number of waterborne disease outbreaks by organism and location (county) over the 2002-2009 period (2009 being the most recent data available). Two organisms were implicated in 61.7 percent of the cases reported – the Norovirus (a virus that causes acute gastroenteritis) and *Cryptosporidium* were blamed for 55 cases (10.4 percent). *Legionella* was the cause of 33 cases (6.2 percent). An outbreak of "sea bather's eruption," dermatitis caused by exposure to *Linuche unguiculata* (larval thimble jellyfish), occurred in 2005; 24 cases (4.5 percent) were reported. Six cases (1.1 percent) were associated with *Naegleria fowleri* and two cases (0.3 percent) were associated with *Shigella*. In 83 cases (15.7 percent), the cause of the outbreak was listed as "unknown." The vast majority of cases were associated with inadequate treatment, improper treatment, or temporary interruption of treatment of drinking water or recreational water (pools, recreational water slides, whirlpools). In some instances, swimmers were infected by pathogenic microorganisms in freshwater lakes, presumably from human or animal waste contamination. None of the cases was attributed to a heated (thermal effluent) or unheated (sanitary waste) discharge from a steam electric plant. Only one outbreak (10 Legionella cases in Dade County in 2009) occurred in one of the counties (i.e., Dade, Glades, Kissimmee, Martin, Okeechobee, and St. Lucie) in which the proposed and alternative sites would lie.

None of the cases described above or in Table 2-59 have been attributed to a heated (thermal effluent) or unheated (sanitary waste) discharge from a steam electric plant.

Table 2-59. Waterborne Disease Outbreaks in Florida, 2002−2009(a)

Year	Total No. of Outbreaks (and Associated Cases)	Organism/Vector	County	No. of Cases	Exposure Source
2002	11 (43)	Unknown	Hillsborough	43	Not described
2003	3 (88)	Norovirus	Orange	56	Public drinking water
		Norovirus	Polk	10	Freshwater lake
		Norovirus	Polk	22	Freshwater lake
2004	1 (42)	Norovirus	Duval	42	Recreational water slide
2005	3 (73)	Cryptosporidium	Duval	47	Recreational water
		Legionella	Broward	2	Unknown
		Linuche unguiculata (thimble jellyfish)	Nassau	24	Atlantic Ocean
2006	4 (119)	Cryptosporidium	Orange	3	Hotel swimming pool
		Giardia	Orange	55	Swimming pool/waterfall
		Legionella	Volusia	11	Whirlpool/ spa
		Norovirus	Santa Rosa	50	Recreational swimming lake
2007	9 (98)	Cryptosporidium	Collier	8	Condo swimming pool
		Cryptosporidium	Indian River	38	“Interactive water fountain”
		Cryptosporidium	Marion	3	Swimming pool
		Cryptosporidium	Palm Beach	6	“water”
		Naegleria fowleri	Orange	1	Lake water
		Naegleria fowleri	Orange	1	Freshwater
		Naegleria fowleri	Osceola	1	Lake water exposure
		Unknown	Palm Beach	38	Public drinking water
		Unknown	Pasco	2	Recreational water exposure
2008	4 (23)	Cryptosporidium	Sarasota	13	Pool
		Legionella	Orange	5	Hot tub
		Legionella	Orange	3	Hot tub
		Shigella	Hillsborough	2	Freshwater
2009	10 (44)	Cryptosporidium	Orange	8	Swimming pool
		Cryptosporidium	Orange	6	Swimming pool
		Cryptosporidium	Orange	5	“Multiple pools”
		Cryptosporidium	Palm Beach	6	Recreational water, untreated
		Cryptosporidium	Santa Rosa	4	Swimming pool
		Legionella	Dade	10	Private water system
		Legionella	Seminole	2	Shower heads
		Naegleria fowleri	Nassau	1	Freshwater lake
		Naegleria fowleri	Polk	1	Lake
		Naegleria fowleri	Orange	1	Lake

(a) Cases associated with waterborne chemicals/chemical contamination were not included.

2.10.2 Noise

Any pressure variation that the human ear can detect is considered sound, and noise is defined as unwanted sound. Sound involves three principal components: a noise source, a person or a group of people, and the transmission path. While two of these components—the noise source and the transmission path—are easily quantified by direct measurements or through predictive calculations, the effect of noise on humans is difficult to determine because of the varying responses of humans to the same or similar noise patterns. The perception of sound (noise) by humans is very subjective and, just as for odors and taste, it is very difficult to predict a response from any particular individual to these levels. To help predict responses, several metrics and tools have been developed. Sound is described in terms of amplitude (perceived as loudness) and frequency (perceived as pitch). Sound pressure levels are typically measured

by using the logarithmic decibel (dB) scale. A-weighting (denoted by dBA) is widely used to account for human sensitivity to frequencies of sound (i.e., less sensitive to lower and higher frequencies and most sensitive to sounds between 1 and 5 kHz), which correlates well with a human's subjective reaction to sound. Several sound descriptors have been developed to account for variations of sound with time. L_{90} is the sound level exceeded 90 percent of the time, called the residual sound level (or background level) or fairly steady lower sound level on which discrete single sound events are superimposed. The equivalent continuous sound level (L_{eq}) is a sound level that, if it were continuous during a specific time period, would contain the same total energy as a time-varying sound. (Unless designated otherwise, all sound levels are instantaneous or L_{eq} values measured over short [e.g., 1- to 5-minute] time periods.) In addition, human responses to noise differ depending on the time of the day (e.g., higher sensitivity to noise during nighttime hours because of lower background noise levels). The day-night average sound level (L_{dn} or DNL) is a single dBA value calculated from hourly L_{eq} over a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. to account for the greater sensitivity of most people to nighttime noise. Generally, a 3-dBA change over existing noise levels is considered to be a "just noticeable" difference, and a 10-dBA increase is subjectively perceived as a doubling in loudness and almost always causes an adverse community response.

Sources of noise related to proposed Units 6 and 7 at the Turkey Point site would be those associated with heavy equipment during the construction phase and with mechanical draft cooling towers, cooling pumps, transformers, transmission lines, and other electrical equipment, and the public address system during operation. The Turkey Point site is located on 9640 ac in unincorporated southeast Miami-Dade County, Florida, approximately 25 mi south of Miami, 8 mi east of Florida City, 9 mi southeast of the City of Homestead, and bordered by Biscayne Bay to the east (FPL 2014-TN4058). There are no residential areas or public roads on the Turkey Point site. The rural surroundings and enclosure of noise-generating equipment in facilities help to mitigate onsite noise perceived by offsite receptors.

An ambient noise-monitoring survey was performed in June 2008 to assess the existing ambient noise in areas adjacent to the current Turkey Point units (FPL 2014-TN4058). Monitoring sites were chosen to characterize the noise levels at or near a variety of locations. These locations are depicted in Figure 2.7-16 of FPL's ER (FPL 2014-TN4058) and in a baseline noise study report (FPL 2009-TN1246). The locations are identified below by a location description, the distance and direction from Unit 1 (not the proposed units), and the site code used in the noise study:

- Onsite, next to Unit 5, northwest, sites S2 and S3
- Site boundaries, 1.3 and 1 mi north, sites S4 and S5
- Day-care facility, 1.6 mi northwest, site S6
- Homestead Bayfront Park entrance, 2.1 mi north, site S7
- Nearest permanent private residence, 3.6 mi northwest, site S8
- Homestead-Miami Speedway, 5 mi west-northwest, site S1.

Distances from the proposed Units 6 and 7 will differ from distances from the existing units, as described in Section 4.8. Also, note that the site boundaries used for the noise survey (1.3 and 1 mi north; sites S4 and S5) differ from the boundaries used for air quality in Section 2.10.1.1

and illustrated in Figure 2-41 (0.35 mi south-southeast and 1.6 mi north) for two reasons. First, the shorter distance noted for air quality (0.35 mi) is for the physically closest boundary to the proposed units, which borders Biscayne Bay to the south-southeast where there are no residences currently and likely none in the future, while for the noise survey the receptors are the potential nearest future residences north of the site on the other side of the existing units. Second, the longer distance noted for air quality (1.6 mi north) is measured from the center of the area that would be used for proposed Units 6 and 7, while the two baseline noise survey site boundaries (S4 and S5) are measured from Unit 1 (an existing unit). In other words, this latter location for noise (S5), at 1 mi north of the existing site, is the same location as the longer air-quality distance, at 1.6 mi north of the proposed site. This location also is considered the nearest site boundary at which a future residence could reasonably be expected to be located.

Section 5.3.4 of NUREG–1555 (NRC 2000-TN614) notes that, based on U.S. Department of Housing and Urban Development (HUD) regulations for exterior noise standards (24 CFR 51.101(a)(8)) (TN1016), no further analysis is needed if the L_{dn} is below 60 to 65 dBA. While the noise survey did not calculate an L_{dn} for each of the sites noted above, it did measure both daytime and nighttime averages (L_{eq}s), which can be used to approximate the L_{dn}, as described below.

The baseline daytime L_{eq} measurements for the monitoring locations within and adjacent to the Turkey Point site boundary ranged from a low of 44 dBA to a high of 67.6 dBA, depending on the site, while the nighttime L_{eq} measurements for these sites ranged from a low of 47 dBA to a high of 67 dBA. These monitoring sites are closest to Unit 5, which had an audible contribution. Also contributing to the observed sound levels were transient noise sources such as traffic, birds, insects, and wind.

The baseline daytime L_{eq} measurements for the monitoring locations beyond the site boundary ranged from a low of 46 dBA to a high of 67 dBA. The contributing audible noise sources to the highest observed noise levels the nearest residence were transient noises that included traffic, birds, insects, and wind. The nighttime L_{eq} measurements beyond the site boundary ranged from a low of 41 dBA to a high of 56 dBA. The contributing audible noise sources to the highest observed noise levels were transient noises that included insects, wind noise, and traffic.

The baseline noise report indicates that audible sound from the Turkey Point site does not reach the current nearest residences (the transient residences in Homestead Bayfront Park, 2.1 mi north of Unit 1, near site S7) and the nearest permanent private residence (3.6 mi northwest of Unit 1, site S8). A residence could be assumed to be located in the future at the Turkey Point boundary (1.3 mi north of the existing units, or 1.6 mi north of the proposed units, site S5). The two daytime average L_{eq}s for this location are 43.9 and 44.3 dBA. The two nighttime average L_{eq}s are 47.3 and 48.5 dBA. Adding 10 dBA to the nighttime L_{eq}s as described above and averaging all values (after converting the values to linear sound pressure level values) results in an L_{dn} of approximately 55.1 dBA, which is less than the 60 to 65 dBA acceptance range noted above.

Occasional activities associated with current operations at the Turkey Point site would have peak noise levels in the range of 100 to 110 dBA. As illustrated in Table 2-60, noise strongly lessens with distance. A decrease of 10 dBA in noise level is generally perceived as cutting the loudness in half. At a distance of 50 ft from the source, these peak noise levels would generally

decrease to the 80 to 95 dBA range and at distance of 400 ft, the peak noise levels would generally be in the 60 to 80 dBA range. For context, the sound intensity of a quiet office is 50 dBA, normal conversation is 60 dBA, busy traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA (Tipler and Mosca 2008-TN1467).

Table 2-60. Construction Noise Sources and Attenuation with Distance

Source	Noise Level (dBa) (peak)	Noise Level (dBa) Distance from Source			
		50 ft	100 ft	200 ft	400 ft
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Forklift	100	95	89	83	77

Source: Golden et al. 1979-TN3873

In addition to the HUD noise level described above, regulations governing noise associated with the activities at the Turkey Point site are generally limited to worker health. Federal regulations governing construction noise are found in 29 CFR Part 1910 (TN654), *Occupational Health and Safety Standards*, and 40 CFR Part 204 (TN653), *Noise Emission Standards for Construction Equipment*. The regulations in 29 CFR Part 1910 (TN654) address noise exposure in the construction environment, and the regulations in 40 CFR Part 204 (TN653) generally govern the noise levels of compressors. Turkey Point would be covered by Section 21-28 of the Miami-Dade County Code of Ordinances ("Noises; unnecessary and excessive prohibited."), although based on the L_{dn} assessment above, noise levels at the nearest receptors would not trigger this ordinance (Miami-Dade Code of Ordinances 21-28-TN1017). The State of Florida does not have noise regulations covering rural areas that would be applicable to the Turkey Point site.

2.10.3 Transportation

The transportation network surrounding the Turkey Point site is shown in Figure 2-6 and Figure 2-34. This network includes U.S. and Interstate highways, multilane divided State highways, local streets, rail service, airports, and waterways. This network is summarized below and is described in more detail in Section 2.5.2.3.

The major Federal highways in Miami-Dade County are US-1, which bisects the county from north to south and continues south to the Florida Keys, and I-75 and I-95, which also have a north-south direction but terminate in Miami. Two of the major State highways in Miami-Dade County are Florida's Turnpike and SR-997. Florida's Turnpike is a multilane, divided toll road that traverses much of Florida, linking I-75 in the interior south of Ocala to Miami. The

Homestead extension of Florida's Turnpike terminates at US-1 north of Florida City. SR-997 connects US-1 in Homestead with US-27, which fringes the western edge of metropolitan Miami and terminates in Homestead, becoming Krome Avenue. Krome Avenue continues south and terminates at US-1 south of Florida City.

The existing access road for the Turkey Point site is SW 344th Street/Palm Drive. SW 344th Street/Palm Drive intersects US-1 and SR-997. It is a four-lane road that narrows at its intersection with SW 137th Avenue/Tallahassee Road to two lanes as it leads to the Turkey Point site. Access to the site and proposed Units 6 and 7 plant area from US-1 could also be made using SW 328th Street/North Canal Drive, which parallels SW 344th Street/Palm Drive to the north. This road is linked to SW 344th Street/Palm Drive by cross streets such as the four-lane SW 137th Avenue/Tallahassee Road and the two-lane SW 117th Avenue. Access to the site from Florida's Turnpike could be made via the exit at SW 312th Street/Campbell Drive or via the Turnpike terminus at US-1. SW 312th Street/Campbell Drive is a four-lane road that parallels SW 344th Street/Palm Drive to the north. A connecting road is SW 137th Avenue/ Tallahassee Road. This intersection should be minimally affected by construction and operations personnel. Most personnel are expected to come from the west and south (as opposed to the north) of the Turkey Point site and only a small number would be expected to commute to/from the site via this intersection. This intersection should be minimally affected by construction and operations personnel, who are expected to come from the west and south (as opposed to from the north) of the Turkey Point site.

Rail passenger service is provided to Miami by Amtrak and TRI-Rail; both have service to connecting rail lines across the United States. Neither rail service travels to locations south of Miami. Rail freight service in Miami-Dade County is provided by CSX operating Class 1 rail lines. The CSX line services the Port of Miami and has an intermodal terminal in Miami. The rail line terminates in Homestead. The nearest rail crossing to Turkey Point is at SW 320th Street and is approximately 11 roadway mi to the plant entrance. There are no rail systems within 5 mi of the Turkey Point site.

An equipment barge-unloading area exists at the Turkey Point site and is accessed via the waterway to receive shipments of oil and equipment.

2.10.4 Electromagnetic Fields

As described in Section 2.2.2, eight 230 kV transmission lines currently connect the existing Turkey Point units to the transmission system by way of two corridors, one proceeding to the north and one to the west. Transmission lines generate both electric and magnetic fields, referred to collectively as electromagnetic field (EMF) (NRC 2013-TN2654). Public and worker health can be compromised by acute and chronic exposure to EMF from power transmission systems, including switching stations (or substations) onsite and transmission lines connecting the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is referred to as extremely low frequency (ELF). In comparison, television transmitters have frequencies of 55 to 890 MHz and microwaves have frequencies of 1,000 MHz and greater (NRC 2013-TN2654).

Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures is an example of an acute effect from EMF associated with transmission lines. Objects near transmission lines can become electrically charged by close proximity to the electric field of the line. An induced current can be generated in such cases, where the current can flow from the line through the object into the ground. Capacitive charges can occur in objects that are in the electric field of a line, storing the electric charge, but isolated from the ground. A person standing on the ground can receive an electric shock by coming into contact with such an object because of the sudden discharge of the capacitive charge through the person's body to the ground. Such acute effects are controlled and minimized by conformance with National Electrical Safety Code criteria and adherence to the standards for transmission systems regulated by the FDEP (Fla. Admin. Code 62-814 2008-TN644).

Long-term or chronic exposure to power transmission lines has been studied for a number of years. These health effects were evaluated in NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 2013-TN2654) for nuclear power in the United States, and are discussed in the ER (FPL 2014-TN4058). The GEIS reviewed human health and EMF and concluded:

> The chronic effects of EMFs associated with nuclear plants and associated transmission lines are uncertain. Studies of 60 Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.

2.11 Radiological Environment

Turkey Point Unit 3 began operation in 1972 and Unit 4 in 1973. FPL has conducted a Radiological Environmental Monitoring Program (REMP) around the Turkey Point site since 1969 (AEC 1972-TN999). The NRC published in the *Federal Register* on April 3, 2012, a final Environmental Assessment and Finding of No Significant Impact (77 FR 20059) (TN1001) and on June 15, 2012 the final approval of the licensing amendments for the approximately 15 percent extended power uprates of Turkey Point Units 3 and 4 (NRC 2012-TN1438). In addition to the REMP and the Offsite Dose Calculation Manual (ODCM) description in the Annual Radiological Effluent Release Report, ODCM Appendix A discusses a supplemental REMP sampling program to address the extended power uprates was agreed between the State of Florida Department of Health and FPL. This supplemental sampling program is being performed to provide additional data for the REMP (FPL 2011-TN119). The sampling under this supplemental program provides additional data, including data from sampling in the discharge canal.

The American crocodile inhabits the CCS used by Turkey Point Units 3 and 4. Units 3 and 4 discharge radioactive liquid effluent to the CCS, thus exposing the crocodiles to this effluent. In addition, the crocodiles are exposed to gaseous radioactive effluents from Turkey Point Units 3 and 4. The exposure pathways for the radiological effluents from Turkey Point Units 6 and 7 are discussed in Section 5.9. The cumulative radiological impacts are discussed in Section 7.8.

Currently, radiological releases are summarized in the annual reports entitled *Turkey Point, Units 3 and 4, Annual Radioactive Effluent Release Report* and *Turkey Point, Units 3 and 4, Annual Radiological Environmental Operating Report*. The limits for all radiological releases are specified in the Turkey Point ODCM, and these limits are designed to meet Federal standards and requirements. The REMP includes monitoring of the aquatic environment (fish, invertebrates, and shoreline sediment), atmospheric environment (airborne radioiodine, gross beta, and gamma), and terrestrial environment (vegetation) and direct radiation. The NRC staff reviewed these annual reports for calendar years 2002 through 2013.[10] These reports show that doses to individuals around the Turkey Point site were a small fraction of the limits specified in Federal environmental radiation standards (10 CFR 20 [TN283]; 10 CFR 50, Appendix I [TN249]; and 40 CFR 190 [TN739]).

FPL is also undertaking a groundwater monitoring program as delineated in the *FPL Turkey Point Power Plant Groundwater, Surface Water, and Ecological Monitoring Plan* (SFWMD 2009-TN149). In this plan, FPL commits to monitoring tritium as a "tracer suite" for tracking the movement of CCS plume. In Section 2.2.1 of the plan, the SFWMD states:

> "The FDEP's drinking water standard for concentrations of tritium in groundwater is 20,000 pCi/L. The Agencies and FPL recognize that the concentrations of tritium from the CCS water are expected to fall below the regulatory standard used to identify the potential for human health concerns. Accordingly it is mutually understood tritium is being monitored only as a potential tracer for identifying contributions of CCS water as a source. According to the FDEP, pursuant to Chapter 62-520 and 62-550, F.A.C., the presence of tritium below 20,000 pCi/L in water does not represent a public health and safety issue."

The NRC's Lessons Learned Task Force Report (NRC 2006-TN1000) made recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear plants. In response to that report, FPL began additional groundwater sampling in various onsite locations that may be sources of groundwater contamination around the Turkey Point site. The ODCM discusses the groundwater sampling program for tritium (FPL 2011-TN119). However, a drinking water pathway does not exist from groundwater at the Turkey Point site (FPL 2009-TN100).

2.12 Related Federal Projects and Consultation

The staff reviewed the possibility that activities of other Federal agencies might impact the issuance of COLs to FPL. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2) [TN250]). As discussed in Chapter 1, the USACE and the NPS are cooperating agencies in the preparation of this EIS.

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(10) (FPL 2003-TN1380; FPL 2003-TN1380; FPL 2004-TN1381; FPL 2005-TN1382; FPL 2006-TN1383; FPL 2007-TN1384; FPL 2008-TN1385; FPL 2009-TN100; FPL 2010-TN1388; FPL 2011-TN119; FPL 2012-TN1389; FPL 2013-TN2578; FPL 2014-TN3662 and FPL 2003-TN1369; FPL 2003-TN1370, Rev 1.; FPL 2004-TN1371; FPL 2005-TN1372; FPL 2006-TN1373; FPL 2007-TN1375; FPL 2008-TN1376; FPL 2008-TN1377, Rev 1; FPL 2009-TN101; FPL 2010-TN1378; FPL 2011-TN267; FPL 2012-TN1379; FPL 2013-TN2579; FPL 2014-TN3661).

The CERP is a congressionally approved long-term Federal effort to restore the Everglades and South Florida ecosystem. The plan is supported by Federal, State, Tribal and local government agencies, including the USACE and the SFWMD. The goal of CERP is to capture, store and redirect freshwater for environmental restoration of the entire Everglades ecosystem (USACE 2010-TN113).

Federal lands within a 50 mi radius of the Turkey Point site include Biscayne National Park, Everglades National Park, FKNMS (Florida Keys National Marine Sanctuary), Crocodile Lake National Wildlife Refuge, Big Cypress National Preserve.

Several state parks exist within the 50 mi radius, including Dagny Johnson Key Largo Hammock Botanical State Park, The Barnacle Historic State Park, Bill Baggs Cape Florida State Park, John Pennekamp Coral Reef State Park, Lignumvitae Key Botanical State Park, San Pedro Underwater Archaeological Preserve State Park, Indian Key Historic State Park, Windley Key Fossil Reef Geological State Park, Oleta River State Park, John U. Lloyd Beach State Park.

The Tribal reservation for the Federally recognized Seminole Tribe of Florida Reservation in Hollywood, Broward County, is within 50 mi of the Turkey Point site. Four Miccosukee Indian reservations –Tamiami Trail (Miami-Dade County), Alligator Alley (Broward County), and two at Krome Avenue (Miami-Dade County)—also lie within 50 mi of the site. Under Section 102(2)(C) of NEPA, the NRC is required to “consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved.” During the course of preparing this EIS, the NRC consulted with various Federal, State, and local agencies and Tribal contacts. Appendix F provides a list of consultation correspondence.