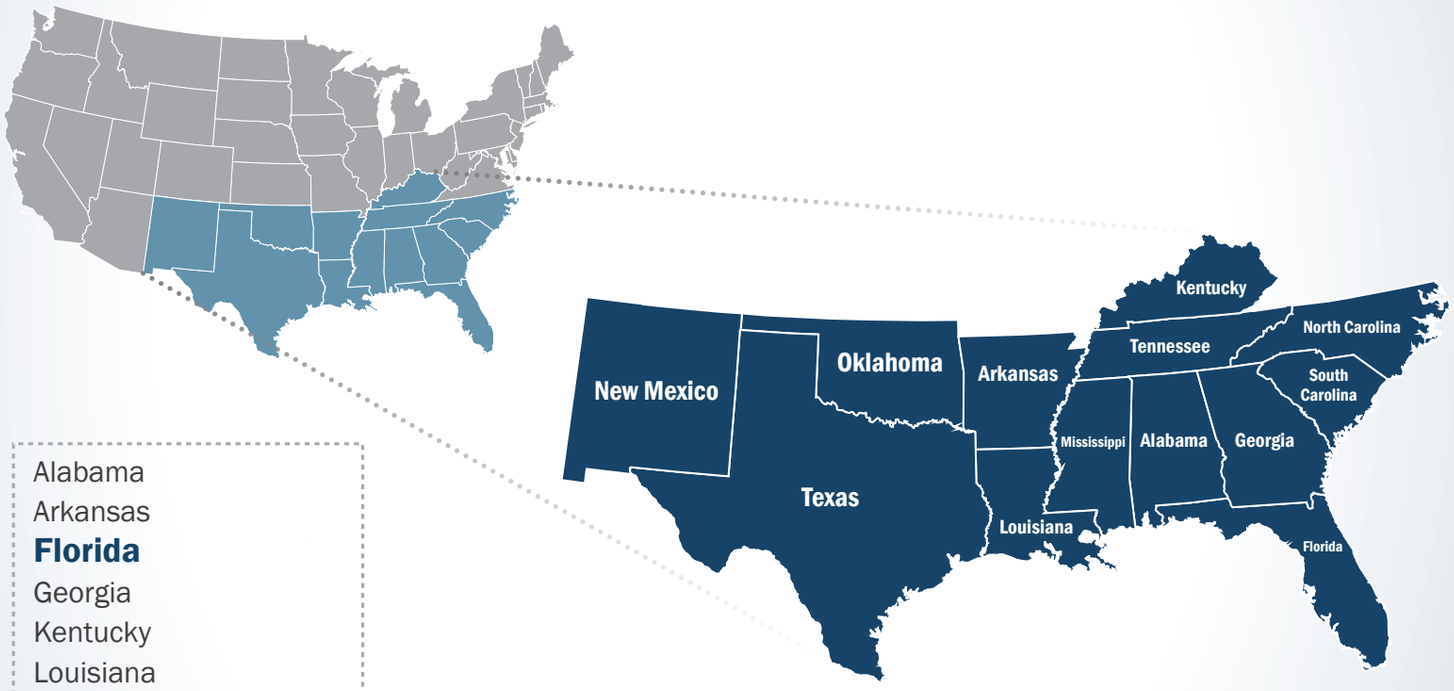
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Southern United States

VOLUME 3 - CHAPTER 5



Alabama
Arkansas
Florida
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North Carolina
Oklahoma
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Tennessee
Texas

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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Southern United States

VOLUME 3 - CHAPTER 5

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Cooperating Agencies
Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

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5. FLORIDA

Prior to the arrival of the famous Spanish explorer Juan Ponce de Leon in 1513 who claimed Florida for Spain, American Indian tribes with a rich cultural history lived in what is now the state of Florida for centuries. In 1845, Florida became the 27th state to join the Union (Florida Department of State, 2015a). Florida is a peninsula located in the southeastern portion of the United States. The state is bordered by Georgia and Alabama to the north, the Atlantic Ocean to the south and east, and the Gulf of Mexico to the west. This chapter provides details about the existing environment of Florida, as it relates to the Proposed Action.

General facts about Florida are provided below:

- **State Nickname:** The Sunshine State
- **Land Area:** 53,625 square miles; **U.S. Rank:** 26 (U.S. Census Bureau, 2015a)
- **Capital:** Tallahassee
- **Counties:** 67 (U.S. Census Bureau, 2015b)
- **2015 Estimated Population:** 20,271,272 people, 2015 estimated population; **U.S. Rank:** 4 (U.S. Census Bureau, 2015a)
- **Most Populated Cites:** Jacksonville, Miami, Tampa, Orlando, St. Petersburg (U.S. Census Bureau, 2015b)
- **Main Rivers:** Apalachicola River, Caloosahatchee River, Chipola River, Choctawhatchee River, Escambia River, Kissimmee River, Ochlockonee River, Peace River, Santa Fe River, St. John's River, St. Mary's River, Suwannee River, Withlacoochee River (Maps of World.com, 2016)
- **Bordering Waterbodies:** Gulf of Mexico and Atlantic Ocean (Maps of World.com, 2016)
- **Mountain Ranges:** None
- **Highest Point:** Britton Hill (345 ft.) (USGS, 2001)

5.1. AFFECTED ENVIRONMENT

5.1.1. Infrastructure

5.1.1.1. Definition of the Resource

This section provides information on key Florida infrastructure resources that could potentially be affected by FirstNet projects. Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as "developed." Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Section 5.1.1.3 provides an overview of Florida's traffic and transportation infrastructure, including road and rail networks and waterway facilities. Florida's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 et seq.)) (the Act), including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in the District are presented in more detail in Section 5.1.1.4. Section 5.1.1.5 describes Florida's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Florida's utilities, such as power, water, and sewer, is presented in Section 5.1.1.6.

5.1.1.2. Specific Regulatory Considerations

Multiple Florida laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 5.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 5.1.1-1: Relevant Florida Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
FS: Title XVII Military Affairs and Related Matters: Florida Administrative Code (FAC): Chapter 6 Department of Management Services	Division of Emergency Management	Coordinates the state's emergency management functions and programs.

[1] The term "public safety entity" means an entity that provides public safety services (7 U.S. Code [U.S.C.] § 1401(26)).

State Law/Regulation	Regulatory Agency	Applicability
FS: Title XXVII Railroads and Other Regulated Utilities: FAC: Chapter 25 Public Service Commission	Florida Public Service Commission	Regulates electric, gas, telephone, water, sewage, railroad, and common carrier companies.
FS: Title XXII Ports and Harbors; Title XXIV Vessels; Title XXV Aviation; FAC: Chapter 14 Department of Transportation; Chapter 30 Regional Planning Councils	Florida Department of Transportation (FDOT)	Oversees the development and operation of the state's highway, mass transit, marine, and aviation facilities and services.

5.1.1.3. Transportation

This section describes the traffic and transportation infrastructure in Florida, including specific information related to the road networks, airport facilities, rail networks, harbors, and ports (this PEIS defines "harbor" as a body of water deep enough to allow anchorage of a ship or boat). The movement of vehicles is commonly referred to as traffic, as well as the circulation along roads. Roadways in the state can range from multilane road networks with asphalt surfaces, to unpaved gravel or private roads. The information regarding existing transportation systems in Florida are based on a review of maps, aerial photography, and federal and state data sources.

The Florida Department of Transportation (FDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for smaller streets and roads. The responsibilities of the FDOT are "to coordinate the planning and development of a safe, viable, and balanced state transportation system serving all regions of the state, and to assure the compatibility of all components, including multimodal facilities" (FDOT, 2015a).

Florida has an extensive and complex transportation system across the entire state. The state's transportation network consists of:

- 122,088 miles of public roads (FHWA, 2014) and 12,137 bridges (FHWA, 2015a);
- 2,753 miles of rail network that includes passenger rail and freight (FDOT, 2015b);
- 874 aviation facilities, including airstrips and heliports (FAA, 2015a);
- 965 harbors (U.S. Harbors, 2015); and
- 15 major ports that includes both public and private facilities (FDOT, 2016).

Road Networks

As identified in Figure 5.1.1-1, the major urban centers of the state from north to south are Tallahassee, Jacksonville, Orlando, Tampa, St. Petersburg, Fort Lauderdale, and Miami (U.S. DoC, 2013). Florida has four major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel outside the major metropolitan areas is conducted on interstates, and state and county roads. Table 5.1.1-2 lists the interstates and their start/end points in Florida. Per the national standard, even numbered interstates run from west to east with

the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015b).

Table 5.1.1-2: Florida Interstates

Interstate	Southern or Western Terminus in FL	Northern or Eastern Terminus in FL
I-4	I-275 in Tampa	I-95 in Daytona Beach
I-10	AL line near Pensacola	I-95 in Jacksonville
I-75	SR 826 in Miami Lakes	GA line near Jennings
I-95	U.S. 1 in Miami	GA line at Yulee

In addition to the Interstate System, Florida has both National Scenic Byways and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA, 2013). Figure 5.1.1-1 illustrates the major transportation networks, including roadways, in Florida. Section 5.1.8, Visual Resources, describes the scenic byways found in Florida from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's Federal Highway Administration (FHWA). Florida has six National Scenic Byways (FHWA, 2015c):

- A1A Scenic & Historic Coastal Byway;
- Big Bend Scenic Byway;
- Florida Black Bear Scenic Byway;
- Florida Keys Scenic Highway;
- Indian River Lagoon National Scenic Byway; and
- Ormond Scenic Loop & Trail.

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by FDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. Florida has 19 State Scenic Byways that crisscross the entire state[2] (FDOT, 2015c):

- Bradenton Beach Scenic Highway;
- Broward County A1A Scenic Highway;
- Courtney Campbell Scenic Highway;
- Florida Black Bear Scenic Byway;
- Green Mountain Scenic Byway;
- Heritage Crossroads: Miles of History Heritage Highway;
- Indian River Lagoon- Treasure Coast Scenic Highway;
- J.C. Penney Memorial Scenic Highway;
- Lemon Bay/Myakka Trail Scenic Highway;

[2] The total number of State Scenic Byways may not include those segments of National Scenic Byways that are also designated as State Scenic.

- Old Florida Heritage Highway;
- Ormond Scenic Loop and Trail;
- Palma Sola Scenic Highway;
- Pensacola Scenic Bluffs Highway;
- The Ridge Scenic Highway;
- River of Lakes Heritage Corridor;
- Scenic Highway 30A;
- Suncoast Scenic Parkway;
- William Bartram Scenic and Historic Highway; and
- Martin Grade Scenic Highway.

Airports

Air service to the state is provided by a number of major international airports.

Miami International Airport (MIA) is owned by Miami-Dade County and operated by the Miami-Dade Aviation Department (MIA 2015). The airport "offers more flights to Latin America and the Caribbean than any other U.S. airport, is America's second-busiest airport for international passengers, boasts a lineup [of] over 100 air carriers and is the top U.S. airport for international freight" (MIA 2015). MIA is the 12th busiest airport in the U.S. for the total number of passengers served, 3rd busiest for the total amount of cargo handled by the airport, and 1st among U.S airports for international freight (MIA 2015). In 2014, MIA served 40.9 million passengers, 339,048 commercial aircraft movements, and 2,174,212 tons of freight (MIA 2015).

Orlando International Airport (MCO) is operated by the Greater Orlando Aviation Authority (MCO 2015). In 2015, the airport was the 14th busiest airport in the U.S. for enplanements and the 28th for the amount of cargo it handles (FAA, 2015b). In 2014, the airport served 35,714,091 passengers, 290,359 aircraft operations, and 172,878 tons of cargo (Greater Orlando Aviation Authority, 2014).

Fort Lauderdale/Hollywood International Airport (FLL) is owned by Broward County and operated by the Broward County Aviation Department (FLL 2015a). The airport is the 21st busiest airport in the U.S. for total passenger traffic and 13th for domestic travelers, since the airport serves over 73,000 passengers every day (FLL 2015a). In 2013, FLL served 14,828,158 passengers, 154,689 aircraft movements, and 51,618 tons of cargo (FLL 2015b).

Tampa International Airport (TPA) is operated by the Hillsborough County Aviation Authority (TPA 2015a). The airport is ranked as the 29th busiest airport in the U.S. for enplanements and the 56th for the amount of cargo it handles (FAA, 2015b). In 2014, TPA served 17,552,707 passengers and 177,094,542 pounds of cargo (TPA 2015b).

Other large airports in the state that each serve over two million passengers per year include Southwest Florida International (RSW), Palm Beach International (PBI), and Jacksonville International (JAX) (FAA 2015a). Figure 5.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 5.1.7, Land Use, Recreation, and Airspace, provides greater detail on airports and airspace in Florida.



Figure 5.1.1-1: Florida Transportation Networks

Rail Networks

Florida is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Of the 2,753 miles of railroad track in Florida, the state owns 143 miles of track, while the rest is owned by the private sector (FDOT, 2015b). Figure 5.1.1-1 illustrates the major transportation networks, including rail lines, in Florida.

Amtrak runs two lines through Florida. The Silver Service runs daily service between New York City and Miami. Florida is also the ending point for Amtrak's Auto Train, with nonstop service from the Washington, D.C. region to just outside of Orlando, FL. Passengers can load their car or other motor vehicle (e.g., van, motorcycle, small boat, jet ski, etc.) onto the train. Amtrak advertises the service by saying that "This IS the best way to drive I-95" (Amtrak, 2015a). Table 5.1.1-3 provides a complete list of Amtrak lines that run through Florida.

Table 5.1.1-3: Amtrak Train Routes Serving Florida

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Florida
Auto Train	Lorton, VA	Sanford, FL	16 hours 58 minutes	Sanford
Atlantic Coast Service – Silver Service: Silver Star & Silver Meteor	New York, NY	Miami, FL	27+ hours	Jacksonville, Orlando, Tampa, West Palm Beach, Fort Lauderdale, Miami

Sources: (Amtrak, 2015b) (Amtrak, 2015c)

Florida has two commuter rail systems: Tri-Rail and SunRail. Tri-Rail, which is owned and operated by the South Florida Regional Transportation Authority, provides regional rail service between the three counties of Palm Beach, Broward, and Miami-Dade (FDOT, 2014). The system is one long route from Mangonia Park Station just north of West Palm Beach, south to the Miami Airport Station (Tri-Rail, 2015). The line has 18 stations: six in Palm Beach County, seven in Broward County, and five in Miami-Dade County (SFRTA, 2015). In fiscal year 2015, Tri-Rail served 4,292,705 passengers (SFRTA, 2015).

SunRail serves the City of Orlando and its environs, including Orange County, and is operated by the Central Florida Commuter Rail Commission (SunRail, 2015). The system is just over one year old, as it began service to 12 stations on May 1, 2014 (SunRail, 2015). Phase 2 of the system is currently under construction and will add an additional five stations to the system, extending its reach into Volusia and Osceola Counties (SunRail, 2015). Once Phase 2 is complete, the SunRail system will run for a total of 61.5 miles (SunRail, 2015).

Miami's Metrorail system is operated by Miami-Dade Transit (FDOT, 2014). The system operates on 25 miles of track and serves 23 stations along two lines (Miami-Dade County, 2015a). The orange line runs from Miami International Airport to Dadeland South; the green line runs from Palmetto to Dadeland South (Miami-Dade County, 2015b). In fiscal year 2014, Metrorail served 21,592,663 passengers (Miami-Dade County, 2014).

In 2006, over 108 million tons of freight moved through Florida via freight rail (FDOT, 2009). Of that total, 45 percent originated and terminated in Florida, 41 percent was inbound, 12 percent

was outbound, and 2 percent was pass-through (FDOT, 2009). Although 15 different freight rail companies operate in Florida, CSX Transportation (CSXT) is by far the largest, with ownership of over 53 percent of the track mileage in the state (FDOT, 2009). In addition to CSXT, one other Class I railroad, Norfolk Southern Corporation, operates in the state, as well as two regional railroads and nine local railroads (FDOT, 2009).

Harbors and Ports

Florida is surrounded on three sides by bodies of water. To the east is the Atlantic Ocean and to the west is the Gulf of Mexico. The Straits of Florida separates the southern end of Florida and the island of Cuba. Florida's geographical position lends itself to the existence of a number of harbors along its coastlines. Many of these natural harbors are home to Florida's seaports, fourteen of which hold membership in the Florida Ports Council (FPC). The FPC is a nonprofit that manages Florida's seaports and advocates for them in matters relating to the state and federal government (FPC, 2015a). The Florida Port Council's member seaports are the Ports of Canaveral, Everglades, Fernandina, Fort Pierce, Jacksonville, Key West, Manatee, Miami, Palm Beach, Panama City, Pensacola, Port St. Joe, St. Petersburg and Tampa Bay (FPC, 2015b). The locations of Florida's largest shipping and cruise ports can be seen in Figure 5.1.1-1. While the FPC manages the ports, the Florida Seaports and Waterways Office (part of Florida's Department of Transportation) works with the ports regarding "planning and funding strategic seaport projects as well as assisting with seaport-related issues" (FDOT, 2015d). The Florida Seaports and Waterways Office deals with the same ports as the FPC, but it also lists Port Citrus, a prospective project located on the Crystal Bay on the Gulf of Mexico (FDOT, 2015d).

Port Pensacola's location on the Florida panhandle's Pensacola Bay gives it useful access to the Gulf of Mexico. Operating on approximately 50 acres of land, the port boasts open and warehoused cargo storage as well as 10 acres of dredge spoil disposal (Port Pensacola, 2015a). The port can be reached by sea through the 33 foot deep Caucus Channel that leads into the Pensacola Bay. Dockside rail access to the port is provided by CSX Transportation, Burlington Northern Santa Fe Railroad and Rail America (Port Pensacola, 2015b). In 2013, the port was responsible for importing cargo $3 million and exporting $219.9 million. This cargo weighed 67,241 tons and 64,265 tons respectively (U.S. Census Bureau, 2015c).

Port Panama City is located on the St. Andrews Bay and is connected to the Gulf of Mexico through small channel called the West Pass. The 138 acre port facility handles a wide range of cargo to keep from establishing reliance on a small number of products. Examples of its cargo include wood pellets, copper imports, steel plate and a range of forest products (Panama City Port Authority, 2015). In 2013, the port imported $2.87 billion in cargo, weighing 4,354,130 tons. The port's exports totaled $721.2 million, weighing 1,021,401 tons (U.S. Census Bureau, 2015c).

The Port of Port St. Joe can be found on the Saint Joseph Bay on the Gulf of Mexico. It offers "213 acres of combined ready-to-be-leased lands adjacent to the bulkheads and thousands of acres of land in the Port environs available for immediate development" (Port of Port St. Joe, 2015a). There are no interstate connections to the port facilities, but it can be reached through

State Road 71 or US 98. Rail access is provided by AN Railway (Port of Port St. Joe, 2015b). Port St. Joe has no trade listed by the US Census Bureau (U.S. Census Bureau, 2015c).

Port Tampa Bay handled a third of Florida's exports during fiscal year 2014. It is also a relevant cruise port, moving nearly a million passengers each year (Port Tampa Bay, 2015a). It is the largest port in the state by both cargo tonnage and acreage (FPC, 2015c). The port is located on the Hillsborough Bay, an inlet of Tampa Bay and offers container, bulk and general cargo facilities, as well as shipbuilding and cruise terminals (Port Tampa Bay, 2015b). In 2013, $2 billion in cargo, weighing 5,952,481 tons was brought in through the port. The same year, Port Tampa Bay exported 6,393,405 tons in cargo worth $2.4 billion (U.S. Census Bureau, 2015c).

Also located on the Tampa Bay is the Port of St. Petersburg. This port does a minimal amount of shipping, but offers a number of non-cargo related attractions. Among these are yacht marinas and marine research facilities. In 2013, the port facilities brought in about $200,000 in cargo, but exported a minimal amount (U.S. Census Bureau, 2015c).

The third port located on Tampa Bay is the Port Manatee. This facility can be found at the entrance to the Bay, compared to the ports of St. Petersburg and Tampa Bay which are further from the Gulf. Port Manatee's location makes it the closest deep-water US Port to the Panama Canal (Port Manatee, 2015a). This 1,100 acre port ranks fruits, vegetables, and citrus juices as some of its more important imports, while phosphate products, citrus juices, and used vehicles are among its most important exports. Port Manatee can be reached via I-75 and I-275. A port-based rail connects to a CSX mainline rail about a mile from the port (Port Manatee, 2015b). In 2013, Port Manatee imported 1,323 tons of cargo goods worth about $505 million. At the same time, the port exported $213 million worth of cargo weighing 352,299 tons (U.S. Census Bureau, 2015c).

In the Straits of Florida, south of the mainland lies the Port of Key West, on the island of Key West. The Port does minimal trade, but operates as a cruise port. Cruise ships from ports in Miami, Port Everglades, Canaveral, Tampa and Jacksonville visit the port regularly, bringing "almost a million total passengers per year resulting in a local business impact of approximately $85,000,000" (FPC, 2015d). It is also home to a ferry terminal that runs ferries to Marco Island and St. Myers beach on the mainland of western Florida (FPC, 2015d).

At the southeast tip of the state is the city of Miami, home of Port Miami. The port facilities are located on Dodge Island, which can be found between Miami Beach and the mainland. The port services both cargo and cruise ships, and is known as the Cruise Capitol of the World. In 2014 the port handled close to five million cruise passengers taking multiple-day trips. The cruise port berths eighteen ships from thirty six companies and features four ships that sail from the port year-round (Miami-Dade County, 2015c). International trade is conducted through the port with "China, Honduras, Brazil, Dominican Republic, Panama, Guatemala, Netherlands and Indonesia" (FPC, 2015e). China and Guatemala are lead the countries that import goods through Miami, at 27.8% percent and 6.7 percent respectively. Leading the port's destination of export are China (12.9 percent) and the Dominican Republic (8.9 percent) (Lynskey, 2015). The use of the on-dock Port Miami-Florida East Coast Railway means that cargo can reach southeast US cities like Nashville, TN or Charlotte, NC within two or three days (Miami-Dade County,

2015d). In 2013, the U.S. Census Bureau listed Port Miami as being responsible for the import of $13 billion in cargo, weighing about 3,306,934 tons and the export of 2,976,241 tons of cargo worth $11 billion (U.S. Census Bureau, 2015c).

Port Everglades is located just up the coast, north of Port Miami. There the Shanahan River flows into Lake Mabel, a small body of water just off the Atlantic Ocean. Much like Port Miami to the south, Port Everglades operates as both a cargo port and a cruise port. As a cruise port, it is "one of the top three cruise ports in the world" (Port Everglades, 2015a) and as a cargo port, Port Everglades acts as "main seaport for petroleum products such as gasoline and jet fuel" (Port Everglades, 2015a). In 2014, a record high 3,880,033 multi-day passengers were handled by Port Everglades. Her cargo trade partners include countries such as Honduras, Guatemala, Panama and Italy (FPC, 2015f). Over land, the port is easily reached via I-595, which runs east-west between I-75 and the port itself. A recently completed intermodal container transfer facility helps to move containers between cargo ships and Florida East Coast Railway trains (Port Everglades, 2015b). In 2013, Port Everglades brought $12 billion worth of cargo into the United States, which weighed about 7,936,641 tons. That year, the port also exported $13 billion in goods with a weight of 2,976,241 tons to its trade partners around the world (U.S. Census Bureau, 2015c).

Also located on the south Florida coast is the Port of Palm Beach. This facility is located on the Lake Worth Lagoon, which is protected from Atlantic storms by Palm Beach. Like other south Florida ports, Palm Beach accommodates both cargo and cruise. Its cruise operations are not on the same scale as Port Miami or Port Everglades, as this port only offers casino cruises and trips to the Bahamas (Port of Palm Beach, 2015). In regard to cargo, the port trades with "Bahamas, Canada, Virgin Islands, Leeward and Windward Islands and Trinidad" (FPC, 2015g). Palm Beach is about 80 miles north of the city of Miami and can be reached easily via I-95. Rail connections to Florida East Coast Railway to the docks allow train service to move cargo to and from the port twice a day (FPC, 2015g). In 2013, the Port of Palm Beach exported more goods than it brought in. That year, 767,209 tons of cargo worth $1.7 billion was exported, in contrast with the 144,403 tons worth $445 million that was imported by the port (U.S. Census Bureau, 2015c).

The Port of Ft. Pierce is also located on the southeast coast of Florida, insulated by the Islands of Hutchinson and North Hutchinson, which lie to the east. The Ft. Pierce inlet separates the two islands and gives the port access to the Atlantic Ocean (St. Lucie County, 2013). The Port of St. Pierce is a small facility whose shipping capabilities are minimal. Recommendations from the 2013 Port Master Plan included the creation of a Port Director position and obtaining funds to help with port development and infrastructure improvements (St. Lucie County, 2013). These recommendations have since been completed (FPC, 2015h). The Port of Ft. Pierce's imports in 2013 weighed 4,409 tons and totaled $1.7 million. Exports that year were worth $9.7 million and weighed 2,535 tons (U.S. Census Bureau, 2015c).

Port Canaveral is another of Florida's important cruise ports (FDOT, 2015d). It is located on Cape Canaveral the southern end of the Canaveral Bight. It is "home to three seasonal ships and eight year-round cruise ships from Carnival Cruise Lines, Disney Cruise Line and Royal

Caribbean International" (FPC, 2015i). The port's cruise facilities handled 4.2 million people in 2014 (FPC, 2015i). Overland connections to the port include I-95 and Florida East Coast Railway. I-95 is located about 13 miles from the port, while "Florida East Coast Railway access is available via an intermodal terminal located just 15 minutes from Port Canaveral" (Port Canaveral, 2015a). The Titusville Norfolk Southern Intermodal Terminal is also about 25 minutes away via road (Port Canaveral, 2015a). Port Canaveral intends to spend more than $600 million in the next five years on improvements to the port, including on-dock rail access and a new container terminal (Port Canaveral, 2015b). In addition, the completion of an effort to widen and deepen the channel leading into Port Canaveral to 55 feet would allow larger cruise and cargo vessels access to the harbor. Expected completion of the countries "garage auto processing terminal" will facilitate auto trade with Mexico and Europe in coming years (FPC, 2015i). In 2013, Port Canaveral was responsible for importing $1.26 billion in cargo goods weighing 2,094,391 tons; as well as exporting $122 million worth of goods that weighed 98,105 tons (U.S. Census Bureau, 2015c).

At the mouth of the St. John's River in Florida's northeast corner is the Port of Jacksonville. Port facilities occupy much of the mouth of the river and its banks, including Blount Island and Dame's Point. The port uses these facilities to operate three cargo terminals and one cruise terminal. A harbor deepening project being led by the U.S. Army Corps of Engineers began in 2014. This would allow larger ships to move down the St. John's River, and therefore into and out of the Atlantic Ocean (FPC, 2015j). Land access to port facilities is provided by Interstates 95 and 295. I-295 to facilities at Dames Point and Blount Island, while I-95 runs to the southeast, through the heart of Jacksonville. Rail service is provided by CSX and Norfolk Southern, along with Florida East Coast Railway. Currently, on-dock rail is available at the Blount Island Marine terminal (Jaxport, 2015a). Another on-dock rail container facility is being built at Dames Point (FPC, 2015j). Carnival Cruise lines runs a ship year round from the port to the Bahamas (Jaxport, 2015b). Over its history, "more than 1.5 million passengers have embarked from JAXPORT's cruise terminal" (FPC, 2015j). In addition to its cruise capabilities, the port trades with partners in Colombia, China, Mexico, Japan and Puerto Rico. In 2013, the Port of Jacksonville was responsible for importing $11 billion worth of cargo goods that weighed 7,165,024 tons. The same year, it exported $12 billion worth of cargo that weighed 2,645,547 tons (U.S. Census Bureau, 2015c).

Just south of the Florida-Georgia border is the Port of Fernandina, nestled in the curve of St. Mary's River where it moves past Fernandina Beach. Unlike some of its colleagues, Port of Fernandina is a regional port that does not offer cruise facilities (FDOT, 2015d). The port's main import service involves moving pulp and paper products to customers the southeastern US. Its major exports include steel products to countries such as Panama, Bermuda and Ecuador (FPC, 2015k). Interstate connections are available via I-95; while Rail connections from the port to CSX rail, Merchant Train and Double Stack Intermodal Train help accomplish the ports goals (Port of Fernandina, 2015). In 2013, the Port of Fernandina imported 10,692 tons of goods worth $7.6 million and exported 189,598 tons worth $167 million (U.S. Census Bureau, 2015c).

5.1.1.4. Public Safety Services

Florida public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 5.1.1-4 presents Florida's key demographics including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 5.1.9, Socioeconomics; however, these demographics are key to understanding the breadth of public safety services throughout the state.

Table 5.1.1-4: Key Florida Indicators

Florida Indicators	
Estimated Population (2014)	19,893,297
Land Area (square miles) (2014)	53,625
Population Density (persons per sq. mile) (2010)	350.6
Municipal Governments (2007)	411

Sources: (U.S. Census Bureau, 2015a) (National League of Cities, 2007)

Table 5.1.1-5 presents Florida's public safety infrastructure, including fire and police stations. Table 5.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 5.1.1-5: Public Safety Infrastructure in Florida by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	1,797
Law Enforcement Agencies [b]	387
Fire Departments [c]	477

[a] Data collected by the U.S. Fire Administration in 2015.
[b] Number of agencies from state and local law enforcement include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[c] Data collected by the U.S. Fire Administration in 2015.

Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011)

Table 5.1.1-6: First Responder Personnel in Florida by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	6,110
Fire and Rescue Personnel [b]	11,661
Law Enforcement Personnel [c]	81,312
Emergency Medical Technicians and Paramedics [d e]	9,610

[a] BLS Occupation Code: 43-5031.
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 53-3011 (Ambulance Drivers and Attendants, Except Emergency Medical Technicians). Volunteer firefighters reported by the U.S. Fire Administration.
[c] Full-time employees from state and local law enforcement agencies which include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[d] BLS Occupation Code: 29-2041.
[e] All BLS data collected in 2015.

Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011) (BLS, 2015a)

5.1.1.5. Telecommunications Resources

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure in Florida; therefore, the following information and data are combined from a variety of sources, as referenced.

Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 5.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology). It also shows backhaul (long-distance wired or wireless connections), core, and commercial networks including a long-term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

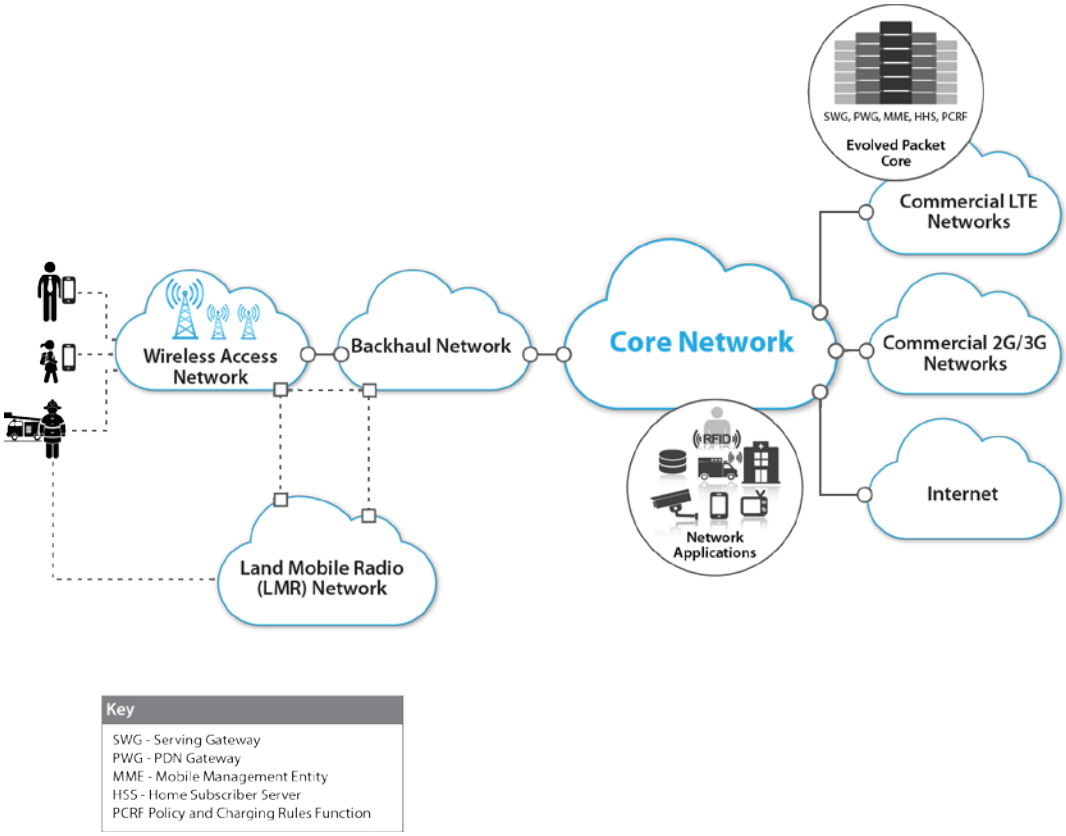


Figure 5.1.1-2: Wireless Network Configuration

Prepared by: Booz Allen Hamilton

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information. Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and specifically in Florida. There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

- Incompatible and aging communications equipment;
- Limited and fragmented funding;
- Limited and fragmented planning;
- A lack of coordination and cooperation; and
- Limited and fragmented radio spectrum.

To help enable the public safety community to incorporate disparate Land Mobile Radio (LMR) networks with a nationwide public safety LTE broadband network, in 2015, the U.S. Department of Commerce Public Safety Communications Research (PSCR) prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies. The program also forecasts the evolution of LBS capabilities and gaps, and identifies potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years (PSCR, 2015).

Florida has experienced significant adoption of LMR Project 25 (P25) systems evidenced by the broad presence of P25 systems in multiple Florida counties as well as the state's commitment to modernization of its legacy 700 MHz Statewide Law Enforcement Radio System (SLERS) to improve interoperability and provide greater standardization. Florida has signaled its planned broader deployment of P25 statewide with its initial phase of the SLERS P25 system statewide for aircraft communications (RadioReference.com 2015a). Examples of the county adoption of P25 include the Miami-Dade County Public Services 700 MHz/800Mhz P25 network and the Osceola County P25 network (Project25.org, 2015a). A full listing of the state's current P25 systems is presented in Table 5.1.1-7. Florida's Department of Management Services (DMS), through the Division of Communications, plays a lead role in the management and governance of public safety networks in Florida; law enforcement agencies are required to consult with the DMS and obtain approval from DMS prior to creating or expanding existing LMR systems (Florida Department of Management Services, 2015).

In 2009, two National Telecommunications and Information Administration (NTIA) Broadband Technology Opportunity Program (BTOP) grants were awarded for significant broadband wireless infrastructure improvement in Florida with North Florida Broadband Authority (NFBA) and Florida Rural Broadband Alliance (FRBA) the recipients. These grants resulted in improved broadband capacity and connectivity to Public Safety locations in the state. NFBA, focused on 14 north central Florida counties, enabled connectivity to 74 Public Safety locations (NFBA, 2014), while FRBA enabled connectivity to an additional 97 Public Safety location (FRBA, 2014).

Statewide/Multi-County Public Safety Networks

Florida's public safety network, like most state's is undergoing transition and modernization is planned initially for greater adoption of P25 technology throughout the state. Florida's statewide public safety network is the SLERS; the legacy system is the Enhanced Digital Access Communications System (EDACS) SLERS system which is a private /public partnership

between the state of Florida and Harris Corporation which operates the network. Florida's EDACS SLERS network is managed by Florida's Department of Management Services (RadioReference.com 2015a). Operating at 800 MHz, this legacy system provides statewide coverage and supports a diverse set of Public Safety agencies totaling 23 currently and also supports diverse system talk groups including federal and county users and currently covers 58,000 square miles and provides coverage up to 25 miles offshore (Harris /SLERS 2015).

State Mutual Aid/Common frequencies in Florida utilize a variety of frequencies depending upon the agency and user group: 800 MHz Mutual Aid is available on the SLERS, Law Enforcement uses both Very High Frequency (VHF)[3] and Ultra High Frequency (UHF)[4] frequencies for emergency communications, fire mutual aid and EMS communications use the National Interoperability VHF channels, and Central Florida communities use VHF for interoperability (RadioReference.com 2015b).

City and County Public Safety Networks

Florida's counties have adopted P25 systems broadly with the majority of these systems operating in the 800 MHz frequency band as Table 5.1.1-7 illustrates below (Project25.org, 2015b). As noted previously above, Florida's statewide P25 system, the Statewide Law Enforcement Radio System-P25, currently services Public Safety aircraft communications Statewide, and operates at 700 MHz (RadioReference.com 2015c).

Similar to many other states, Florida counties as well as municipalities reflect a mix of legacy public safety systems as well as diversity in the mix of frequencies utilized. For example, in addition to its P25 system in Miami-Dade County (highest population county in Florida), public safety communications occur on both VHF and UHF, with fire rescue using UHF frequencies for dispatch,, tactical, and EMS communications. Municipalities surrounding Miami, such as Bal Harbour and Key Biscayne, use a mix of VHF and UHF for police tactical communications; whereas the city of Miami uses 800 MHz for fire and police (RadioReference.com 2015d).

Public Safety Answering Points (PSAPs)

According to the Federal Communication Commission's (FCC) Master PSAP registry, there are 67 PSAPs in Florida serving Florida's 234 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

Florida's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC, 2014a) (FCC, 2014b). The following subsections present information on Florida's commercial telecommunications infrastructure, including information on the number of carriers and technologies deployed; geographic coverage; voice, Internet access, and wireless subscribers; and the quantity and location of telecommunications towers, fiber optic plant, and data centers.

[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).
[4] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

Table 5.1.1-7: Florida P25 Networks

Florida Public Safety P25 Systems	Frequency Band	P25 Version	Access Type
Coral Springs Public Safety	800 MHz	Phase 1	Frequency Division
Greater Orlando Public Safety Cooperative	800 MHz	Phase 1	Frequency Division
Hillsborough County Public Safety	700 MHz	Phase 1	Frequency Division
Lake County Public Safety	700 MHz/800 MHz	Phase 1	Frequency Division
Lee County Public Safety	800 MHz	Phase 1	Frequency Division
Marion County FL Public Safety	800 MHz	Phase 1	Frequency Division
Miami-Dade County Public Services	800 MHz	Phase 1	Frequency Division
Monroe County Public Services	800 MHz	Phase 1	Frequency Division
Nassau County Public Services	800 MHz	Phase 1	Frequency Division
Ocala Public Safety	800 MHz	Phase 1	Frequency Division
Osceola County P25	800 MHz	Phase 1	Frequency Division
Pinellas County Public Services (P25)	700 MHz/800 MHz	Phase 1	Frequency Division
Polk, Hardee, Highlands Counties Public Safety	700 MHz/800 MHz	Phase 1	Frequency Division
Region 5 Mutual Aid Incident Command System (ICS)	700 MHz	Phase 1	Frequency Division
Seminole County Public Services (P25) System	800 MHz	Phase 1	Frequency Division
Saint John's County Public Safety System	800 MHz	Phase 1	Frequency Division
Statewide Law Enforcement P25 System	700 MHz	Phase 1	Frequency Division
Sumter County Public Safety System	800 MHz	Phase 1	Frequency Division
Tallahassee/Leon County (P25)	800 MHz	Phase 1	Frequency Division
Alachua County, Gainesville Regional Utilities	800 MHz	Phase 2	Time Division
Apopka Public Safety Project Orange County	700 MHz	Phase 2	Time Division
Jacksonville Public Safety-First Coast Radio Duval County	800 MHz	Phase 2	Time Division
Lakeland City Services Project 25 System	800 MHz	Phase 2	Time Division
Orange County Public Service, Orange County	800 MHz	Phase 2	Time Division

Sources: (Project25.org, 2015a), (Project25.org, 2015b)

Carriers, Coverage, and Subscribers

Florida's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems as well as cable submarine systems for international connectivity. Table 5.1.1-8 presents the number of providers of switched access[5] lines, Internet access,[6] and mobile wireless services including coverage.

[5] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2014b).
[6] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

Table 5.1.1-8: Telecommunications Access Providers and Coverage in Florida as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines [a]	241	97% of households [b]
Internet access [c]	94	63% of households
Mobile Wireless [d]	6	95% of population

[a] Switched access lines are a service connection between an end user and the local telephone company's switch (the basis of older telephone services); this number of service providers was reported by the FCC as of December 31, 2013 in Table 17 as the total of ILEC and non-ILEC providers (FCC, 2014b).

[b] Household coverage data provided by the FCC in "Universal Service Monitoring Report" as a Voice Penetration percentage (percentage of household with a telephone in the unit) and is current as of 2013.

[c] Internet access providers are presented in Table 21 by technology provided; the number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers. Household coverage is provided in Table 13 (FCC, 2014a).

[d] Mobile wireless provider data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). The process of the data collection is explained in the broadband footnote.

Sources: (FCC, 2014a) (FCC, 2014b) (NTIA, 2014) (FCC, 2013)

Table 5.1.1-9 shows the wireless providers in Florida along with their geographic coverage. The following four maps, Figure 5.1.1-3 to Figure 5.1.1-6 show the combined coverage for the top two providers; Sprint's coverage; T-Mobile's and SVIC's coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.

Table 5.1.1-9: Wireless Telecommunications Coverage by Providers in Florida

Wireless Telecommunications Providers	Coverage
AT&T Mobility	98.98%
Verizon Wireless	92.64%
Sprint	81.32%
T-Mobile	79.12%
SVIC	11.31%
Other[a]	12.71%

[a] Other: Provider with less than 5% coverage area. Providers include: PDMNet; Alternative Choice Wireless, LLC; Areyouonline.Net Inc.; AirPowered; The Home Town Network, Inc.; Myakka Technologies; Cellular South, Inc.; Long Hammock Wireless; and VelocityOnline.net.

Source: (NTIA, 2014)

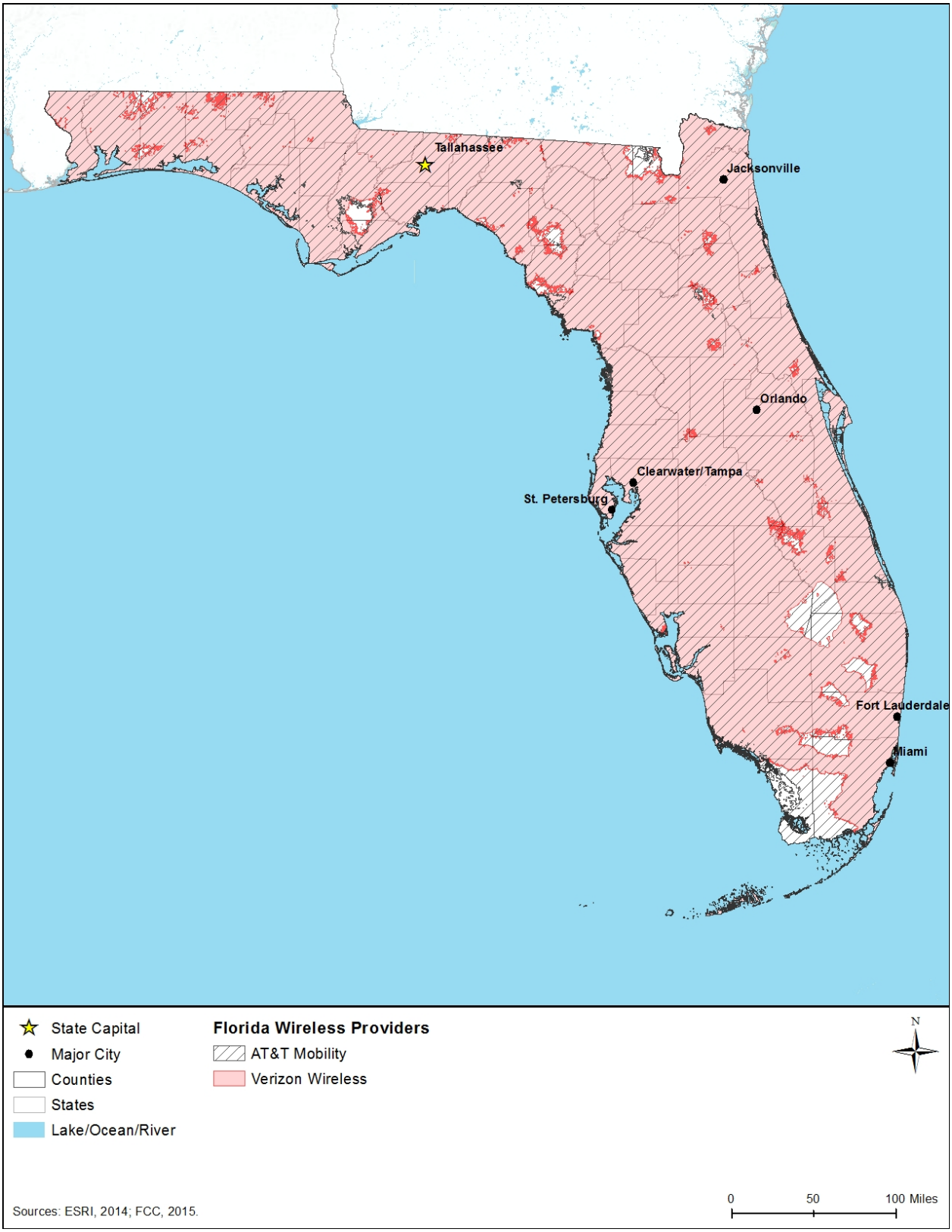


Figure 5.1.1-3: AT&T and Verizon Wireless Availability in Florida

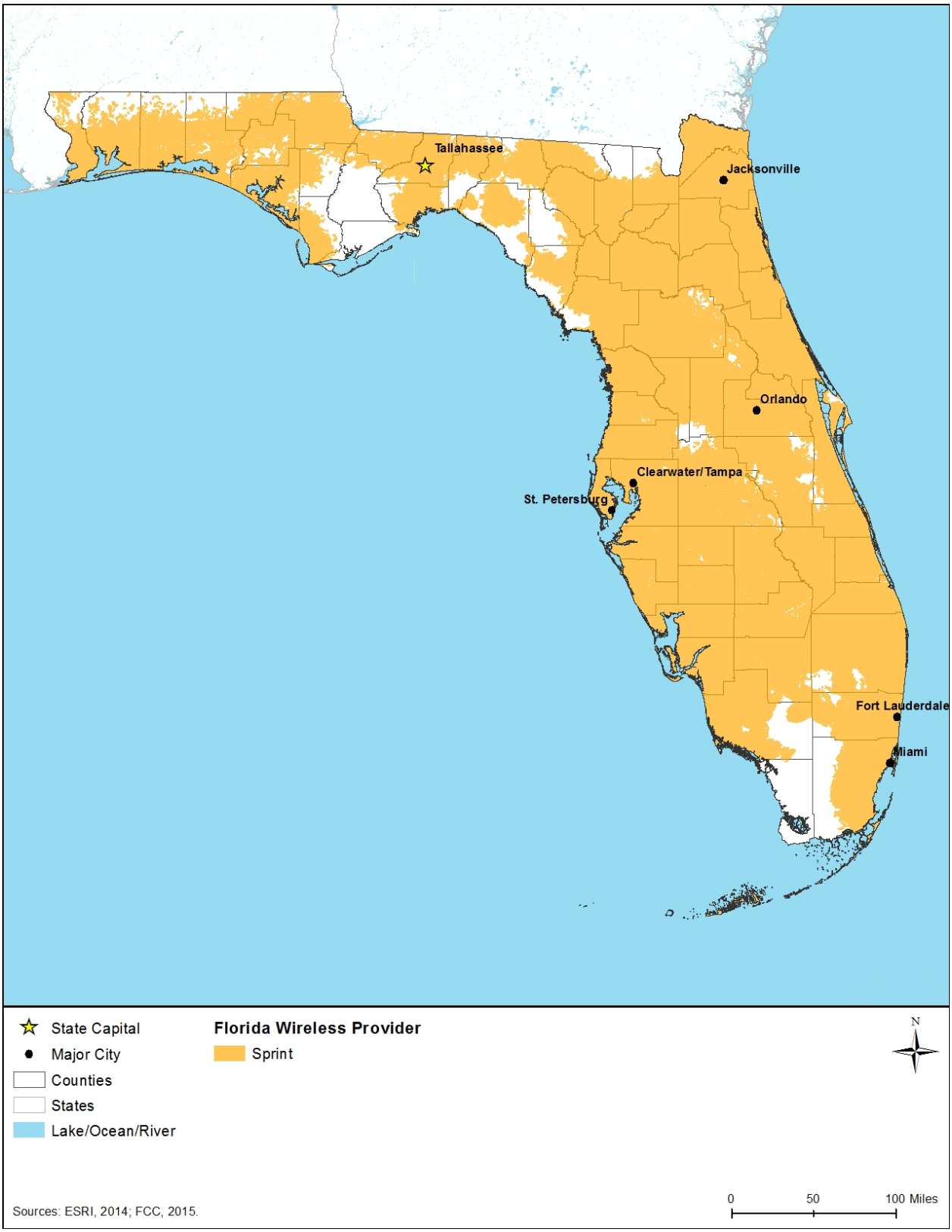


Figure 5.1.1-4: Sprint's Wireless Availability in Florida

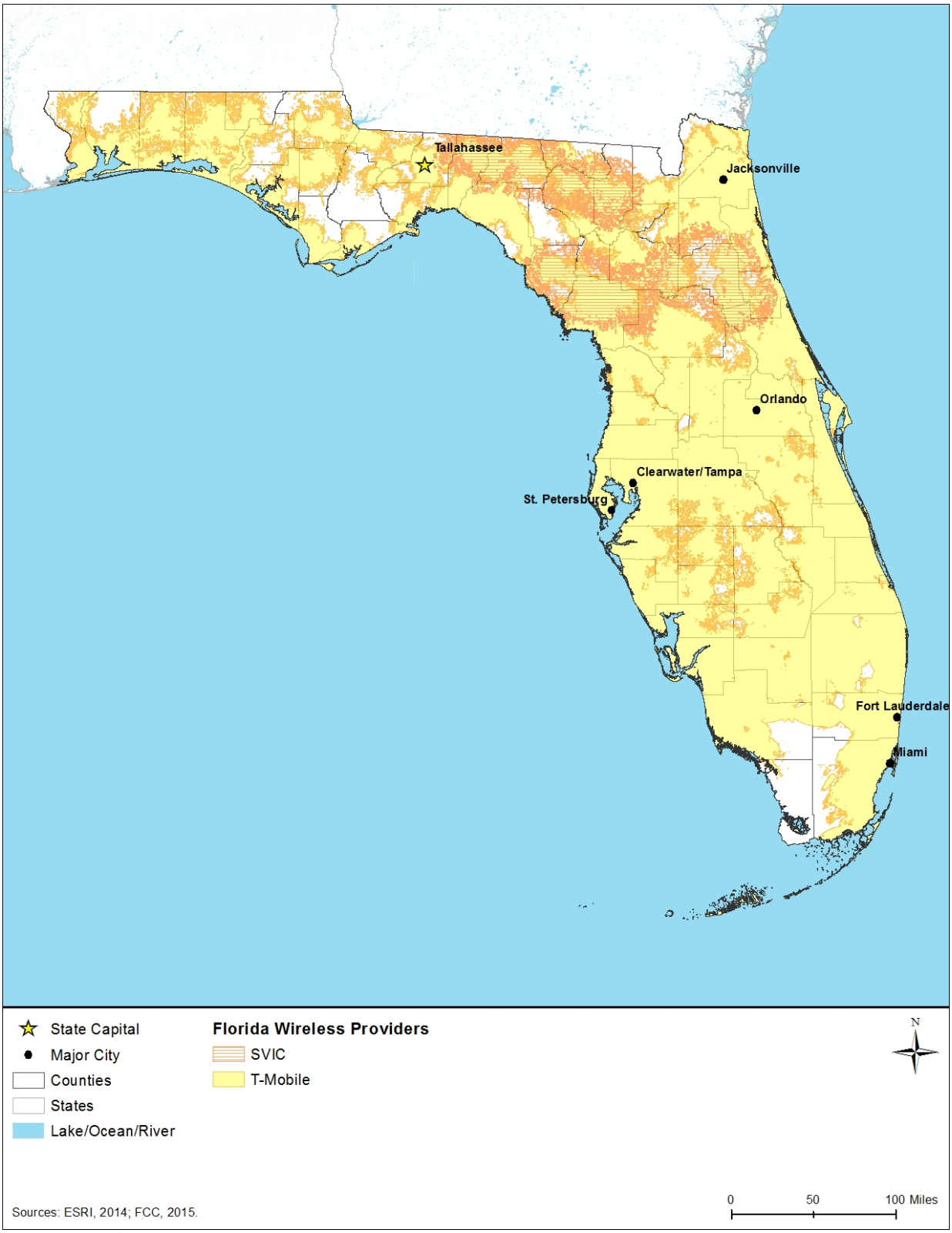


Figure 5.1.1-5: T-Mobile's and SVIC's Wireless Availability in Florida

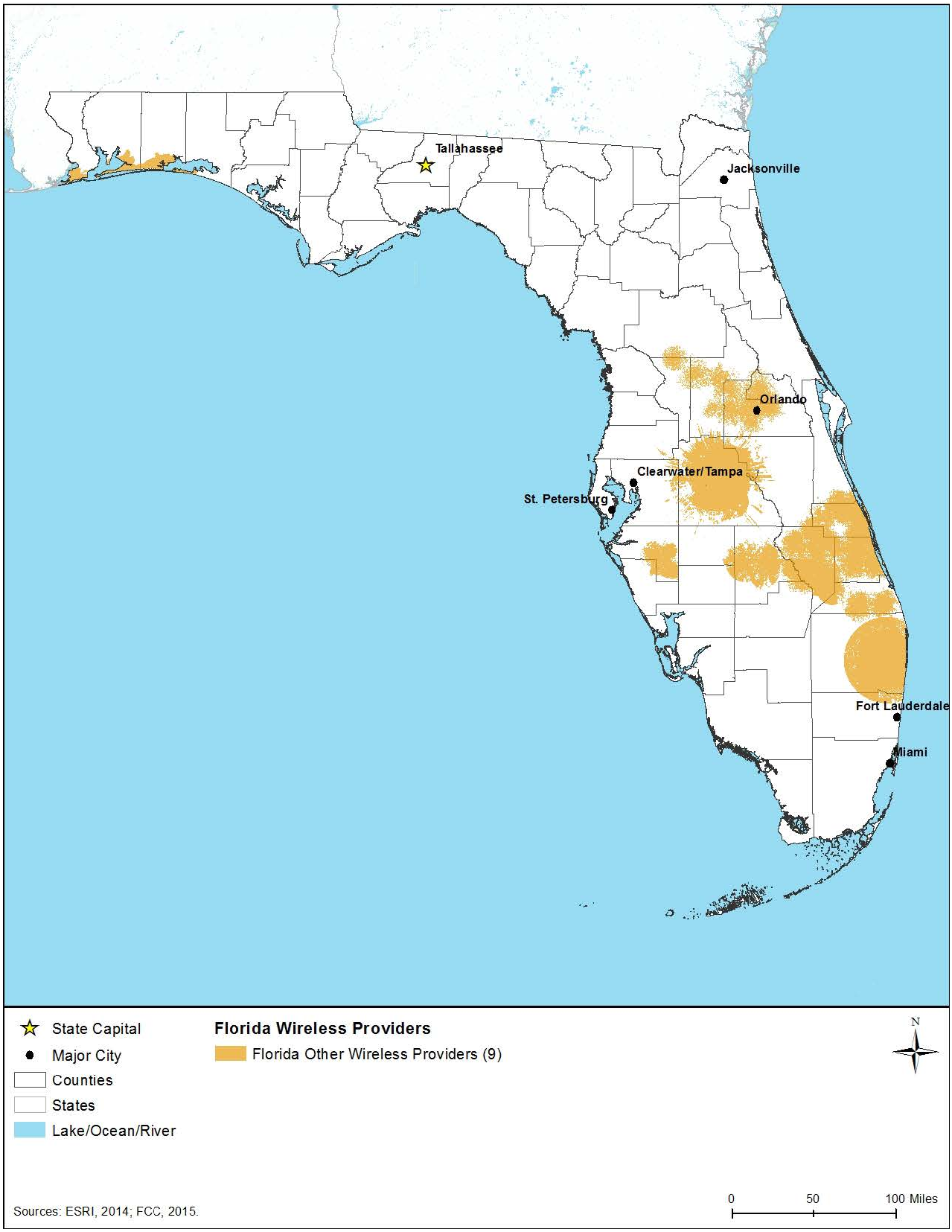


Figure 5.1.1-6: Other Wireless Providers in Florida

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 5.1.1-7 presents representative examples of each of these categories or types of towers.



Monopole
100 – 200 feet
Source:
http://laps.noaa.gov/birk/laps_intranet/site_photos/Monarch/tower.jpg

Lattice
200 – 400 feet
Source: Personal Picture

Guyed
200 – 2,000 feet
Source:
http://www.esrl.noaa.gov/gmd/ccgg/insitu/

Figure 5.1.1-7: Types of Towers

Telecommunications tower infrastructure proliferates throughout Florida, although tower infrastructure is concentrated in the higher and more densely populated areas of Florida. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b).[7] Table 5.1.1-10 shows the number of towers (including broadcast towers) registered with the FCC in Florida, by tower type, and Figure 5.1.1-8 presents the location of those 4,329 structures, as of July 2016.

[7] An antenna structure must be registered with the FCC if the antenna structure is taller than 200 feet aboveground level or may interfere with the flight path of a nearby airport (FCC, 2016b).

Table 5.1.1-10: Number of Commercial Towers in Florida by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft. and over	576	100ft. and over	0
75ft. – 100ft.	1,062	75ft. – 100ft.	4
50ft. – 75ft.	932	50ft. – 75ft.	99
25ft. – 50ft.	747	25ft. – 50ft.	213
25ft. and below	76	25ft. and below	3
Subtotal	**3,393**	**Subtotal**	**319**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft. and over	99	100ft. and over	3
75ft. – 100ft.	118	75ft. – 100ft.	5
50ft. – 75ft.	59	50ft. – 75ft.	7
25ft. – 50ft.	36	25ft. – 50ft.	4
25ft. and below	1	25ft. and below	0
Subtotal	**313**	**Subtotal**	**19**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft. and over	25	100ft. and over	4
75ft. – 100ft.	145	75ft. – 100ft.	2
50ft. – 75ft.	69	50ft. – 75ft.	2
25ft. – 50ft.	23	25ft. – 50ft.	5
25ft. and below	2	25ft. and below	0
Subtotal	**264**	**Subtotal**	**13**
Constructed Tanks[d]			
Tanks	8		
Subtotal	**8**		
Total All Tower Structures		**4,329**	

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed. (FCC, 2015b)

[b] Self standing or guyed (anchored) structure used for communication purposes. (FCC, 2012)

[c] Multiple constructed structures per antenna registration. (FCC, 2016c)

[d] Any type of tank – water, gas, etc. with a constructed antenna. (FCC, 2016c)

Source: (FCC, 2015b)

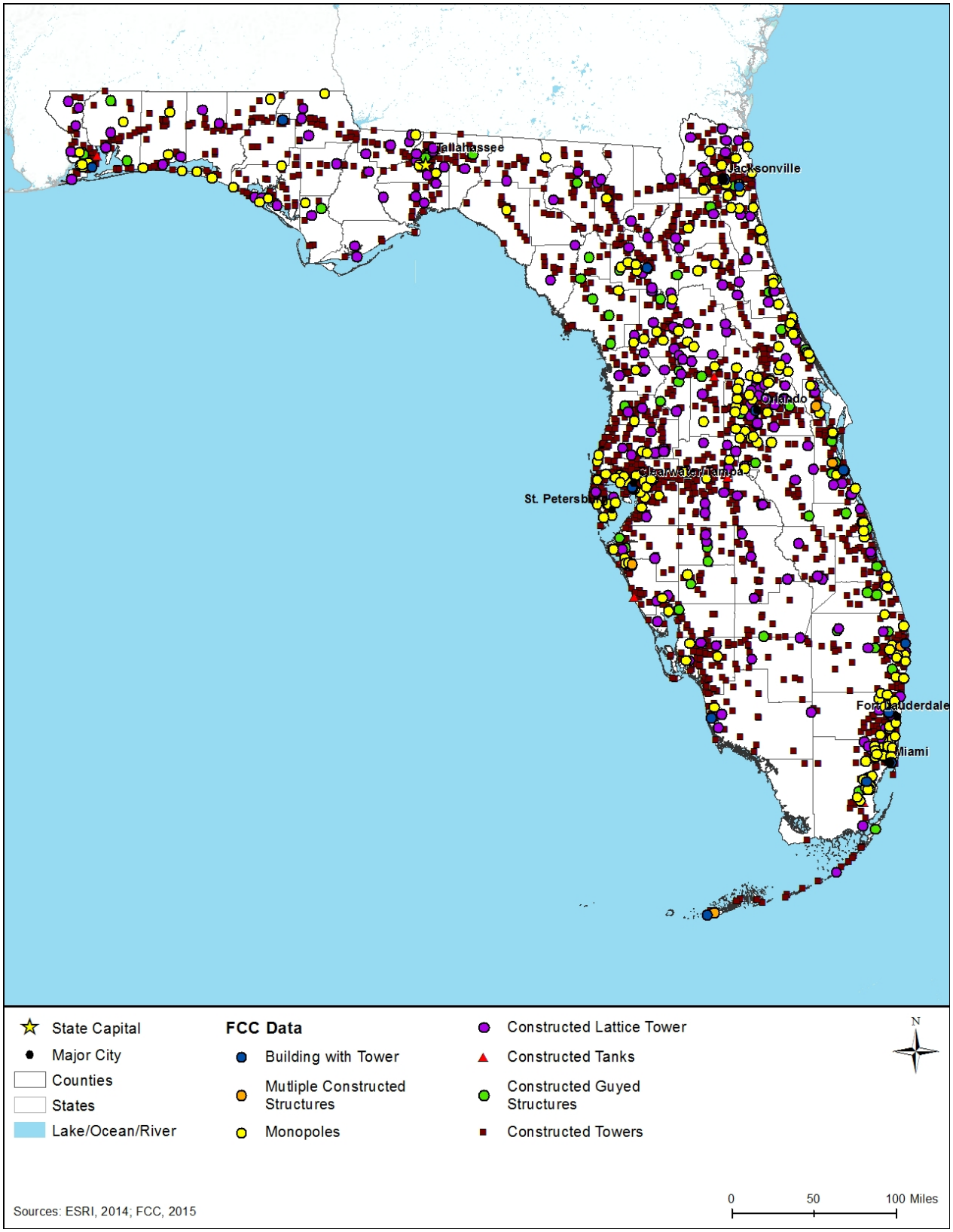


Figure 5.1.1-8: FCC Tower Structure Locations in Florida

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 5.1.1-9. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

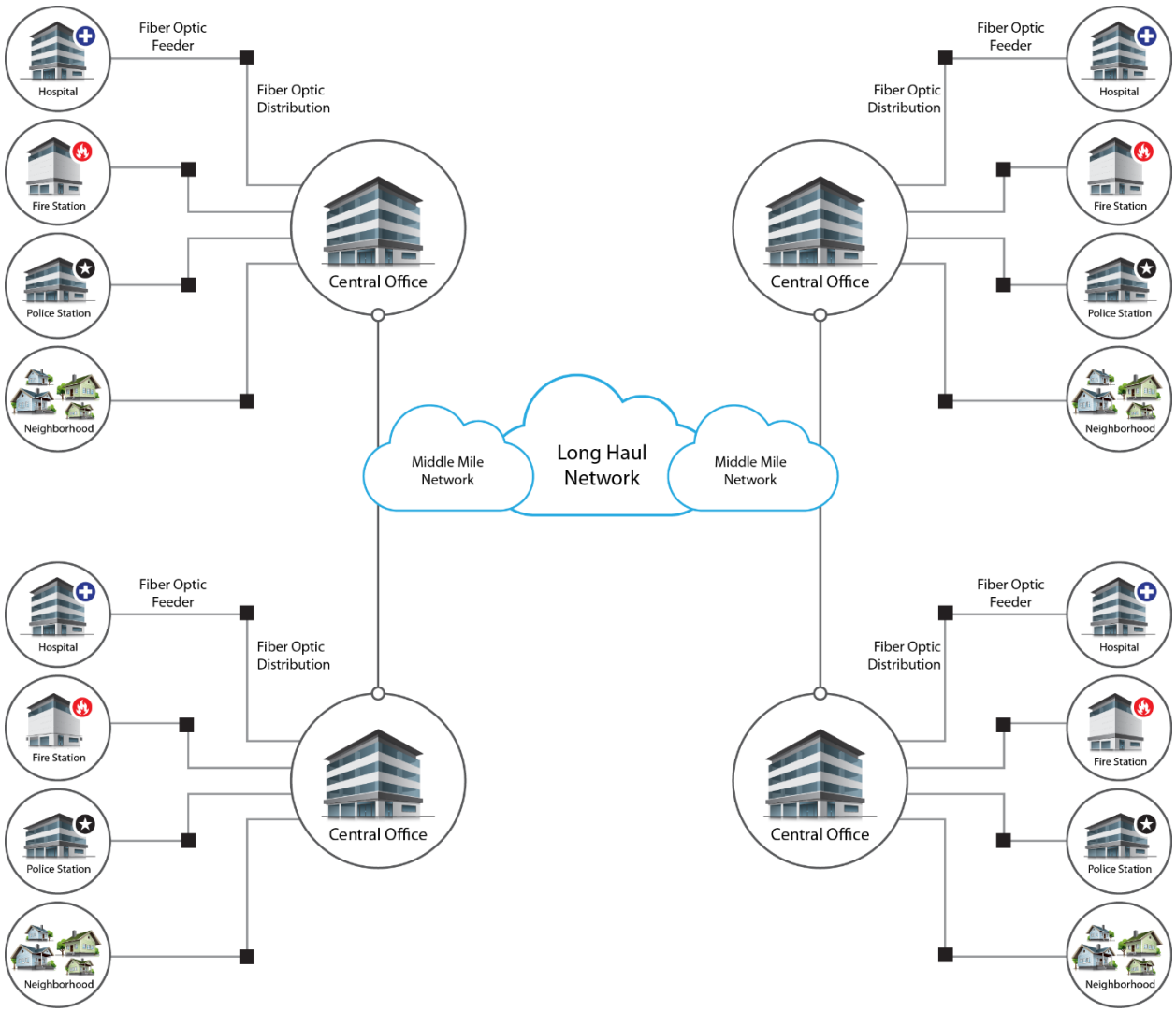


Figure 5.1.1-9: Typical Fiber Optic Network in Florida

Prepared by: Booz Allen Hamilton

Source: (ITU-T, 2012)

Last Mile Fiber Assets

In Florida, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Florida, there are 31 fiber providers that offer service in the state, as listed in Table 5.1.1-11. Figure 5.1.1-10 shows coverage for CenturyLink and AT&T, Figure 5.1.1-11 showing Comcast/MegaPath/Bright House Networks, and Figure 5.1.1-12 showing other providers with less than 5 percent coverage area, respectively.[8]

Table 5.1.1-11: Fiber Provider Coverage

Fiber Provider	Coverage
CenturyLink	12.89%
Bright House Networks	11.74%
AT&T Florida	10.50%
Comcast	9.95%
MegaPath	6.26%
Others[a]	12.71%

[a] Other: Provider with less than 5% coverage area. Providers include: Verizon Online; Summit Broadband; Windstream Florida, Inc.; FPL FiberNet LLC; Southern Light; FairPoint Communications, Inc.; Mediacom; Cox Communications; Wow! Internet, Phone, and Cable; FiberLight LLC; NEFCOM; Frontier Communications; TW Telecom; TDC Telecom; ITS Telecom; Level 3 Communications, LLC; City of Leesburg; Florida Cable; Myakka Communications; Advanced Cable Communications; Smart City; NetQuincy; Cablevision of Marion County LLC; Atlantic Broadband, LLC; Home Town Cable Plus; Cogent Communications, Inc.

Source: (NTIA, 2014)

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among and between telecommunications carriers and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013). Ownership of data centers may be public or private; comprehensive information regarding data centers may not be publicly available as some are related to secure facilities.

[8] The broadband map utilized data collected as part of the broadband American Recovery and Reinvestment Act initiative. The data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). Each state's broadband data was downloaded accordingly. The data pertaining to broadband data/coverage for census blocks, streets, addresses, and wireless were used. Census blocks, roads, and addresses were merged into one file and dissolved by similar business and provider names. Square miles were calculated for each provider. The maps show all providers over 5% on separate maps; providers with areas under 5% were merged and mapped as "[State Name] Other Fiber Providers." All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "[State Name] Other Wireless Providers." Providers under 5% were denoted in their respective tables.

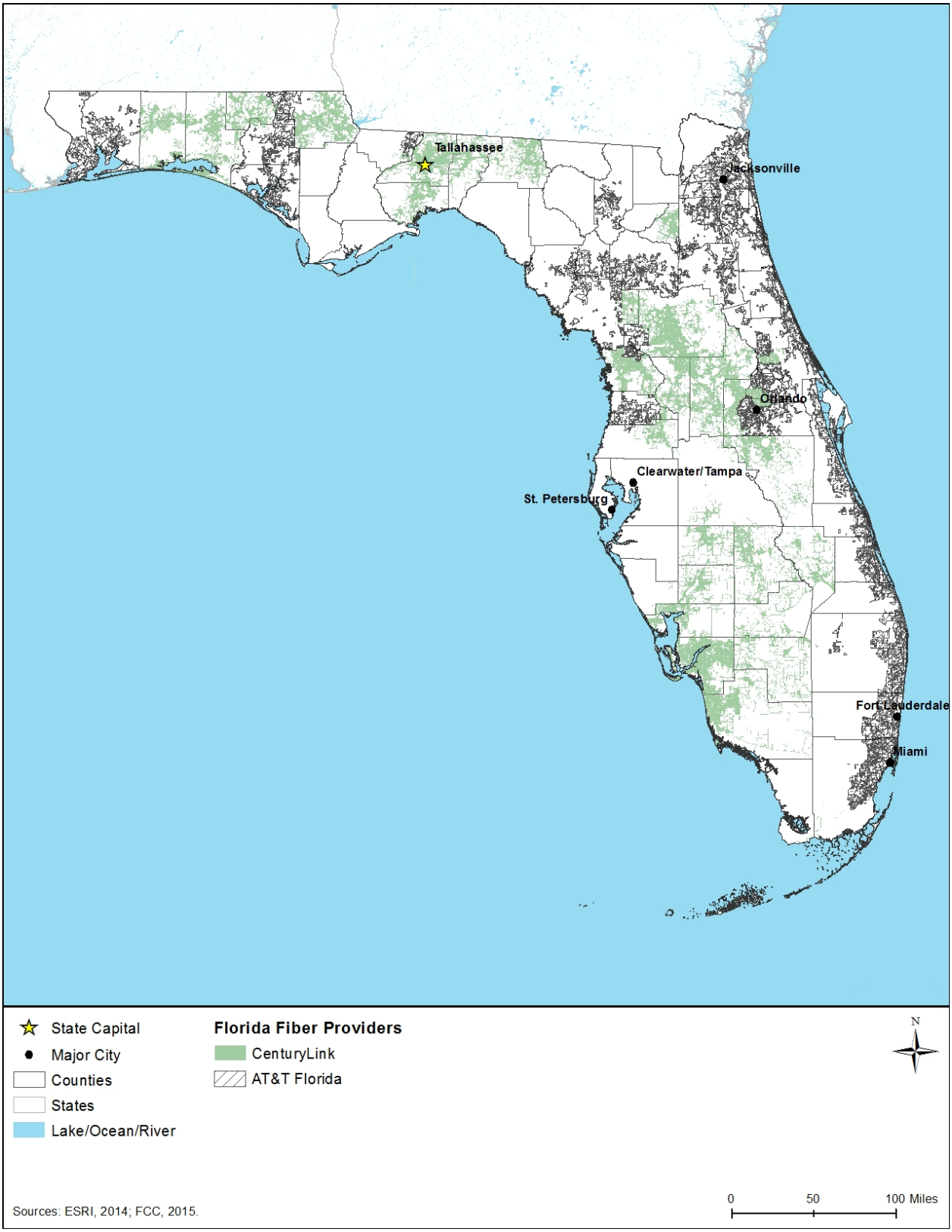


Figure 5.1.1-10: Fiber Availability in Florida for CenturyLink and AT&T

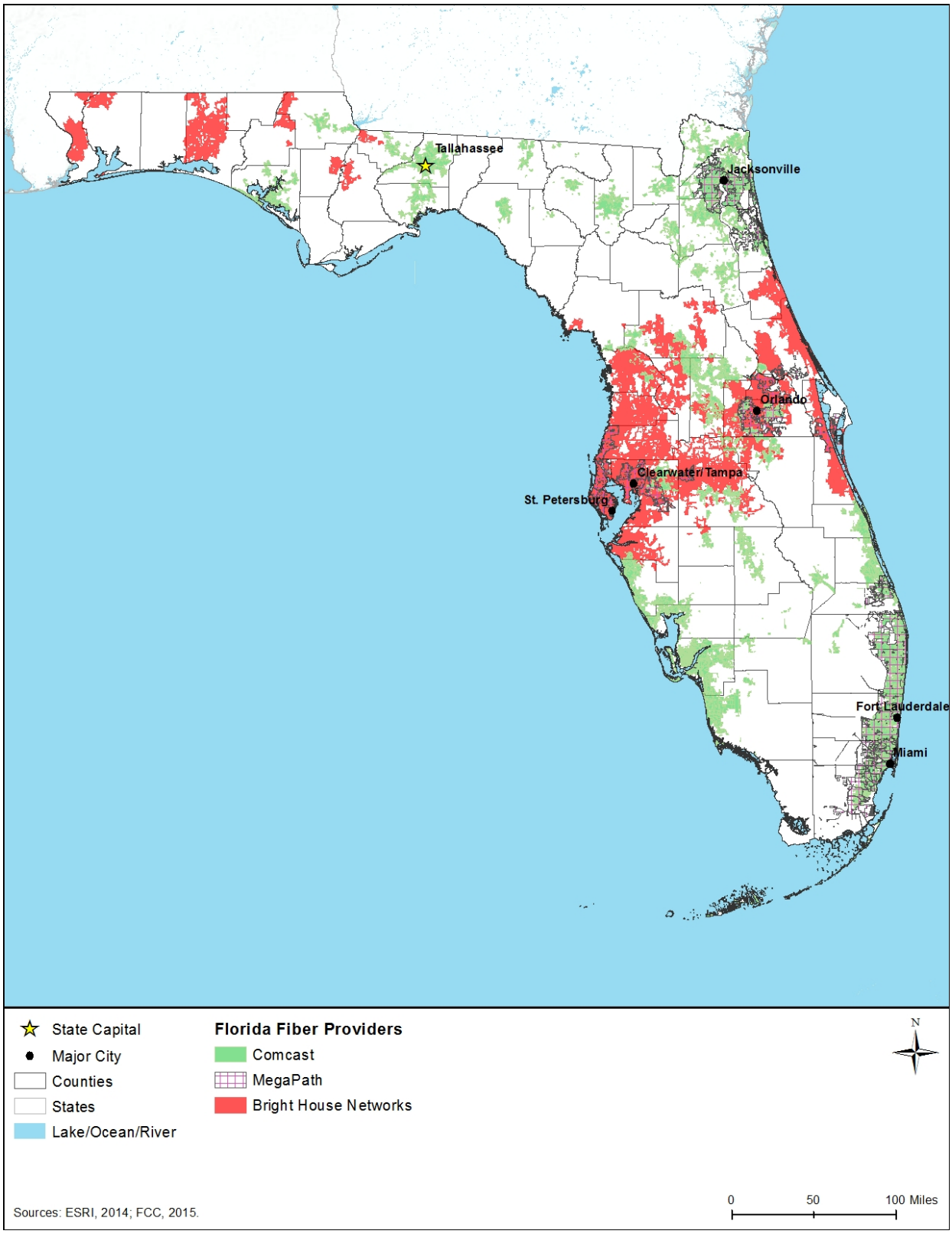


Figure 5.1.1-11: Comcast, MegaPath, and Bright House Networks Fiber Availability in Florida

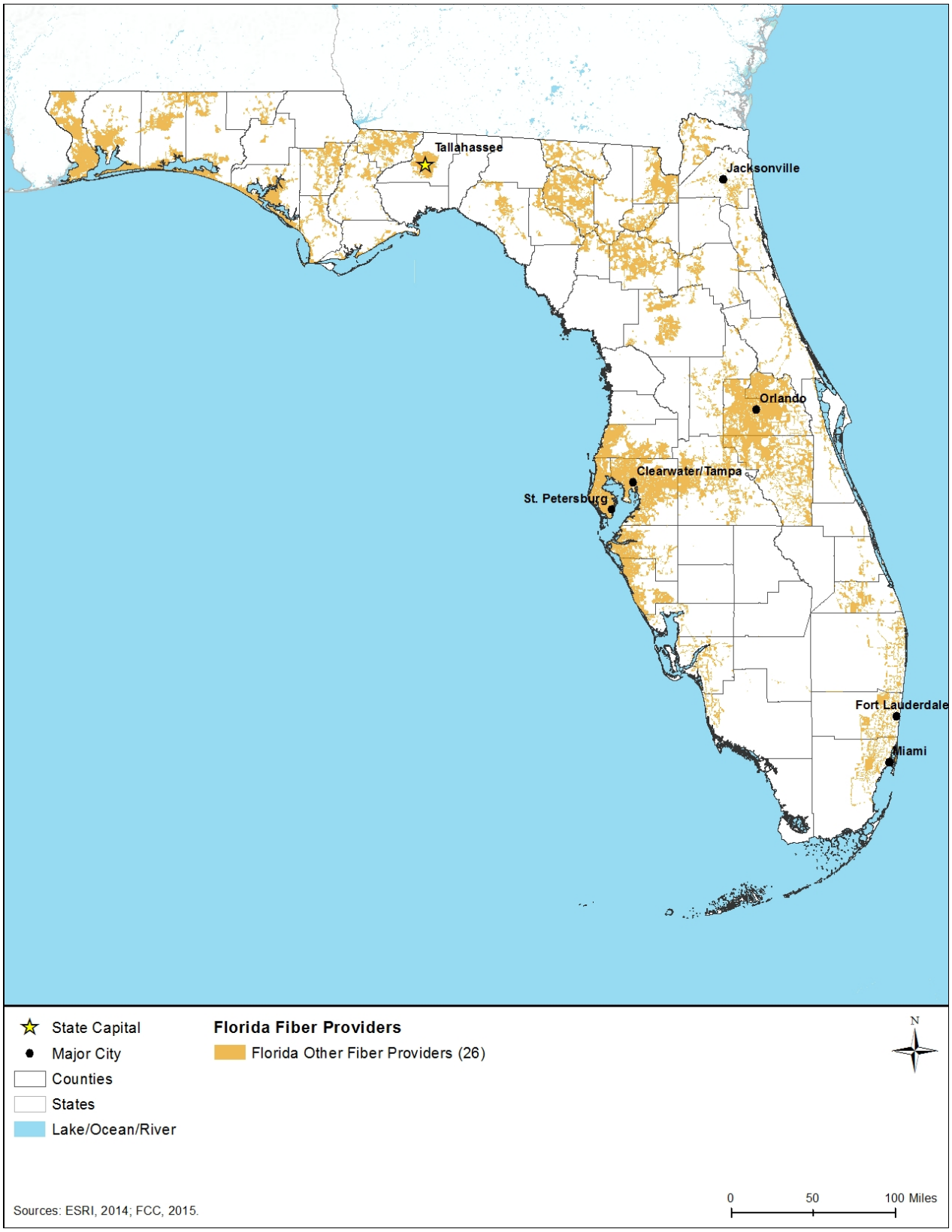


Figure 5.1.1-12: Other Fiber Providers in Florida

5.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 5.1.4, Water Resources, describes the potable water sources in the state.

Electricity

In the state of Florida, electricity utilities are regulated by the Florida Public Service Commission (FPSC). For the five investor owned electricity utilities, the FPSC has oversight in the areas of "rate base/economic regulation; competitive market oversight; and monitoring of safety, reliability, and service issues" (FPSC, 2015a). In addition to these investor owned companies, the FPSC also regulates the rates, territory and planning of "34 municipally owned electric systems and 18 rural electric cooperatives" (FPSC, 2015a). Annual reports filed with the commission by utility companies includes information on finances, rates, and other operational data (FPSC, 2015b).

In 2014, 230,015,937 megawatthours[9] (MWh) of electricity were generated in Florida; of which 140,034,070 (about 61 percent) came from natural gas (EIA, 2015a). A further 23 percent came from coal and 12 percent from nuclear power facilities. These three sources have historically been responsible for large portions of the state's electricity, while dependence on petroleum liquids decreased sharply in the mid 2000s (EIA, 2015f). Also in 2014, Florida was ranked "10th in the nation in net generation from utility-scale solar energy" (EIA, 2015f).

Water

The Florida Public Service Commission (FPSC) regulates the rates of investor-owned water utilities and assures "adequate service and setting just, reasonable, compensatory and nondiscriminatory rates" (FPSC, 2015c). While the FPSC regulates the rates and economic factors, environmental factors affecting Florida's water supply fall under the jurisdiction of the Florida Department of Environmental Protection (DEP) (FPSC, 2015c). A total of 125 utilities have their rates regulated by the FPSC, including public and private companies (FPSC, 2015d).

The public water systems under the jurisdiction of the DEP are defined as those that provide "water to 25 or more people for at least 60 days each year or serves 15 or more service connections" (DEP, 2015a). Systems too small to fit this definition fall under the regulation of the state's Department of Health, as are public and private wells (DEP, 2015a). Those systems that are regulated by the DEP are required to submit a yearly consumer confidence report (CCR) to their customers, detailing information on their drinking water. These CCRs include, among other things, descriptions of the source body of water (such as a river or lake), summaries of the source's sensitivity to contamination, and actual levels of contamination in the water (DEP, 2015b). The DEP's Ground Water Management Program is tasked with the maintenance of ground water resources that may affect the quality of surface waters. In total, about 90 percent

[9] One megawatthour is defined as "one thousand kilowatt-hours or one million watthours." One watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2016)

of the people of Florida use groundwater as their source for drinking water; as do more than 50 percent of the other water users, including agriculture, mining and other industries (DEP, 2015c).

Wastewater

Wastewater treatment regulation in Florida is handled by two entities. The Florida Public Service Commission regulates rates and certifications for wastewater treatment utilities and facilities; while the DEP regulates environmental factors, such as sewage disposal and health standards, as well as issuing permits to discharge into Florida's bodies of water (FPSC, 2015c). There are 91 wastewater utilities regulated by the FPCS, with an additional utility waiting for approval of an application (FPSC, 2015e).

In relation to the 29 FPCS regulated utilities, there are more than domestic 3,700 permitted wastewater systems that discharge into Florida's bodies of water; around 75 percent are domestic facilities that treat waste from homes or businesses. This number excludes septic systems and industrial level facilities. The DEP reports that they have permitted about 2,000 domestic systems and about 1,700 industrial systems (DEP, 2015d). Of the 3,700+ systems, about 75 percent discharge their treated waters into groundwater instead of surface water, while the remaining quarter are industrial systems and facilities (DEP, 2015e). Florida's permitted domestic wastewater treatment facilities have a capacity of 2.5 billion gallons/day. Over 96 percent of this is occupied by about 18 percent of the domestic wastewater facilities. Each of these facilities have capacities of more than 500,000 gallons/day. To contrast this, 73 percent of Florida's facilities occupy about 2 percent of the capacity and handle under 100,000 gallons/day (DEP, 2015d). While most of the water treated by these facilities is discharged into either Florida's ground or surface waters, some of it is repurposed for use in industrial settings or for irrigation of agriculture or public areas like parks or schools. Over half (55 percent) of the water reclaimed in 2014 was used in public access areas, while16 percent went to industrial uses (DEP, 2015f). In 2013 alone, about 719 million gallons of reused water was used each day, helping make Florida a national leader in water reuse (DEP, 2015d).

Solid Waste Management

The management and disposal of Florida's solid waste is managed by the DEP. Oversight is split between the Solid Waste Section, which manages policy and rule development; and the DEP District Offices, who oversee permitting and enforcement of rules (DEP, 2015g). There are a total 579 active solid waste facilities in the state, of which 73 are landfills (class type 100) and 4 composting facilities (class type 740), 97 are transfer stations (class type 750), and 56 are facilities designed to handle yard debris (class type 310). Additionally, 118 are facilities dedicated to handling waste tires (class type 751) and 70 handle construction debris (class type 540). The rest are a combination of coal ash monofills, container to container facilities, energy or material recovery families, processing facilities, combustors and shredders (DEP, 2015h).

In 2014, the state collected 32.3 million tons of solid waste from municipal sources. Of this, about 12.7 million tons, or 39 percent was recycled. The largest portion of this recycled material was construction debris (27.5 percent) and yard waste (11.5 percent) (DEP, 2015i). Aside from the 39 percent of waste that was recycled, 47 percent was landfilled and 14 percent was

combusted or destroyed (DEP, 2015j). Also noteworthy is the fact that 56 percent of the municipal waste generated in 2014 came from commercial sources, while 31 percent came from single family residences and 13 percent from multi-family residences (DEP, 2015k).

5.1.2. Soils

5.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

(i) "The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants." (NRCS, 2015a)

(ii) "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." (NRCS, 2015a)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (University of Minnesota, 2001):

- *Parent Material*: The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.
- *Climate*: Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
- *Topography*: Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.
- *Biology*: The presence/absence of vegetation in soils affects the quantity of organic content of the soil.
- *Time*: Soil properties are dependent on the period over which other processes act on them.

5.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Appendix C, Environmental Laws and Regulations. A list of applicable state laws and regulations is included in Table 5.1.2-1 below.

Table 5.1.2-1: Relevant Florida Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State of Florida Erosion and Sediment Control Designer and Reviewer Manual	Florida DEP	Erosion and Sediment Control (E&SC) drawings are required as part of a Stormwater Pollution Prevention Plan (SWPPP) that must be approved by DEP or the Water Management Districts (WMD) to obtain a Florida storm water or Environmental Resource Permit (ERP) for new development (HydroDynamics Incorporated, 2007).

5.1.2.3. Environmental Setting

Florida is composed of three Land Resource Region (LRR),[10] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Atlantic and Gulf Coast Lowland Forest and Crop Region;
- Florida Subtropical Fruit, Truck Crop, and Range Region; and
- South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region.

Within and among Florida's three LRRs are nine Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of Florida's MLRAs are presented in Figure 5.1.2-1 and Table 5.1.2-2, respectively.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation and position on the landscape, biota[12] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[13] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[14] (discussed further in the subsections below).

[10] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).

[11] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).

[12] All living organisms of an area (USGS, 2013a).

[13] Expansive soils are characterized by "the presence of swelling clay minerals that absorb water molecules when wet and expand in size or shrink when dry leaving voids in the soil" (Rogers, Olshansky, & Rogers, 2004).

[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

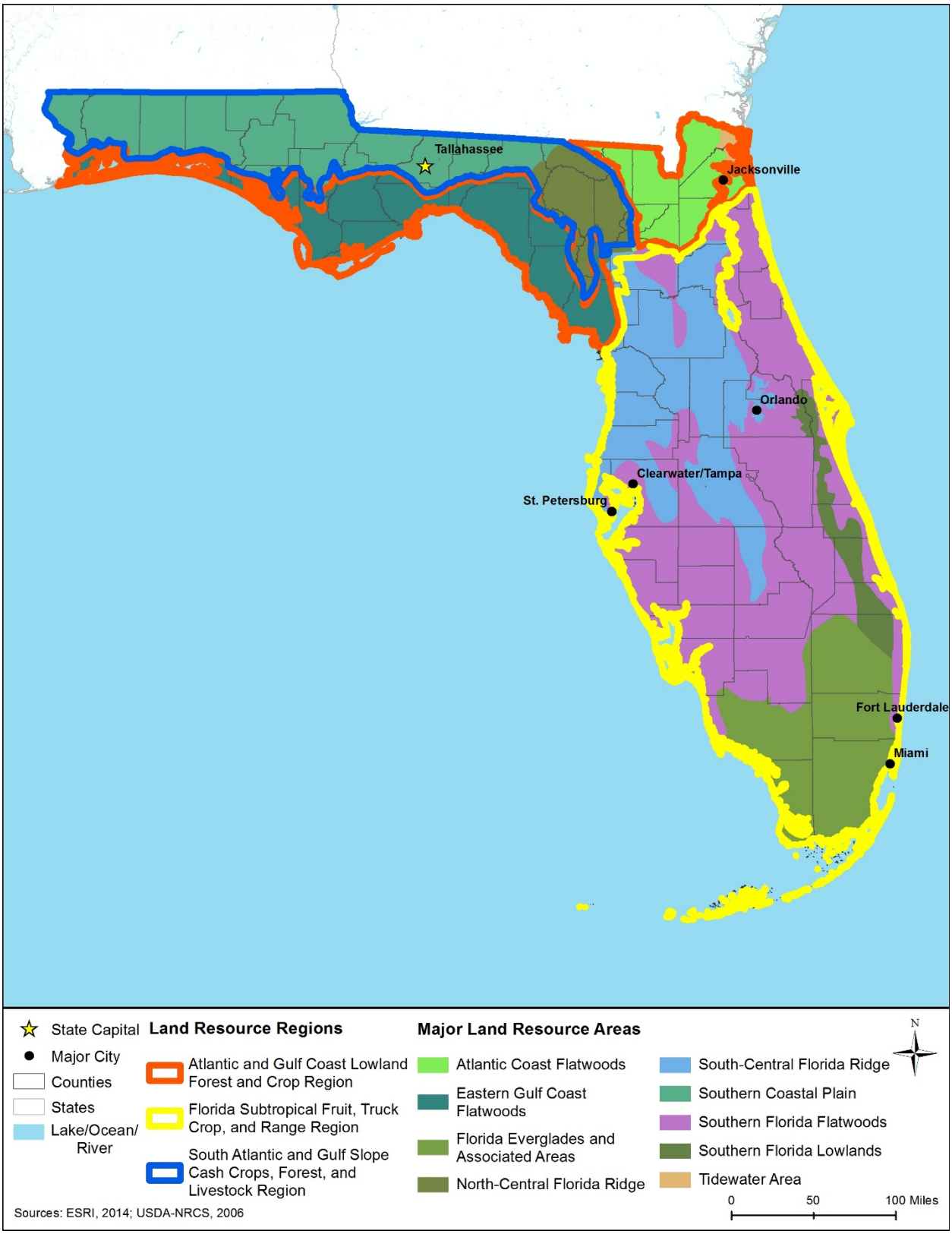


Figure 5.1.2-1: Locations of Major Land Resource Areas in Florida

Table 5.1.2-2: Characteristics of Major Land Resource Areas in Florida

MLRA Name	Region of State	Soil Characteristics
Atlantic Coast Flatwoods	Northeastern Florida	The dominant soil orders in this MLRA are Spodosols[a] and Ultisols[b] are the dominant soil orders. These deep soils are clayey or loamy[c] and range from very poorly drained to well drained.
Eastern Gulf Coast Flatwoods	Southern Panhandle, along Gulf Coast	The dominant soil orders in this MLRA are Alfisols,[d] Ultisols, Entisols,[e] Spodosols, and Histosols[f] are the predominant soil orders for this MLRA. These soils are typically deep to very deep. They can be loamy, mucky, or sandy, and range from somewhat poorly drained to very poorly drained.
Florida Everglades and Associated Areas	South Florida	Entisols and Histosols are the dominant soil orders. These soils can be very shallow to very deep. They are loamy or sandy, and typically moderately well drained to very poorly drained.
North Central Florida Ridge	North Central Florida	Alfisols, Entisols, and Ultisols are the predominant soil orders for this MLRA. These soils range from well drained to somewhat poorly drained.
South-Central Florida Ridge	Central Florida	Entisols and Ultisols dominate this MLRA. These very deep soils are typically sandy or loamy. They range from excessively drained to somewhat poorly drained.
Southern Coastal Plain	Panhandle	Entisols, Inceptisols,[g] and Ultisols are the dominant soil orders. These are loamy, very deep soils that range from poorly drained to somewhat excessively drained.
Southern Florida Flatwoods	Central Florida	Alfisols, Entisols, and Spodosols are the dominant soil orders in this MLRA. These soils are deep or very deep. They can be sandy or loamy, and are typically poorly drained to very poorly drained.
Southern Florida Lowlands	Eastern Florida	Alfisols, Entisols, and Histosols are the predominant soil orders. These loamy and sandy soils are deep or very deep, and range from poorly drained to very poorly drained.
Tidewater Area	Northeastern Florida	Alfisols, Entisols, and Histosols (to a lesser extent) are the dominant soil orders in this MLRA. These soils are typically a mix of clay and sand, and are typically poorly drained.

[a] Spodosols: "Soils formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in subsoil. They commonly occur in areas of coarse-textured deposits under forests of humid regions, tend to be acid and infertile, and make up nearly 4% of the world's ice-free land surface." (NRCS, 2015e)
[b] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8% of the world's ice-free land surface." (NRCS, 2015e)
[c] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)
[d] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10% of the world's ice-free land surface." (NRCS, 2015e)
[e] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface." (NRCS, 2015e)
[f] Histosols: "Soils that have a high content of organic matter and no permafrost. Also known as bogs, moors, peats, or mucks, these soils are saturated year round and form in decomposed plant remains. If exposed to air and drained, the microbes will decompose and the soils can subside dramatically. They make up nearly 1% of the world's ice-free land surface." (NRCS, 2015e)
[g] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface." (NRCS, 2015e)

Source: (NRCS, 2006)

5.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy;[15] there are 12 soil orders in the world and they are characterized by both observed and inferred[16] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (USGS, 2015d). The STATSGO2[17] soil database identifies fifteen different soil suborders in Florida (NRCS, 2015b). Figure 5.1.2-2 depicts the distribution of the soil suborders, and Table 5.1.2-1 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[15] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013c).

[16] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015e)

[17] STATS2GO is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map includes general soil association units and is maintained and distributed as a spatial and tabular dataset. (NRCS, 2015c)

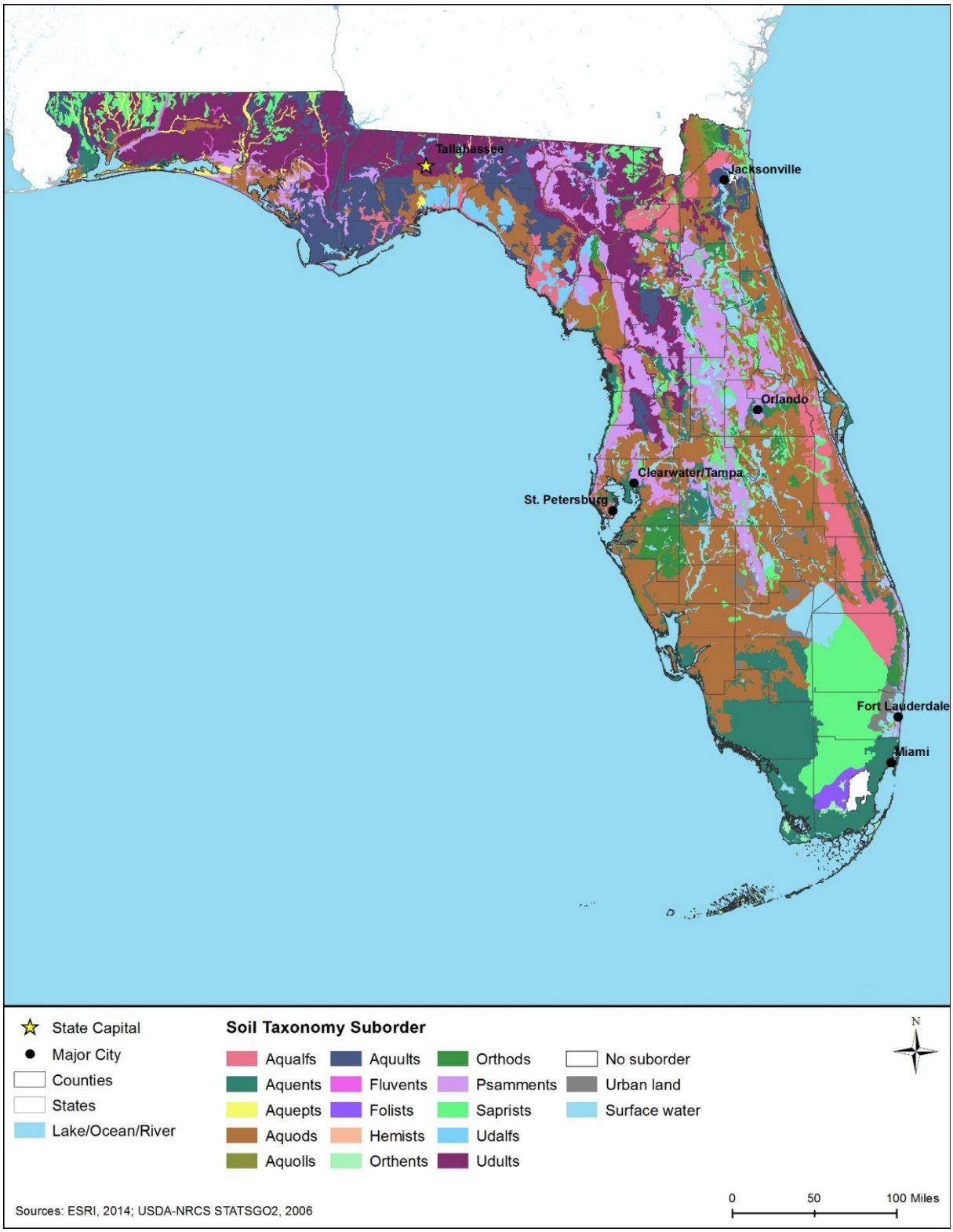


Figure 5.1.2-2: Florida Soil Taxonomy[18] Suborders

[18] Soil taxonomies are defined in Table 5.1.2-3.

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Table 5.1.2-3: Major Characteristics of Soil Suborders[a] Found in Florida, as Depicted in Figure 5.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential[c]	Permeability	Erosion Potential	Compaction and Rutting Potential
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Fine sand, fine sandy loam, muck, sand, sandy loam, variable	0-2	Very poorly drained to poorly drained	No, Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Clay, fine sand, gravelly variable, loamy sand, marl, muck, sand, sandy loam, silt, silt loam, silty clay loam, unweathered bedrock, weathered bedrock	0-2	Very poorly drained to poorly drained	Yes	A, B, D	Low, Medium, High	High, Moderate, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Loam, mucky sand, silty clay loam	0-1	Very poorly drained to poorly drained	Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Spodosols	Aquods	Aquods are characterized by a shallow fluctuating water table, with water-loving vegetation, ranging from moss, shrubs, and trees in cold areas to mixed forests and palms in the warmest areas. Although some Aquods have been cleared and are used as cropland or pasture, most are used as forest or wildlife habitat, as they are naturally infertile (but they can be highly responsive to good management).	Fine sand, loamy fine sand, loamy sand, sand, sandy clay loam	0-2	Very poorly drained to poorly drained	No, Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, fine sand, fine sandy loam	0-2	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Ultisols	Aquults	Aquults are found in wet areas where groundwater is very close to the surface during part of each year, usually in winter and spring. Their slopes are gentle, with many soils formerly and currently supporting forest vegetation.	Clay loam, fine sand, Fine sandy loam, loam, loamy sand, Mucky fine sandy loam, sandy clay, sandy clay loam, sandy loam, silt loam, variable	0-2	Very poorly drained to somewhat poorly drained	No, Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Sandy loam	0-2	Moderately well drained	No	C	Medium	Low	Medium	None
Histosols	Folists	Folists mostly consist of horizons derived from leaf litter, twigs, and branches resting on bedrock or on fragmental materials. Most support forest vegetation, with some also supporting grass, or used for specialty crops or for urban or recreational development.	Weathered bedrock	0-2	Moderately well drained	No	D	High	Very Low	High	None
Histosols	Hemists	Hemists are usually found in broad, flat areas, such as coastal plains and outwash plains as well as closed depressions. They are typically under natural vegetation and uses for rangeland, woodlands, and/or wildlife habitat, although some large areas have been cleared and drained, and utilized for cropland.	Mucky peat	0-1	Very poorly drained	Yes	A, D	Low, High	High, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential[c]	Permeability	Erosion Potential	Compaction and Rutting Potential
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Extremely gravelly sand, very gravelly loam	0-1	Somewhat poorly drained	No	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	None
Spodosols	Orthods	Orthods have a moderate accumulation of organic carbon, and are relatively freely drained. Most of these soils are either used as forest or have been cleared and are used as cropland or pasture. Although they are naturally infertile, they can be highly responsive to good management.	Fine sand, sand	0-5	Somewhat poorly drained	No	C	Medium	Low	Medium	None
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Fine sand, loamy sand, sand	0-15	Somewhat poorly drained to excessively drained	No	A, C	Low, Medium	High, Low	Low to Medium, depending on slope	None
Histosols	Saprists	Saprists have organic materials are well decomposed, and many support natural vegetation and are used as woodland, rangeland, or wildlife habitat. Some Saprists, particularly those with a mesic or warmer temperature regime, have been cleared, drained, and used as cropland.	Fine sand, loamy sand, muck, sand, sandy loam, unweathered bedrock	0-2	Very poorly drained	Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Sand, unweathered bedrock, weathered bedrock	0-8	Somewhat poorly drained to moderately well drained	No	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	None
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have an udic moisture regime. Most of these soils currently support or formerly supported mixed forest vegetation, and many have been cleared and used as cropland (mostly with the use of soil amendments).	Clay loam, fine sandy loam, loamy fine sand, loamy sand, sand, sandy clay loam, sandy loam	0-12	Somewhat poorly drained to somewhat excessively drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	None

[a] Soil suborders constitute a broad range of soil types. Within each suborder, the range of soil types may have a range of properties across the state, which result in multiple values being displayed in the table for that suborder.
[b] Hydric Soil: "A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (NRCS, 2015f). Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[c] Based on Runoff Potential, described in Section 5.1.2.5.

Sources: (NRCS, 2015b) (NRCS, 1999)

5.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[19] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 5.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in Florida.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[20] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Aquents, Hemists, Psamments, and Udults fall into this category in Florida.

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Aqualfs, Aquents, Aquepts, Aquods, Aquults, Orthents, Saprists, Udalfs, and Udults fall into this category in Florida.

Group C. Sandy clay loam soils. This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University, 2015). This group has medium runoff potential. Fluvents, Orthods, Psamments, and Udults fall into this category in Florida.

Group D. Clay loam, silty clay loam, sandy clay, silty clay, or clay soils. This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University, 2015). Aqualfs, Aquents, Aquepts, Aquods, Aquolls, Aquults, Folists, Hemists, Orthents, Saprists, and Udalfs fall into this category in Florida.

5.1.2.6. Soil Erosion

"Soil erosion [is] the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015d). Water-induced erosion can transport soil into streams, rivers, and lakes, and degrade water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public

[19] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.

[20] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time" (FEMA, 2010).

safety hazard (NRCS, 1996a). Table 5.1.2-3 provides a summary of the erosion potential for each soil suborder in Florida. Soils with the highest erosion potential in Florida include those in the Aqualfs, Aquents, Aquepts, Aquods, Aquolls, Aquults, Fluvents, Folists, Hemists, Orthents, Orthods, Psamments, Saprists, Udalfs, and Udults suborders, which are found throughout the entire state (Figure 5.1.2-2).

5.1.2.7. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates. (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFWS, 2009b). Other characteristics that factor into compaction and rutting risk include soil composition (i.e., low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than 10 tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 5.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Florida. Soils with the highest potential for compaction and rutting in Florida include those in the Aqualfs, Aquents, Aquepts, Aquods, Aquolls, Aquults, Hemists, and Saprists suborders, which are found throughout the state (Figure 5.1.2-2).

5.1.3. Geology

5.1.3.1. Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 5.1.4), Climate Change (Section 5.1.14), and Human Health and Safety (Section 5.1.15).

This section covers the six aspects of geology most relevant to the Proposed Action and Alternatives:

- Section 5.1.3.3, Major Physiographic Regions and Provinces;[21] [22]
- Section 5.1.3.4, Surface Geology;

[21] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology. (Fenneman N. , 1916)
[22] Physiographic provinces: Subsets within physiographic regions (Fenneman N. , 1916).

- Section 5.1.3.5, Bedrock Geology;[23]
- Section 5.1.3.6, Paleontological Resources;[24]
- Section 5.1.3.7, Fossil Fuel and Mineral Resources; and
- Section 5.1.3.8, Geologic Hazards.[25]

5.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 5.1.3-1 below.

Table 5.1.3-1: Relevant Florida Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Florida Statue Chapter 1004.57, and Rule 6C1-7.541, FAC	Florida Museum of Natural History	Florida Paleontology regulations state that vertebrate fossils found on lands owned or leased by the state belong to the state with title to the fossils vested in the Florida Museum of Natural History for the purposes of administration. Additionally, field collection of vertebrate fossils may be conducted under the authority of a permit issued by the Florida Program of Vertebrate Paleontology.
Florida Building Code 5th Edition (2014)	Florida Department of Business and Professional Regulation	Guidelines for seismic design.

5.1.3.3. Environmental Setting: Physiographic Regions and Provinces

The concept of physiographic regions was created in 1916 by geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation). Physiographic regions are areas of distinctive topography, geography, and geology. "Important physiographic differences between adjacent areas are, in a large proportion of cases, due to differences in the nature or structure of the underlying rocks" (Fenneman N., 1916). There are eight distinct physiographic regions in the continental United States: 1) Atlantic Plain, 2) Appalachian Highlands, 3) Interior Plains, 4) Interior Highlands, 5) Laurentian Upland, 6) Rocky Mountain System, 7) Intermontane Plateaus, and 8) Pacific Mountain System. Regions are further sub-divided into physiographic provinces based on differences observed on a more local scale. (Fenneman N., 1916)

Florida is entirely within the Atlantic Plain Region and the Coastal Plain Province (USGS, 2003b) (Figure 5.1.3-1). Physiography throughout the state is discussed in greater detail in the subsections below.

[23] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015a).

[24] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015c).

[25] Geologic Hazards: "Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements" (NPS, 2013).

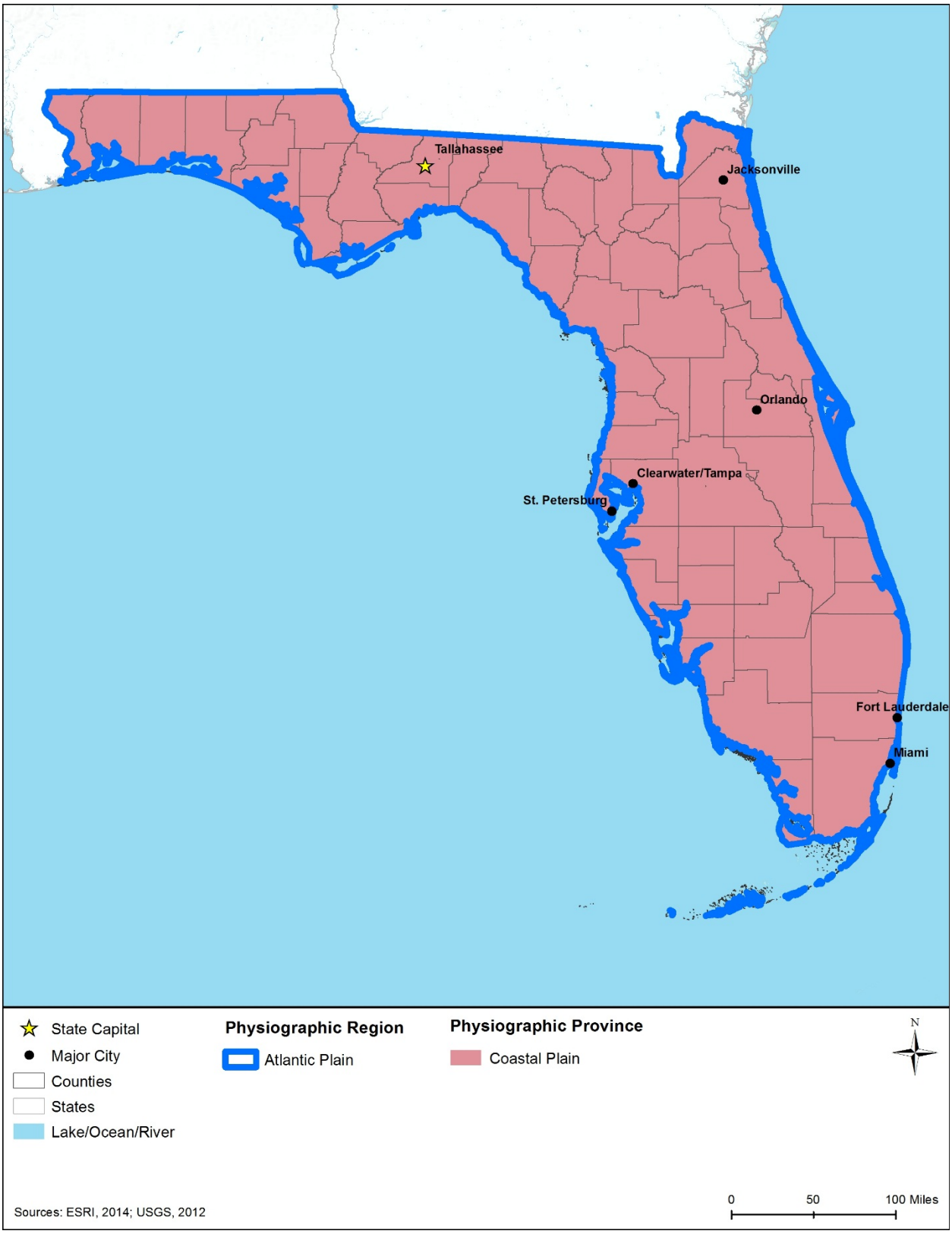


Figure 5.1.3-1: Physiographic Regions, Provinces, and Sections of Florida

Atlantic Plain Region

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York south to Florida and west to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. Sedimentary strata become thinner moving westward through the region, and thicken to several thousand feet thick along the coastline. Erosion from the Appalachian Mountains, which began to form 480 to 440 million years ago (MYA), dislodged sediments, which were subsequently deposited by rivers to form the Atlantic Plain.[26] The area is characterized by gentle topography and a transition zone between the land and sea often having marshes, lagoons, swamps, sand bars, and reefs. Deposits of coastal marine life over millions of years form the basis for rich fossil fuel reserves in the region. (NPS, 2015a)

As reported above, the Atlantic Plain Region within Florida is composed of one physiographic province: the Coastal Plain Province. The entire state is also located within the Floridian physiographic section. (USGS, 2003b).

Coastal Plain Province – Within Florida, the Coastal Plain Province is underlain by Cretaceous (146 to 66 MYA) and younger sedimentary rocks (USGS, 2015i). Florida is underlain by both terrestrial and marine deposits (NPS 2005).



Great Egret in the Florida Everglades
Source: (NPS, 2015aa)

Florida's peninsula is composed of marine terraces, barrier islands, and lagoons (which separate the barrier islands from the mainland). Terrace drop-offs mark the locations of former shorelines (NPS 2005). In Southeastern Florida, the Coastal Plain includes the Florida Everglades. The Everglades extend southward from Lake Okeechobee to near Florida Bay. The Everglades tilt slightly to the south, with a slope that averages less than 2 inches per mile. In extreme southern Florida, the Florida Keys are a "series of low limestone[27] islands that extend 140 miles southwest of the mainland" (USGS, 2013d). The elevation of the Florida Keys is primarily less than 5 feet above sea level (ASL) (USGS, 2013d).

In western Florida, the Florida Panhandle is characterized by a southward-sloping plateau and hills that include the state's highest location, Britton Hill, which is 345 feet ASL (DEP, 2000) (USGS, 2005). The Cody Scarp,[28] which is both a relic of an ancient coastline and a product of

[26] For consistency, this PEIS uses the University of California Berkeley Geologic Time Scale for all of the FirstNet PEIS state documents. Time scales differ among universities and researchers; FirstNet utilized a consistent time scale throughout, which may differ slightly from other sources. (University of California Museum of Paleontology, 2011)
[27] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation." (USGS, 2015g)
[28] Scarp: "A cliff formed by faulting, erosion, or landslides" (USGS, 2015g).

karst[29] topography, is a defining feature that trends east-west across much of the Florida Panhandle. The drop-off along this topographic break is roughly 100 feet. The scarp is defined by "sinking streams, springs, and large sinkholes" (Upchurch, 2007). The Cody Scarp separates Miocene (23 to 5.3 MYA) resistant sand, clay, and carbonate[30] sediments of the northern Panhandle from softer and more easily eroded carbonate rocks of the southern Panhandle (Upchurch, 2007).

5.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[31] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures,[32] subsidence,[33] and erosion. (Thompson, 2015)

The main surface materials exposed in Florida are alluvium,[34] beach ridge and dune sediments, and silica-bearing sediments that were deposited during periods of high sea levels over the last 6M years. Florida's present landscape originated 120,000 years ago, when the limestone bedrock that underlies the state was deposited during an interglacial period when sea level was about 25 feet higher than today. Limestone has subsequently been exposed in parts of Florida due to erosion from rainfall and wind. The oldest sediments that are exposed are Eocene (56 to 34 MYA) carbonates found in the Avon Park Formation. Other exposed materials include sediments from the Anastasia Formation, Key Largo Limestone, Miami Formation, Trail Ridge Sands, and Shelly Sediments, all of which emanated from the Plio-Pleistocene (approximately 1.6 MYA) and Holocene (approximately 11,700 years ago) Epochs. Sediments from the Miocene Epoch (23 MYA to 5.3 MYA) include Alum Bluff Group, Hawthorn Group, Coosawhatchie Formation, among others. (USGS, 2014a) (MacNeil, 1949)

Figure 5.1.3-2 depicts a generalized illustration of the surface geology for Florida.

[29] Karst: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater" (USGS, 2015g).

[30] Carbonate: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$)" (USGS, 2015g).

[31] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013e).

[32] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. (Idaho State University 2000)

[33] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a).

[34] Alluvium: "Sand, gravel, and silt deposited by rivers and streams in a valley bottom" (USGS, 2015g).

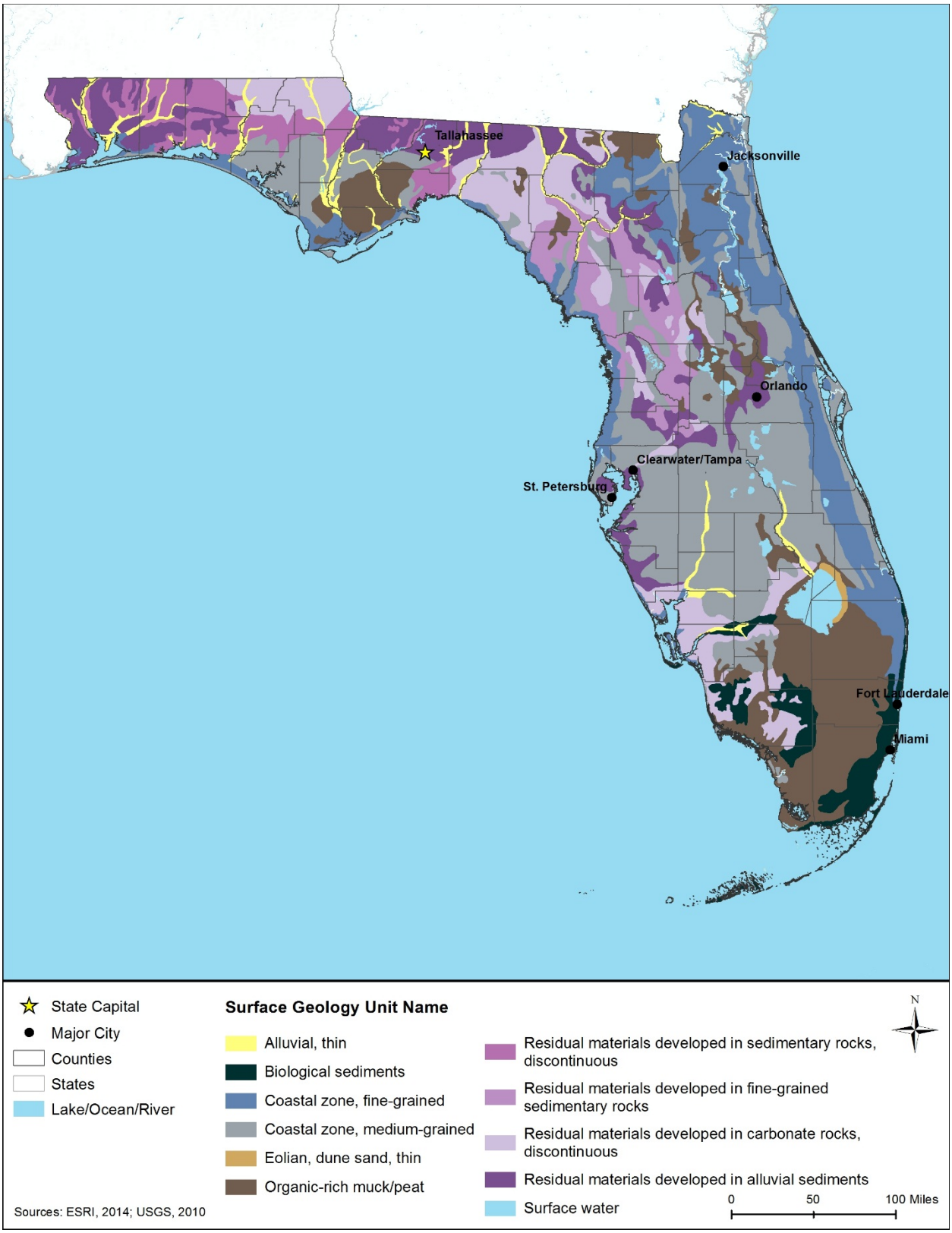


Figure 5.1.3-2: Generalized Surface Geology for Florida

5.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015e) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[35] rock composition, and regional tectonism.[36] These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (New Hampshire Department of Environmental Services, 2014).

The Florida peninsula is underlain by carbonate rocks (predominantly limestone) that were deposited beginning about 180 MYA. The peninsula has grown through marine carbonate deposition including shells, limy mud, offshore sand bars, and coral reefs. The rocks, which dip to the south, were generally deposited in shallow water, during periods in which sea level was higher than present day levels. Rocks gently dip to the south (Whitman, 1997).

Figure 5.1.3-3 displays the generalized bedrock geology for Florida.

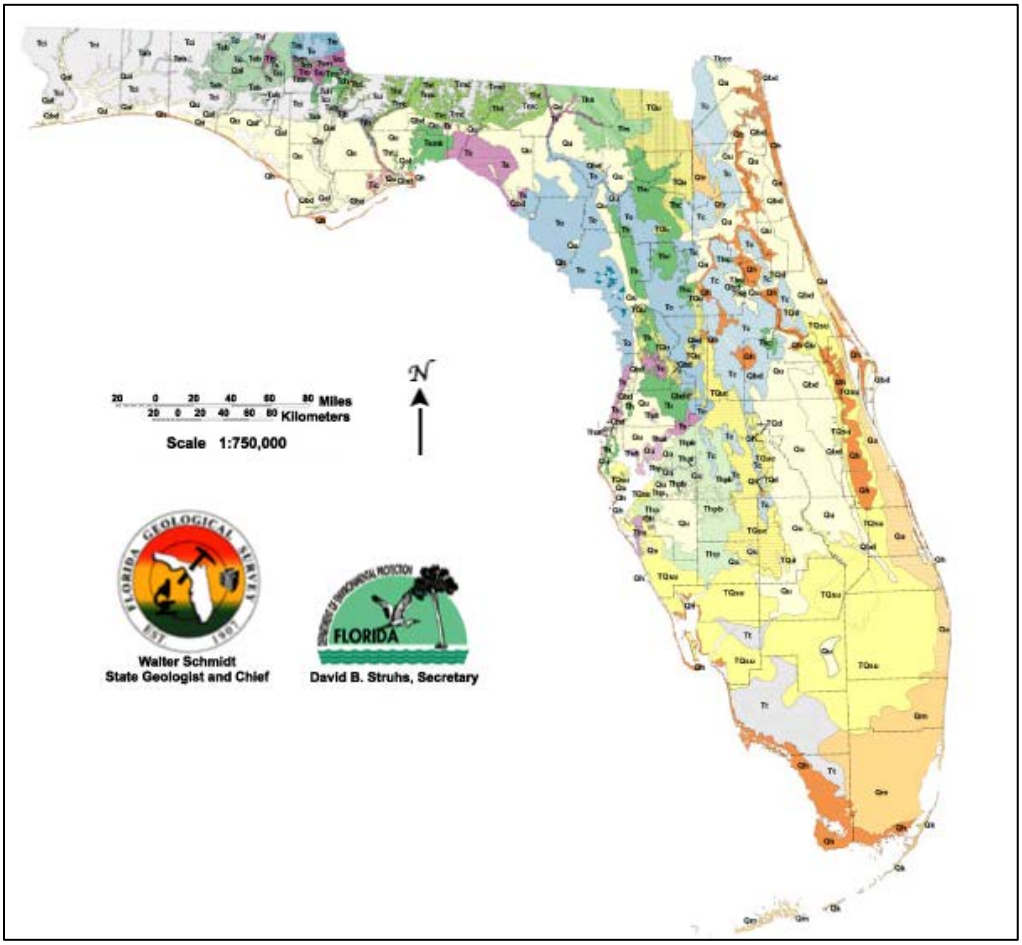
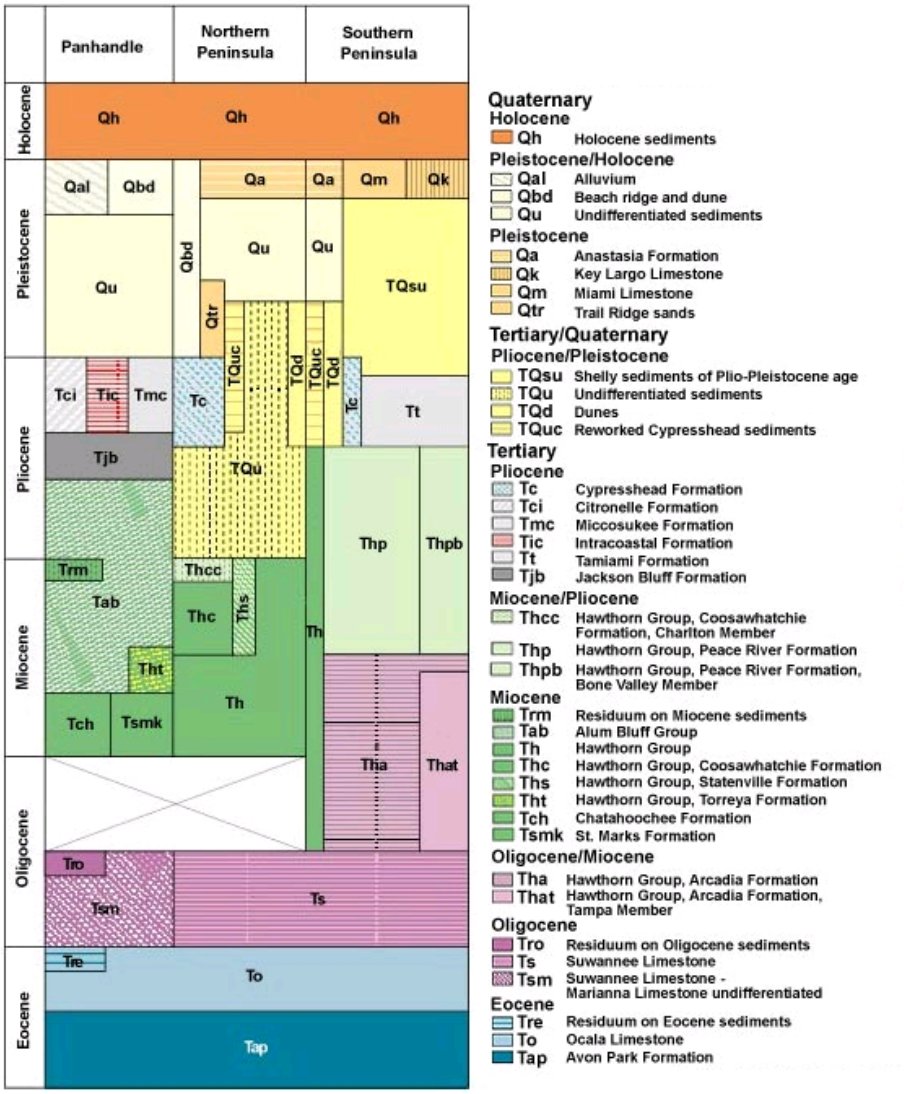


Figure 5.1.3-3: Generalized Bedrock Geology for Florida

[35] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure" (NPS, 2000).

[36] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2015e).



Legend for Figure 5.1.3-3: Generalized Bedrock Geology for Florida

Source: (Scott, et al., 2001)

5.1.3.6. Paleontological Resources

Much of Florida is underlain by limestone bedrock which contains marine animal shells that date to the Cenozoic Era (66 MYA to present). Bones from mammoths and mastodons have accumulated on stream beds, while open pit mines and quarries yield fossils from both marine and land animals (DEP, 2015l). Fossils have also been found "in sinkholes, caves, rivers, lakes, beaches, shell pits, limestone quarries, and backyards" (The Florida Museum of Natural History, 2008).

Eocene Epoch (55 to 34 MYA) marine vertebrate fossils that have been recorded in Florida include three species of primitive toothed whales, early sea cows, giant sea snakes, sea turtles, barracuda, porcupine fish, sea bass, sawfish, sharks, and rays. Shark and stingray teeth are common in Gainesville creek beds. Additionally, at least 40 species of Echinoids, including sea urchins, sea biscuits, and sand dollars, have been found in Florida's Eocene sediments. (The Florida Museum of Natural History, 2008)

Amphicyon longiramus
(White's bear-dog, found at Thomas Farm)



Source: (Florida Museum of Natural History, 2015)

The earliest terrestrial fossils in Florida are from the Oligocene Epoch (34 to 23 MYA); fossils from this period have been located near Gainesville. The Thomas Farm fossil site, which may be an ancient sinkhole, is north of Gainesville (Figure 5.1.3-4) and has some of the richest deposits of Miocene Epoch (23 to 5 MYA) fossils in eastern North America. The Thomas Farm site contains thousands of individual animals including alligators, birds, small rodents, rhinos, horses, camels, peccaries, dogs, bears, and bear-dogs. Additionally, the Haile 7C fossil site (northeast of the town of Newberry, Alachua County) (Figure 5.1.3-4) is an ancient sinkhole pond with many freshwater vertebrate fossils including turtles, alligators, and ducks. (The Florida Museum of Natural History, 2008)

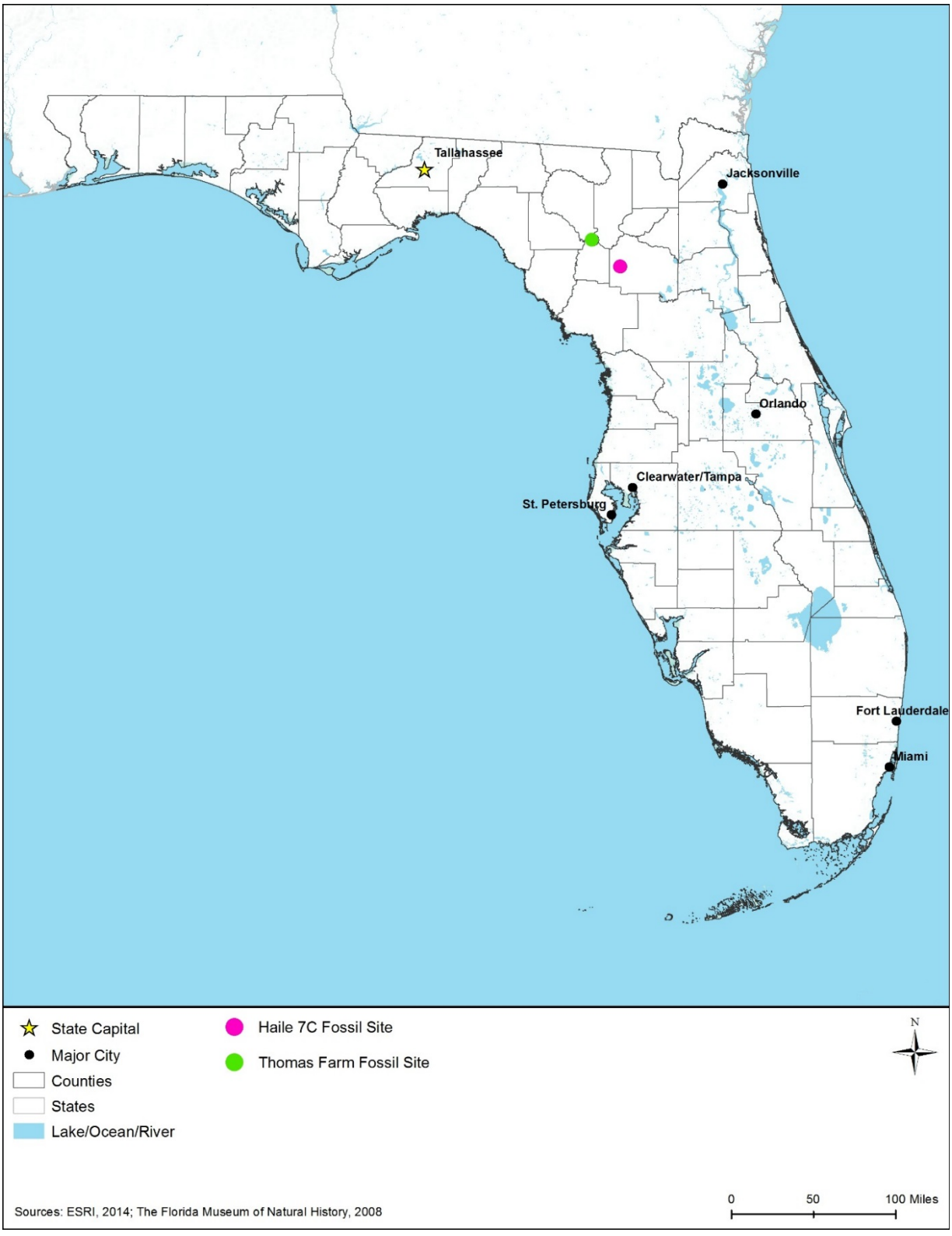


Figure 5.1.3-4: Major Florida Fossil Sites

5.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

While crude oil production in Florida reached 100,000 barrels per day in 1978, production had diminished to 6,000 barrels per day by June 2014 (EIA, 2013). Florida ranks 22nd nationwide for production of crude oil (EIA, 2015c). Current production is focused within sections of the western Florida Panhandle and in areas of southern Florida, both of which contain oil resources within rocks dating from the Upper Jurassic (161 to 146 MYA) and Lower Cretaceous 146 to 100 MYA) (BLM, 2008).

Florida produced 292 million cubic feet of natural gas in 2013; almost all natural gas production in Florida comes from the Jay Field in the Florida Panhandle (EIA, 2013). As of 2013, Florida ranked 29th nationwide for production of natural gas (EIA, 2015c).

Minerals

As of 2015, Florida's nonfuel mineral production was valued at $2.84B, ranking 9th nationwide (in terms of dollar value). Florida's nonmineral commodities were phosphate rock, crushed stone, Portland cement, construction sand and gravel, and masonry cement. Industrial mineral commodities include sulfur, phosphate rock, ilmenite, rutile, zircon, peat, and sand. (USGS, 2016a)

5.1.3.8. Geologic Hazards

The three major geologic hazards of concern in Florida are earthquakes, landslides, and subsidence. Volcanoes do not occur in Florida and therefore do not present a hazard to the state (USGS, 2015h). A discussion of each geologic hazard in Florida is included below.

Earthquakes

Between 1973 and March 2012, 13 earthquakes of a magnitude 2.0-3.5 (on the Richter scale[37]) occurred in immediate proximity to Florida and its coastline (USGS, 2014b). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the earth and, if they are strong enough, they can damage manmade structures on the surface. Earthquakes can produce secondary flooding impacts resulting from dam failure (USGS, 2012a).

The shaking due to earthquakes can be noteworthy many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes occur where Earth's tectonic plates collide. When tectonic plates collide, one

[37] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude. (USGS, 2014d)

plate slides beneath the other, where it is reabsorbed into the mantle of the earth. Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (USGS, 2014g).

Figure 5.1.3-5 depicts the seismic risk throughout Florida; the box surrounding the range of colors shows the seismic hazards in the state. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with exceedances of 10 % g (USGS, 2010). Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 % g (USGS, 2010). Florida is located on the trailing margin of the North American tectonic plate (DEP, 2014a).

Areas of greatest seismicity in Florida are concentrated in the northeast Florida and in the western portion of the Florida Panhandle. One notable earthquake that caused minor damage in Florida occurred near St. Augustine, in the northeast part of the state, in January 1879. Another tremor that impacted Florida, including the city of Jacksonville, originated in Charleston, SC, in 1886. (USGS, 2015b). The chances of a tsunami affecting Florida are unlikely (DEP, 2014a).

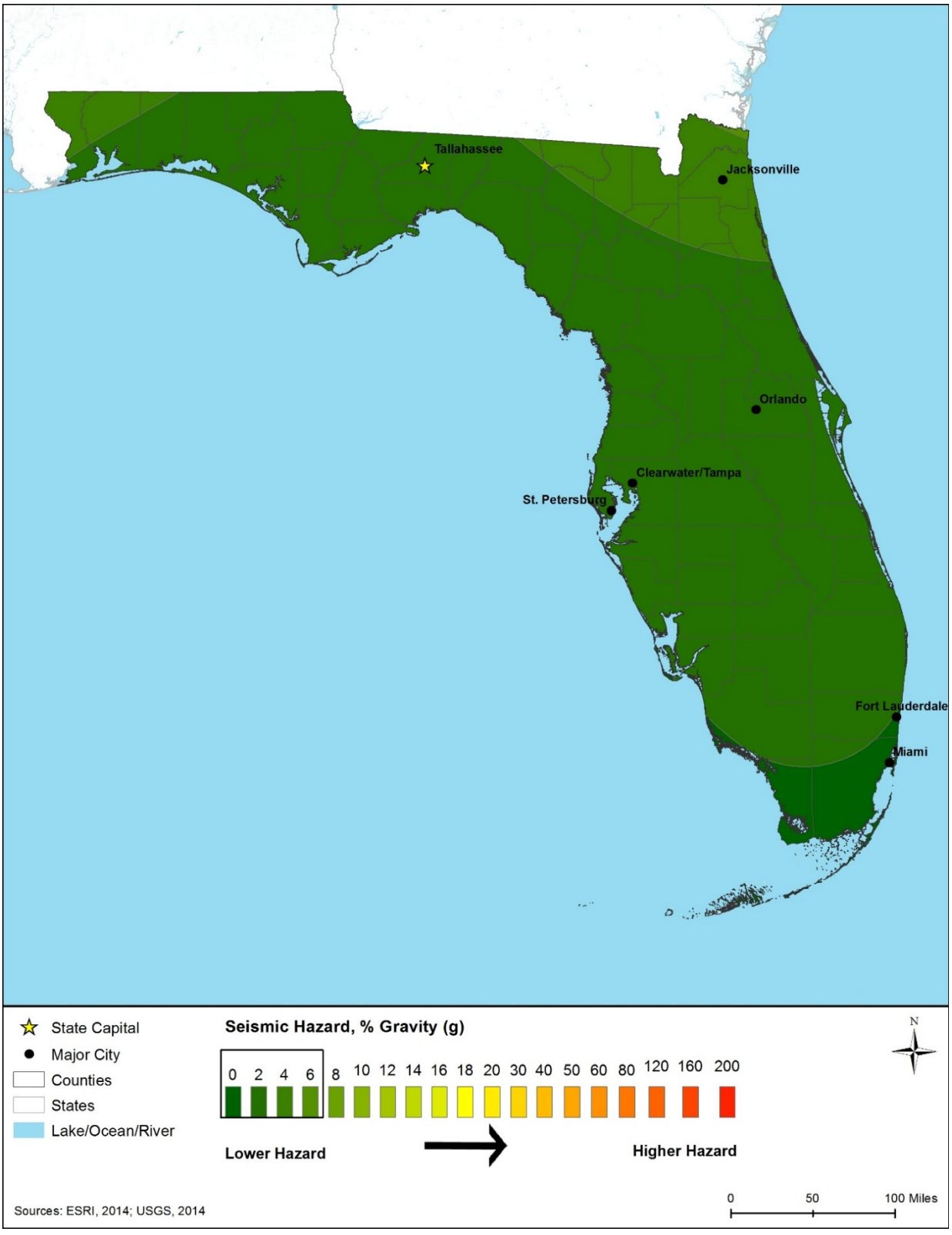


Figure 5.1.3-5: Florida 2014 Seismic Hazard Map

Landslides

Landslides are uncommon in Florida, due to the state's minimal topographic relief (DEP, 2014b). "The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures" (USGS, 2003a). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003a).

Landslides can be triggered by a single severe storm or earthquake, causing widespread damage in a short period. Most landslide events are triggered by water infiltration that decomposes and loosens rock and soil, lubricates frictional surfaces, adds weight to an incipient landslide, and imparts buoyancy to the individual particles. Intense rainfall, rapid snowmelt, freeze/thaw cycles, earthquakes, volcanic eruptions, and human alterations to the natural landscape can trigger mass land movements. Large landslides can dam rivers or streams, and cause both upstream and downstream flooding. (USGS, 2003a)

Southeast View of the Scarp Formed by the Pitt Landslide



Source: (DEP, 2014b)

Florida's only recorded landslide occurred in Gadsden County in 1948, when the unconsolidated sediments comprising the north-facing slope along Flat Creek flowed downhill toward the stream bed. It was likely caused by rushing floodwaters from the creek below. (DEP, 2014b)

Figure 5.1.3-6 displays the landslide risk throughout Florida.

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a). The main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (USGS, 2000a). Sinkholes are among the largest contributors to land subsidence in Florida (DEP, 2014g).

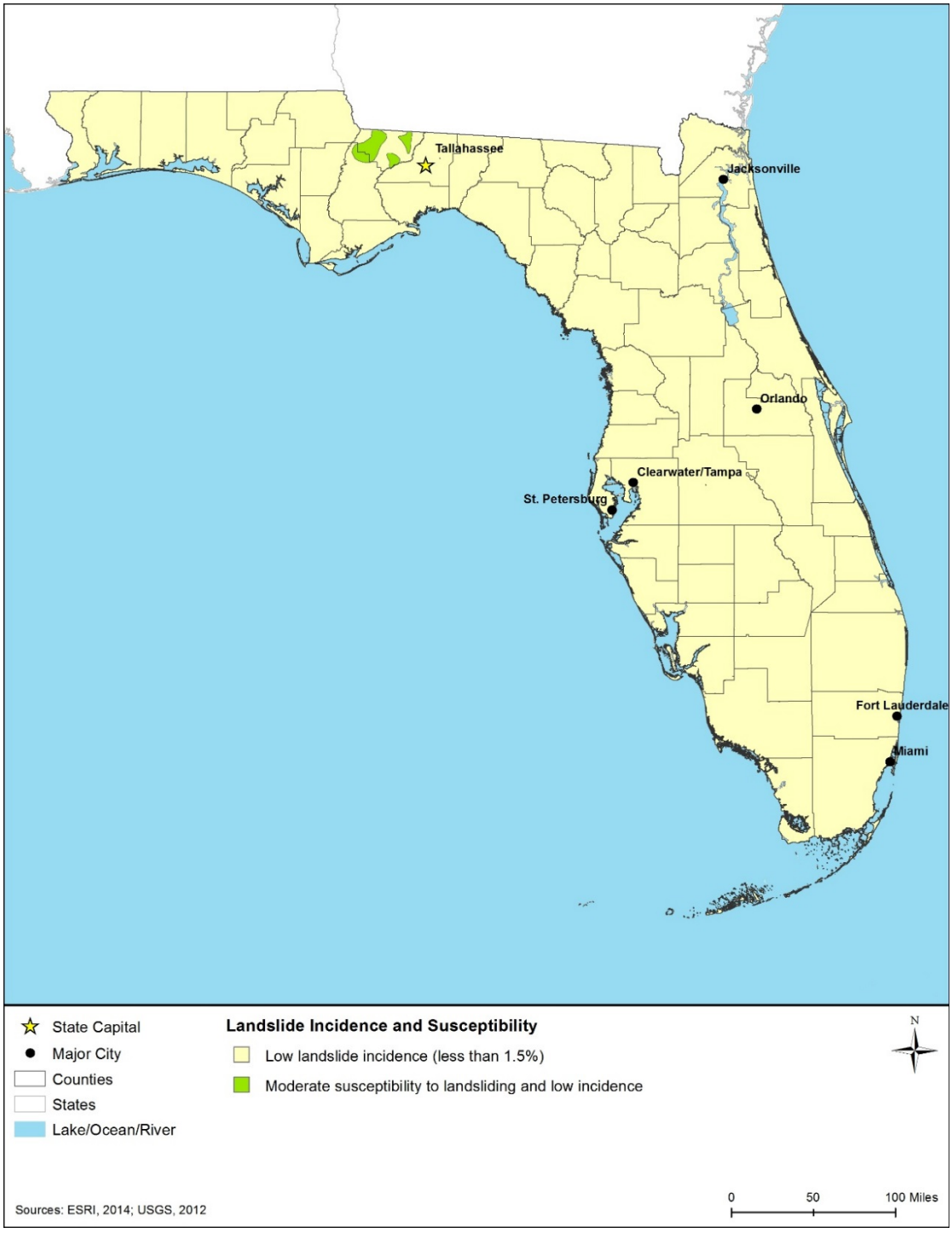


Figure 5.1.3-6: Florida Landslide Incidence and Susceptibility Hazard Map[38]

[38] Susceptibility hazards not indicated in Figure 5.1.3-6 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014e)

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Additionally, land subsidence can affect vegetation and land use. (USGS, 2013b)

Sinkholes are common in Florida because the entire state is underlain by limestone, which can slowly dissolve under natural conditions. Limestone dissolution rates are directly correlated to exposure to precipitation, and occur, on average, at rates of millimeters per thousand years. The abrupt formation of sinkholes may follow extreme rain producing events (Tihansky, 1999). Since 1954, thousands of sinkhole incidents have been recorded in the Subsidence Incident Reports database maintained by the Florida Geological Survey (DEP, 2014g). Sinkholes pose risks to infrastructure throughout the state, including roads and buildings (Rupert & Spencer, 2004). Sinkholes also threaten aquifer quality by transporting unfiltered surface water into underlying aquifers (Tihansky, 1999). Figure 5.1.3-7 displays a map of documented sinkholes throughout Florida.

Winter Park, FL Sinkhole (1981)



Source: (USGS, 2015d)

Florida's most famous sinkhole developed in the city of Winter Park on May 8, 1981. The Winter Park Sinkhole formed due to the sudden failure of a subsurface cavity and measured 300 feet in diameter and 80 feet in depth. The sinkhole completely swallowed a house, automotive repair shop and community pool (USGS, 2014c).

Land subsidence in Florida has also been observed due to drainage of organic soils. "The most important cause of this subsidence is microbial decomposition, which, under drained conditions, readily converts organic carbon to carbon-dioxide gas and water. Compaction, desiccation, erosion by wind and water, and prescribed or accidental burning can also be significant factors" (USGS, 2000a). In the Florida Everglades, organic-soil subsidence is a factor due to transfers of water out of the natural habitat (USGS, 2000a).

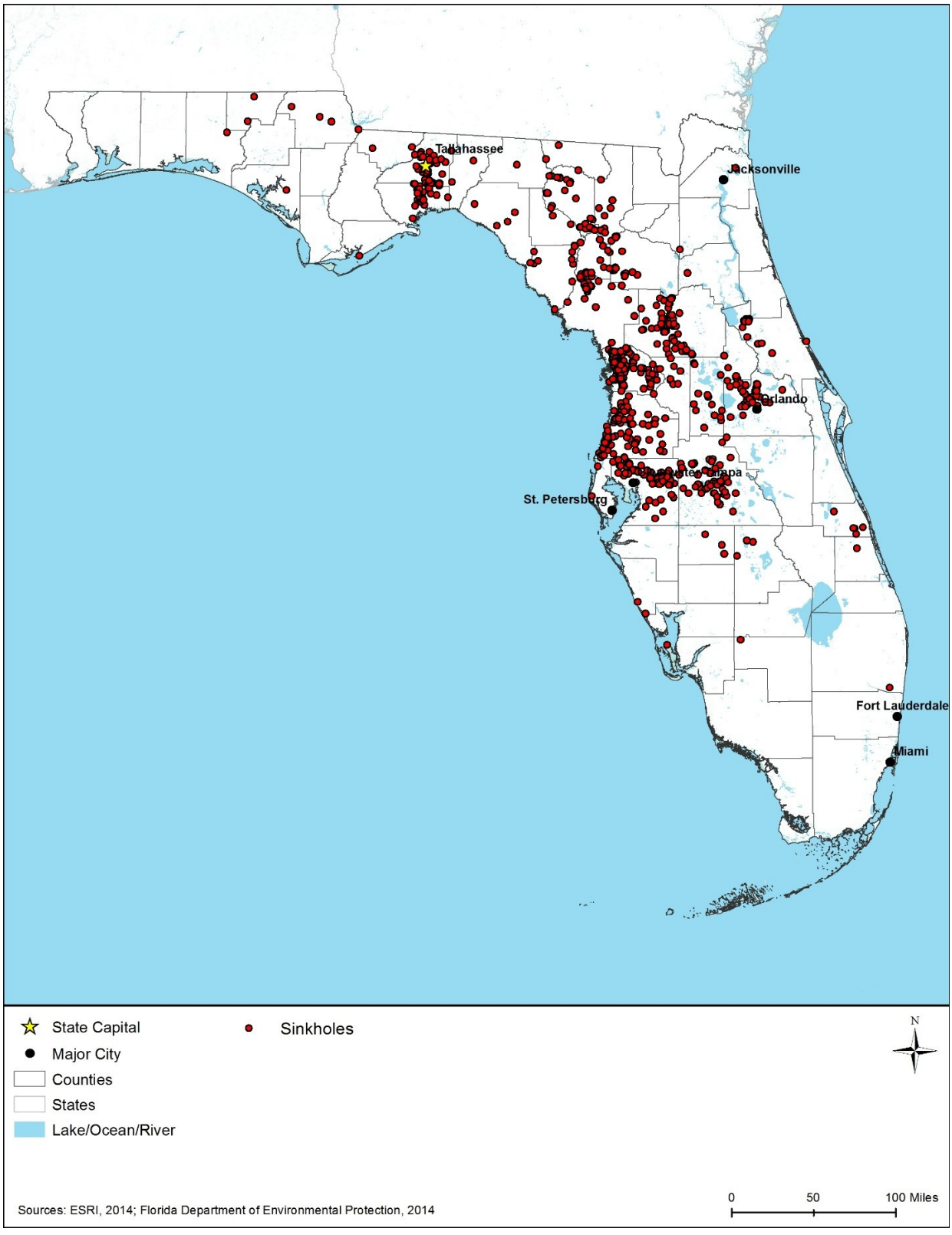


Figure 5.1.3-7: Documented Sinkholes in Florida

5.1.4. Water Resources

5.1.4.1. Definition of the Resource

Water resources are defined as all surface waterbodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 5.1.5, Wetlands). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human and ecological health and economic wellbeing. (USGS, 2014h)

5.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 5.1.4-1 summarizes the relevant Florida laws and regulations for water resources.

Table 5.1.4-1: Relevant Florida Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Environmental Resource Permit Program	DEP	Projects that alter flows of surface waters including projects that affect stormwater runoff, and dredging and filling in surface waters.
Storm Water Permitting Program	DEP	Construction activities that disturb an acre or more of surface soil.
Clean Water Act (CWA) Section 404 permit, Nationwide Permit (NWP), Jacksonville District Regional Conditions	U.S. Army Corps of Engineers (USACE), Jacksonville District	Certain activities cannot be authorized under the NWP program in Critical Resource Waters, including waters within: National Estuarine Research Reserves, Biscayne National Park, Everglades National Park, state natural heritage sites, the Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area, the Florida Keys, Florida Areas of Critical State Concern, and the city of Apalachicola.
Florida Water Quality Standards (33 U.S.C. 1341)	DEP	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from DEP indicating that the proposed activity will not violate water quality standards.
Article II, Section 7 of the Florida Constitution	DEP	Requires abatement of water pollution and conservation and protection of Florida's natural resources and scenic beauty.

State Law/Regulation	Regulatory Agency	Applicability
Water and Land Conservation Amendment, 2014, pursuant to Art. X, s. 28 of the Florida Constitution	Florida Legislature	Requires that, for the next 20 years, 33 percent of net revenues from the state's excise tax on documents must be deposited into the Land Acquisition Trust Fund (LATF) to be used only for specified purposes including, among other things, land acquisition, wildlife management, Everglades protection, beaches and shore preservation, recreational lands, farms and ranches, and the restoration of natural systems.
Everglades Forever Act, Section 373.4592(4)(f), F.S. Exit	DEP	Addresses best management practices in the Everglades Agricultural Area.
Grizzle-Figg Statute, Section 403.086, F.S. Exit	DEP	Addresses sewage disposal facilities and advanced secondary treatment of discharges from such facilities.
Florida Statute (F.S.) 403.0882 Discharge of Demineralization Concentrate Exit	DEP	Addresses demineralization of water discharges.

5.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[39] and coastal waters. Florida has nearly 55,000 miles of perennial rivers and streams; more than 7,700 lakes, ponds, and reservoirs; and about 8,400 miles of Gulf of Mexico and Atlantic coastline including barrier island coastlines (as shown in Figure 5.1.4-1 and Figure 5.1.4-2) (DEP, 2014h). These waterbodies supply drinking water; provide aquatic habitat, and support recreation, tourism, agriculture, fishing, power generation, and industry throughout the state (DEP, 2014h).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). Florida's waters (lakes, rivers, and streams) are divided into 29 major watersheds, or drainage basins (Figure 5.1.4-2). Florida Appendix A, Table A-1: Characteristics of Florida's Watersheds, provides detailed information on the state's major watersheds, as defined by DEP. This website (http://www.dep.state.fl.us/water/watersheds/) contains detailed information and additional maps about each DEP watershed's location, size, and water quality (DEP, 2015m).

[39] Estuarine: related to an estuary, or a "partially enclosed body of water where fresh water from rivers and streams mixes with salt water from the ocean. It is an area of transition from land to sea." (USEPA, 2015b)

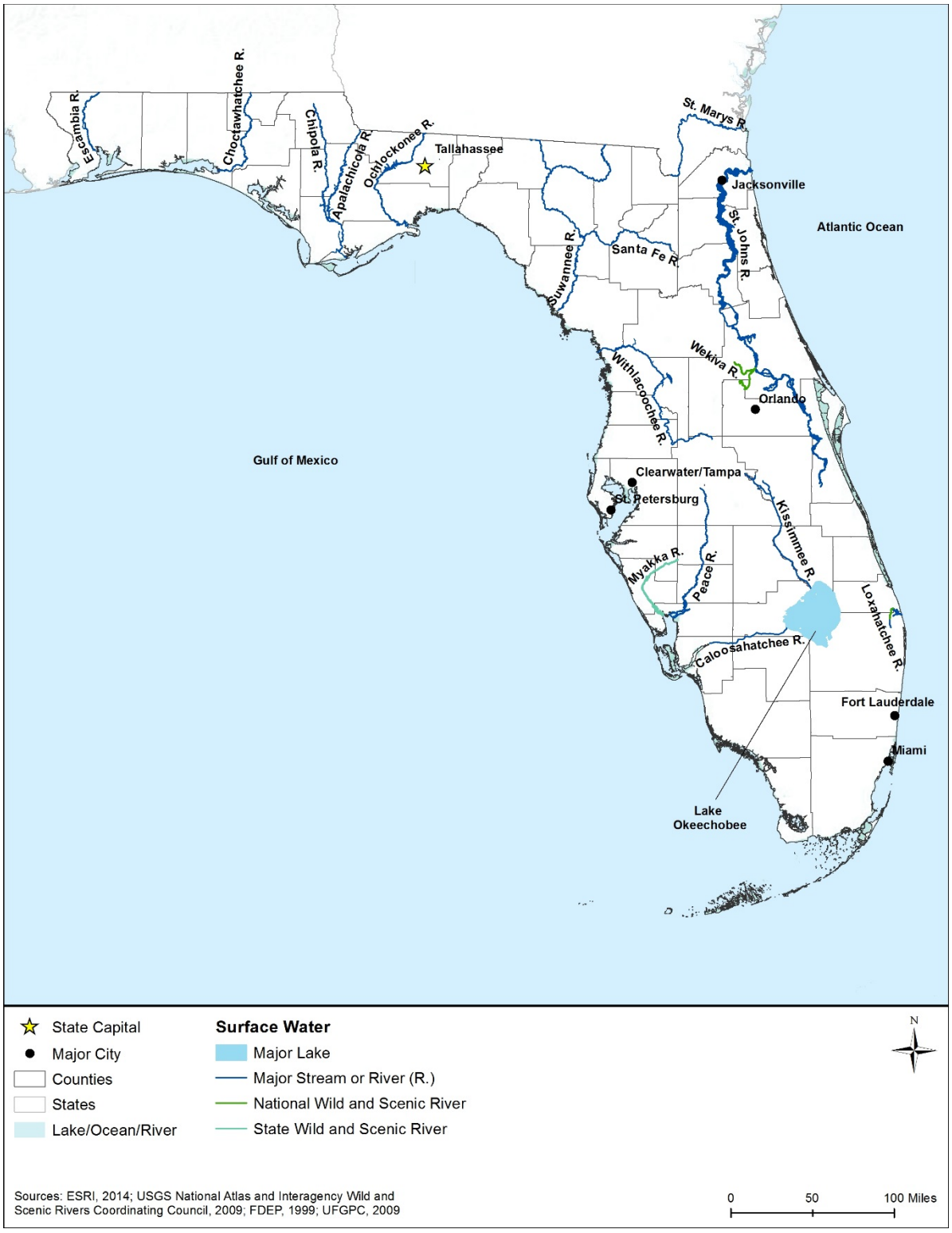


Figure 5.1.4-1: Major Florida Surface Waters

The largest watershed in the state is the Suwannee River watershed located on the northwestern portion of the Florida peninsula (Figure 5.1.4-2). It is also features the highest density of springs on the planet with 253 springs. The Everglades watershed, located at the southern tip of the state, has highly modified water flows for agricultural and flood control purposes through a system of canals and levees. The Sarasota Bay – Peace– Myakka watershed is located along the Gulf of Mexico coast and contains the only state-designed wild and scenic river, the Myakka River (Figure 5.1.4-1). The Indian River Lagoon watershed lies on the state's Atlantic coastline and contains the Indian River Lagoon estuary, the most biologically diverse estuary in North America. The Lake Okeechobee watershed is home to Lake Okeechobee, the second largest lake entirely within the U.S. (DEP, 2015m).

Freshwater

As shown in Figure 5.1.4-1, there are 13 major rivers in Florida: Escambia, Chipola, Apalachicola, Choctawhatchee, Ochlockonee, Suwannee, Santa Fe, St. Johns, Withlacoochee, Peace, Kissimmee, St. Mary's, and Caloosahatchee. In the northwestern part of the state, the Escambia, Choctawhatchee, and Apalachicola Rivers are alluvial river systems that flow into the Gulf of Mexico. The Apalachicola River has the largest discharge flow of any Florida river, averaging about 23,400 cubic feet per second. The St. John's River, located along the northeastern portion of the Florida peninsula, is the longest river in the state at 273 miles (DEP, 2014h). Major dams have been built on the Apalachicola, Ocklawaha, Ochlockonee, Hillsborough, and Withlacoochee Rivers. Florida also contains more than 7,700 lakes, ponds, and reservoirs that are greater than 10 acres in surface area. Florida's largest lake is Lake Okeechobee with a surface area of about 730 square miles (DEP, 2014h).

Estuarine and Coastal Waters

Estuaries (including bays and tidal rivers) are bodies of water that provide transition zones between fresh river water and saline ocean water. Barrier islands, sand bars, and other landmasses protect estuaries, including those in Florida, from ocean waves and storms. Florida's estuarine environments support a variety of habitats, including tidal wetlands, mudflats, rocky shores, oyster reefs, freshwater wetlands, sandy beaches, and eelgrass beds, and are a critical part of the lifecycle of many different plant and animal species (USEPA, 2012a).

Florida has two distinct coastal water environments: the Atlantic Ocean on the state's eastern coast and the Gulf of Mexico on the state's west coast. Florida's 8,426 miles of tidal shoreline include embayments, low- and high-energy tidal salt marshes, lagoons, mangrove swamps, and tidal segments of river mouths (DEP, 2014h). The National Oceanic and Atmospheric Administration (NOAA), DEP, and other state and federal agencies have developed management plans to address areas of concern and to develop protection and restoration strategies for these systems (DEP, 2014c). Information on Florida's estuaries is available on the DEP Coastal Office site (www.dep.state.fl.us/coastal/fco.htm).



Figure 5.1.4-2: Major Florida Watersheds and Surface Waterbodies

The Gulf of Mexico is part of the Atlantic Ocean and is the ninth largest waterbody in the world with an area of about 600,000 square miles. The Gulf of Mexico is bordered by the states of Florida, Alabama, Mississippi, Louisianan, and Texas to the north; Mexico to the west and south; and the island of Cuba to the east (NOAA, 2012). Gulf of Mexico fisheries also lead the U.S. in shrimp and oyster catches. The Gulf of Mexico features submerged vegetation, marine habitat, and coastal wetlands, which provide habitat for fish, migrating waterfowl, seabirds, wading bird, and sport and commercial fisheries (USEPA, 2014a).

Florida is also home to a number of Gulf Ecological Management Sites (GEMS), established by the Gulf of Mexico Program, that receive special protection. Florida's GEMS include NWRs managed by the U.S. Fish and Wildlife Service (USFWS), National Estuarine Research Reserves (NERRs), and Florida Aquatic Preserves (DEP, 2014d).

Florida has four major estuaries located in the southeastern corner of the state (Figure 5.1.4-3). For more information on these estuaries, access the USEPA's National Estuary Program website at (http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2).

- The **Indian River Lagoon** Estuary stretches about 160 miles from Ponce de Leon Inlet in the north to the St. Lucie/Martin County border in the south (St. Johns River WMD, 2013a). The Indian River Lagoon Estuary is home to about 690 species of fish, more than 350 bird species, and about 2,100 plant species (St. Johns River WMD, 2013b). The Indian River Lagoon Estuary was designated an Estuary of National Significance by USEPA in 1990, and a Comprehensive Conservation and Management Plan (CCMP) for the estuary was published in 1996 (Indian River Lagoon National Estuary Program, 2008). The CCMP identified four goals for the estuary: "achieve and maintain water and sediment quality to support a healthy ecosystem; achieve and maintain an ecosystem that supports commerce, recreation, fisheries, and endangered and threatened species; increase public awareness and interagency coordination; and identify and develop needed funding" (Indian River Lagoon National Estuary Program, 2008).
- The **Charlotte Harbor Estuary** lies on the west coast of the Florida peninsula and stretches from the city of South Venice in the north to the border of Lee and Collier Counties in the south. Charlotte Harbor has an area of 350 square miles and the watershed covers about 4,700 square miles, including the river mouths of the Caloosahatchee, Peace, and Myakka Rivers (the Myakka River is a Florida-designated Wild and Scenic River) (Charlotte Harbor National Estuary Program, 2013). The estuary is home to more than 275 species of shellfish (Charlotte Harbor National Estuary Program, 2013). Charlotte Harbor was recognized as an Estuary of National Significance in 1995 and the estuary's CCMP was completed in 2000 (Charlotte Harbor National Estuary Program, 2013). The CCMP identified four "Priority Problems: water quality degradation, hydrologic alterations, fish and wildlife habitat loss, and stewardship gaps" (Charlotte Harbor National Estuary Program, 2013).
- The **Sarasota Bay Estuary** lies on the west coast of the Florida peninsula to the north of Charlotte Harbor. The estuary stretches 56 miles from the town of Holmes Beach in the north to the town of Venice in the south and has a watershed of about 450 square miles (Sarasota Bay National Estuary Program, 2015a). The estuary is home to five species of

seagrass, more than 20 species of reptiles, more than 50 species of fish, about 60 bird species, and more than 25 species of mammals (Sarasota Bay National Estuary Program, 2015b). Sarasota Bay was designated an Estuary of National Significance by the USEPA in 1989, and its CCMP was completed in 1995 (Sarasota Bay National Estuary Program, 2014). The CCMP set forth seven goals for the estuary: improve water transparency, reduce pollution from stormwater, restore lost seagrass and shoreline habitats, establish a management structure for the estuary, provide increased access, restore fish and other living resources, and educate the public about Sarasota Bay (Sarasota Bay National Estuary Program, 2014).

- The **Tampa Bay Estuary** is located on Florida's west coast just north of Sarasota Bay. The estuary's approximately 400 square miles stretch from Lake Tarpon in the north to the mouth of the Manatee River in the south (Tampa Bay National Estuary Program, 2015a). Approximately 25 species of shorebirds and wading birds nest within the estuary, and the estuary is home to more than 200 species of fish (Tampa Bay National Estuary Program, 2015b). The estuary is also home to manatees and nesting sea turtles (Tampa Bay National Estuary Program, 2015c) (Tampa Bay National Estuary Program, 2015d). The USEPA established Tampa Bay as an Estuary of National Significance in 1991, and its CCMP was finalized in 1998 (Tampa Bay National Estuary Program, 2006). The current CCMP outlines eight actions focusing on water and sediment quality, habitats, fish and wildlife, dredging and dredged material, spill prevention and response, invasive species, public education, and public access (Tampa Bay National Estuary Program, 2006).

5.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

Two river segments in Florida have been designated National Wild and Scenic Rivers: the Loxahatchee River from Riverbend Park downstream to Jonathan Dickinson State Park and the Wekiva River from its confluence with the St. Johns River to Wekiwa Springs, Rock Springs Run, and Blackwater Creek (Figure 5.1.4-1) (NWSRS, 2015a).

Designated segments of the Loxahatchee River total 10.3 miles of pristine cypress swamps, and red and white mangroves. The river is threatened by increased salt-water concentrations resulting from hydrologic modifications causing decreased fresh water flows. Tree species within the river corridor include pop ash, bald cypress, water ash, and pond apple (DEP, 2010).

The Wekiva River basin includes sand pine scrub communities, pine flatwoods, hardwood hammocks, wetland prairies, sinkholes, seepage areas, springs, lakes, and streams. Some streams are clear and spring-fed while others are blackwater streams. The Wekiva River has 31.4 miles of designated as wild, 2.1 miles as scenic, and 8.1 miles as recreational. The Wekiva River basin is almost entirely within Florida state lands and is in "superb ecological condition." (NWSRS, 2015b)

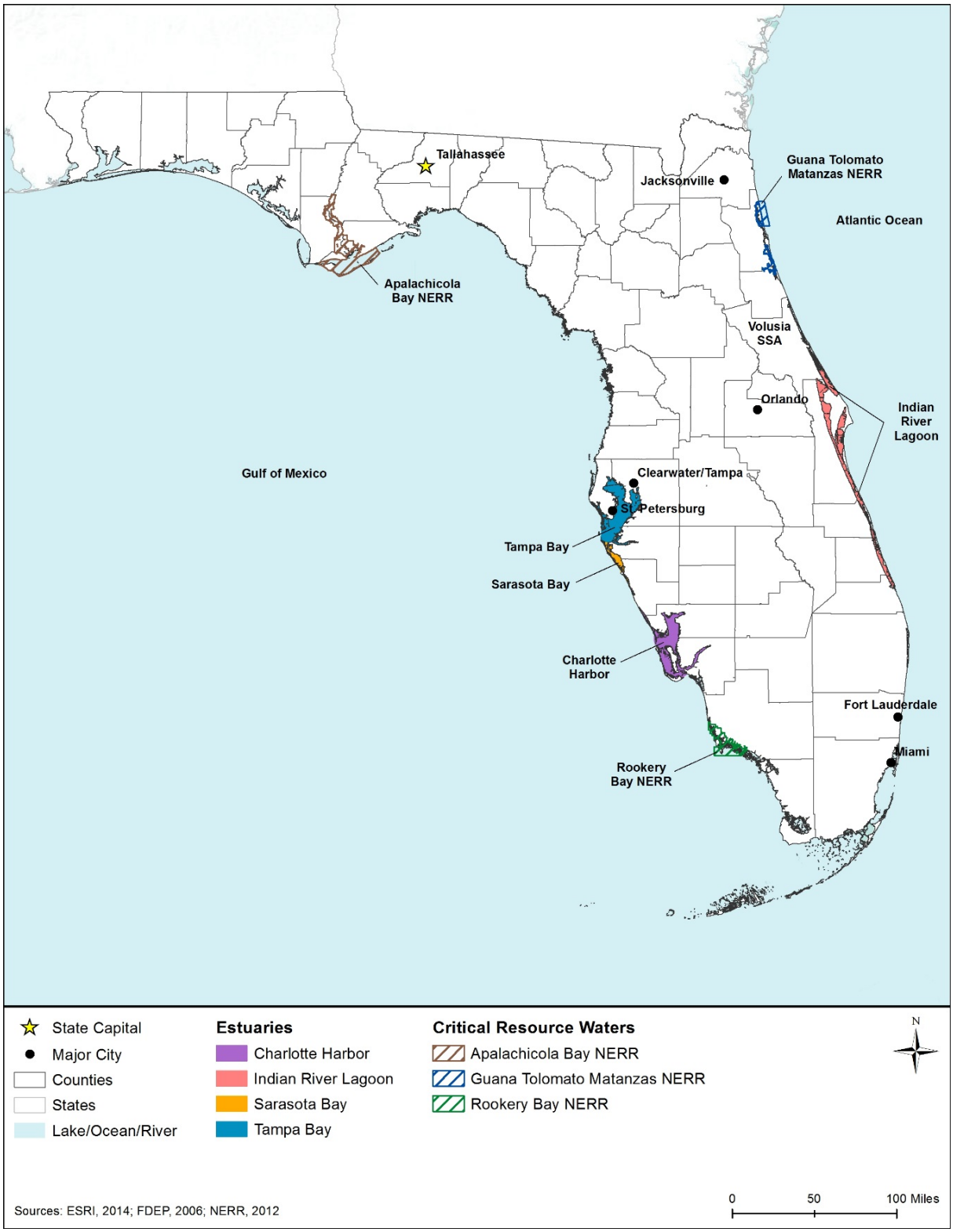


Figure 5.1.4-3: Florida's Estuaries and Critical Resource Waters

The Florida Legislature passed the Myakka River Wild and Scenic Designation and Preservation Act in 1985, which established a 12-mile segment of the Myakka River as the only state designated wild and scenic river. The Myakka River is a slow-flowing blackwater river which flows into Charlotte Harbor (an Estuary of National Significance, see Estuaries and Coastal Waters above) and ultimately into the Gulf of Mexico. The river has "very good water quality," and features aquatic habitats including tributaries, lakes, tidal freshwater, and estuarine/marine marshes (DEP, 2011a).

State Designated Critical Resource Waters[40]

The three National Estuarine Research Reserves (NERR) in Florida are all designated critical resource waters (Figure 5.1.4-3). The National Estuarine Research Reserve System (NERRS) is a network of 28 NERRs across the country whose mission is to "practice and promote stewardship of coasts and estuaries through innovative research, education, and training using a place-based system of protected areas" (NERRS, 2011).

- The Guana Tolomato Matanzas NERR protects more than 110 square miles on the northern Atlantic coast of Florida. The reserve consists of estuarine lagoons, salt marshes, and oyster bars and features sand dunes up to 40 feet in height. The waters of the reserve also serve as calving grounds for North Atlantic right whales. (NOAA, 2015a)
- Rookery Bay NERR protects over 170 square miles of estuarine habitat on Florida's southern Gulf of Mexico coastline. The reserve provides habitat for about 250 fish species, 150 bird species, and 400 plant species and lies on the western edge of the everglades ecosystem. The estuary and the Ten Thousand Islands ecosystem within the bay feature tidal streams, bays, interconnected embayments, and lagoons. Canals, tidal creeks, sloughs, and strands supply freshwater to the estuary. (NOAA, 2015b)
- Apalachicola NERR occupies more than 380 square miles on the Gulf of Mexico coastline on Florida's panhandle. Within the reserve, the Apalachicola River, which has the largest freshwater discharge of any river in Florida, flows into Apalachicola Bay. The bay is protected by the barrier islands of St. Vincent's Island and St. George Island. The estuary is home to over 130 species of fish, over 280 species of birds, and about 50 species of mammals. (NOAA, 2015c)

State Protected Waters

The state also designates certain waterbodies as Outstanding Florida Waters (OFWs) which gives them special protection. Some state waters are designed as OFWs because of their location within state or federally protected areas. Waters within the following areas are designated OFWs:

[40] Critical Resource Waters include NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. (ILDNR 2015)

- National Parks;
- NWRs;
- National Preserves;
- National Marine Sanctuaries and Estuarine Research Reserves;
- National Forests (certain waters);
- State Parks and Recreation Areas;
- State Preserves and Reserves;
- State Ornamental Gardens and Botanical Sites;
- Environmentally Endangered Lands Program, Conservation and Recreational Lands Program, and Save Our Coast Program Acquisitions; and
- Wild and Scenic Rivers (both national and state designated).

More information on these areas is described in Section 5.1.8, Visual Resources. The state also designates 41 Special Waters OFWs that are not otherwise protected at the state or federal level. For a list of Florida's Special Waters OFWs, see Florida Appendix A, Table A-2, Outstanding Florida Waters, and Special Waters (DEP, 2015n).

5.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the CWA, states are required to assess water quality and report a listing of impaired waters,[41] the causes of impairment, and probable sources. Table 5.1.4-2 summarizes the water quality of Florida's assessed major waterbodies by category, percent impaired, designated use,[42] cause, and probable sources, as of 2010.

As shown in Table 5.1.4-2, nearly all of Florida's estuaries and bays are impaired (USEPA, 2015a). Designated uses of the impaired estuaries and bays include propagation of fish, wildlife, and shellfish (USEPA, 2015a). According to DEP's 2014 Integrated Water Quality Assessment for Florida, mercury in fish tissue is the greatest cause of impairment of estuaries, coastal waters, and lakes, and the second greatest cause of impairment in rivers (DEP, 2014h). Other common causes of impairment in Florida's surface waters include low dissolved oxygen and pathogens (DEP, 2014h).

[41] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters. (USEPA, 2015b)

[42] Designated Use: an appropriate intended use by humans and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply. (USEPA, 2015b)

Table 5.1.4-2: Section 303(d) Impaired Waters of Florida, 2010

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	20%	80%	Fish and wildlife propagation, potable water supply, shellfish propagation	Dissolved oxygen, mercury in fish tissue, fecal coliform	No probable sources of impairment reported
Lakes Reservoirs and Ponds	54%	90%	Fish and wildlife propagation, potable water supply	Nutrients, mercury in fish tissue, turbidity	No probable sources of impairment reported
Bays and Estuaries	100%	97%	Fish and wildlife propagation, shellfish propagation	Mercury in fish tissue, pathogens, low dissolved oxygen	No probable sources of impairment reported
Coastal Shoreline	NA[43]	97%	Fish and wildlife propagation, shellfish propagation	Mercury in fish tissue, pathogens, low dissolved oxygen	No probable sources of impairment reported

[a] Some waters may be considered for more than one water type.
[b] Florida has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015b use this one).

Source: (USEPA, 2015a)

The DEP manages two water quality monitoring networks, the Status Network and the Trends Network, to monitor and report on the state's surface and groundwater quality. These networks are used to generate a Status Report and a Trends Report (DEP, 2015o). The Status Report provides a yearly summary of water quality throughout the state (DEP, 2015o). The Trends Report provides water quality trends analysis for individual waterbodies of interest (DEP, 2015o). According to DEP's Status Network, for the 2011 to 2013 reporting period, only about 80 percent of streams met water quality standards for dissolved oxygen, 80 percent of streams met water quality standards for pathogen indicators, and only 70 percent of rivers and 65 percent of streams met water quality standards for total nitrogen (DEP, 2015p). The Trends Network indicates that the Apalachicola River shows an improving trend for total phosphorous, a worsening trend for dissolved oxygen, and no change for pathogen indicators over the period of 1999 to 2012 (DEP, 2015q). The Indian River Lagoon shows an improving trend for total phosphorous and pathogen indicators, but a worsening trend for dissolved oxygen over the period of 1999 to 2012 (DEP, 2015q).

[43] Florida assessed 6,034 miles of coastline in 2010, but the total miles of coastline in Florida, measured with the same methodology as the assessed miles, is unavailable. Therefore, a percentage of coastline assessed is unavailable.



Figure 5.1.4-4: Section 303(d) Impaired Waters of Florida, 2010

5.1.4.6. Floodplains

The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as "any land area susceptible to being inundated by water from any source" (44 Code of Federal Regulations [CFR] 59.1)[44] (FEMA, 2000). Through FEMA's flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as "a flood that has a 1 percent chance of occurring in any given year," to allow communities to prepare and protect against flood events (FEMA, 2013).

Floodplains provide suitable and sometimes unique habitat for a wide variety of plants and animals, and are typically more biologically diverse than upland areas due to the combination of both terrestrial and aquatic ecosystems. Vegetation along stream banks provides shade, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically, floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping. (FEMA, 2014a)

There are two primary types of floodplains in Florida:

- **Riverine and lake floodplains** occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. Flatter floodplains, including those in Florida, may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014b)
- **Coastal floodplains** in Florida border the Atlantic Ocean and Gulf of Mexico coastlines. Coastal flooding can occur when strong wind and storms, usually hurricanes, increase water levels on the adjacent shorelines. (FEMA, 2013)

There are several causes of flooding in Florida, often resulting in loss of life, and damage to personal property, crops, business facilities, utilities, and transportation. These include severe thunderstorms, hurricanes, flash floods, dam and levee breaks, and other conditions related to the weather (Florida Division of Emergency Management, 2013).

Due to the large amounts of coastline, significant drainage systems, and the relatively low elevation, the entire state of Florida is susceptible to flooding. Along Florida's coasts, many counties have large population concentrations that are vulnerable to the effects of coastal flooding. More than 45 percent of the state's population resides in six coastal counties: Miami-Dade, Broward, Palm Beach, Hillsborough, Pinellas, and Duval, with 3.95 million people residing in areas prone to coastal flooding. As of 2010, Miami-Dade County has 537,320

[44] To search for and locate CFR records, see the Electronic Code of Federal Regulations (e-CFR): www.ecfr.gov.

persons requiring evacuation in the event of a Category 3 hurricane.[45] Additionally, other counties in the area with large coastal populations include Broward County with 155,705 persons; Palm Beach County with 271,993 persons; Hillsborough County with 295,636 persons; Pinellas County with 474,504 persons; and Lee County with 378,593 persons. As urban encroachment and population growth continues, mitigation plans will be an integral part of overall emergency planning, especially as sprawl stays on or near the coast. Approximately 2.1 million of the 2.6 million National Flood Insurance Program (NFIP) policies in the nation were in Florida, as of January 2013 (Florida Division of Emergency Management, 2013).

Canals of the South Florida Water Management System

Southern Florida is home to a network of 2,600 miles of canals, 64 pumping stations, and 1,300 other water control structures that provide flood control, water supply, and navigation. The canal system was built over the past century, primarily to make southern Florida more suitable for human development, and is one of the most sophisticated and extensive civil works projects on the planet. One of the many functions of the canal system is to provide groundwater recharge, which can be particularly important to prevent saltwater intrusion in some areas. The canal system is also removes excess water to prevent flooding during heavy rainfall events. (SFWMD, 2010)



Source: (USGS, 2013c)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to approximately 500 communities in Florida through the NFIP (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Florida had 228 communities participating in the CRS (FEMA, 2014d).[46]

[45] Category 3 hurricanes have sustained winds of 111-129 miles per hour and cause devastating damage including major damage to buildings and uprooting of trees (NPS, 2013).

[46] A list of the 39 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (www.fema.gov/media-library-data/1398878892102-a5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system)

5.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and include underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

Florida's principal aquifers are the Biscayne aquifer, surficial aquifer system, Floridian aquifer system, and the Coastal lowlands aquifer system. The state's groundwater system features some of the most productive aquifers in the U.S. Florida's groundwater is generally of high quality and potable, providing the majority of the state's drinking water (90 percent) to over 19 million residents. Threats to groundwater include arsenic from pesticides, saltwater encroachment, leaking landfills and septic tanks, and nitrates from fertilizers. (DEP, 2014h)

Table 5.1.4-3: Description of Florida's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Biscayne Permeable sand and sandstone and highly permeable limestone.	Southeast tip of the Florida peninsula, south of Lake Okeechobee	Suitable for most uses including drinking. Water contains calcium bicarbonate and small concentrations of dissolved solids and chloride and is hard.
Surficial system Consists of unconsolidated sand, shells, and shelly sand.	Located in the south and east portions of the Florida peninsula and in parts of the Florida panhandle.	Dissolved solid concentrations range up to 150 milligrams per liter. Water is slightly acidic.
Floridian system Consists of a sequence of carbonate rocks. This is a carbonate rock aquifer.[a]	Found in the northwestern part of the Florida peninsula and a portion of the Florida panhandle.	Portion of the aquifer in the Florida panhandle contains calcium, magnesium, and sodium. Portion of the aquifer in the Florida peninsula contains bicarbonate, chloride, and sulfate.
Coastal Lowlands Aquifer System Unconsolidated to poorly consolidated sediments (primarily clay, sand, and silt).	Located in the westernmost portion of the state.	Concentrations of dissolved solids are typically less than 50 milligrams per liter. Chloride concentrations are typically less than 50 milligram per liter except near the coast where concentrations are higher. Water is slightly acidic.

[a] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott, 1995).
Sources: (USGS, 2000b) (USGS, 1995a) (USGS, 1995b) (USGS, 1995c) (USGS, 1995d) (USGS, 1996)

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015c). Florida has two designated SSAs both of which occur entirely within the state (as shown in Figure 5.1.4-5). The Biscayne SSA is located in the

southeast tip of the Florida peninsula and central Florida near Lake Okeechobee. The Volusia SSA is located along the northern Atlantic coast of the state. Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015c).

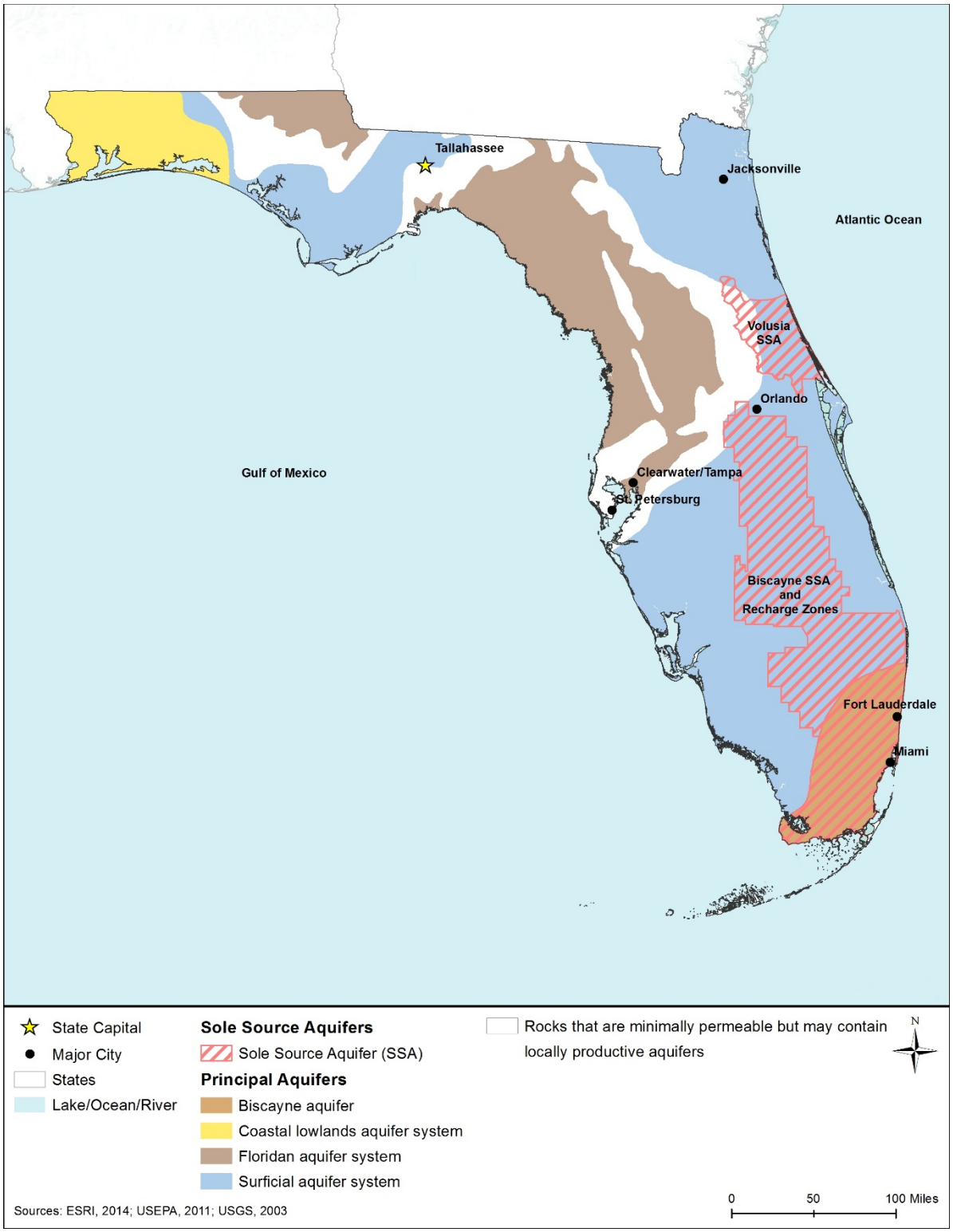


Figure 5.1.4-5: Principal and Sole Source Aquifers of Florida

5.1.5. Wetlands

5.1.5.1. Definition of the Resource

The Clean Water Act (CWA) defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (40 CFR 230.3(t), 1993).

The USEPA estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half of such species use wetlands at some point in their lives" (USEPA, 1995). In addition to providing habitat for many plants and animals, wetlands also provide benefits to human communities. Wetlands store water during flood events, improve water quality by filtering polluted runoff, help control erosion by slowing water velocity and filtering sediments, serve as points of groundwater recharge, and help maintain base flow in streams and rivers. Additionally, wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography (USEPA, 1995).

5.1.5.2. Specific Regulatory Considerations

Florida implements a statewide regulatory Environmental Resource Permit (ERP) program to ensure that activities in uplands, wetlands, and other surface waters do not degrade water quality. The DEP oversees this program and five water management districts (WMDs). Local programs in Broward, Miami-Dade, and Hillsborough Counties have been delegated authority or partial-authority to implement the program on behalf of the DEP and WMDs. The Florida ERP program operates in addition to the USACE wetland regulatory program that oversees activities in waters of the United States. For limited activities, the DEP is allowed to grant both the ERP and federal permit under a State Programmatic General Permit. (DEP, 2011b)

All state, local, and regional governments in Florida delineate wetlands in accordance with a state methodology instead of using the USACE 1987 Wetland Delineation Manual methodology. This adopted methodology is based on the vegetation, hydrologic, and soil features that specifically exist in the state and differs in many respects from the USACE's method. The USACE methodology is used separately by the federal permitting agencies in Florida. The state and federal wetland lines are typically very similar or identical with one another, although, in certain areas of the state, noteworthy differences do exist. For example, under the ERP Program, isolated wetlands are included under state jurisdiction, which is not the case under the federal CWA. (DEP, 2015r) (DEP, 2011b)

Appendix C, Environmental Laws and Regulations, explains the pertinent federal laws to protecting wetlands in detail. Table 5.1.5-1 summarizes Florida state laws and regulations relevant to the state's wetlands.

Table 5.1.5-1: Relevant Florida Wetland Laws and Regulations

State Law/Regulation	Regulatory Authority	Applicability
Clean Water Act (CWA) Section 404 Permit, Florida regional conditions	USACE	Certain activities in Critical Resource Waters are not authorized under the NWP program. Critical Resource Waters include wetlands in NERR; the Florida Keys; Biscayne and Everglades National Parks; and Green Swamp and Big Cypress Swamp.
Environmental Resource Permit Program	DEP	Projects that alter flows of surface waters including dredging and filling in wetlands.
Storm Water Permitting Program	DEP	Construction activities that disturb an acre or more of surface soil.
CWA Section 401 Certification	DEP	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from DEP indicating that the proposed activity will not violate water quality standards.

5.1.5.3. Environmental Setting: Wetland Types and Functions

The USFWS National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined by (Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979). The Wetlands Classification System includes five major wetland Systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. All five of these systems are present in Florida, as detailed in Table 5.1.5-2. The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (USFWS, 2015dn)

- "The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the Water Regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of estuaries." Where wave energy is low, mangroves or mudflats may be present.
- "The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean and the ocean water is at least occasionally diluted by freshwater runoff from the land."
- "Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt."
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy greater than 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.

- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The system is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types) (Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979) (FGDC, 2013).

As of the mid 1990s, there were about 11.4 million acres of wetlands in Florida. The wetlands were composed of freshwater wetlands (90 percent) and marine and estuarine intertidal wetlands (10 percent). Wetland habitat makes up approximately 29 percent of Florida, more than any other state in the continental United States (Haag & Lee, 2010).

Table 5.1.5-2 uses 2014 NWI data to characterize and map Florida wetlands on a broad-scale.[47] The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations. As shown in Figure 5.1.5-1, Figure 5.1.5-2, and Figure 5.1.5-3, Florida is predominately palustrine wetlands, while estuarine/marine wetlands are found in the eastern and southern portion of the state and along the coast. The map codes and colorings in Table 5.1.5-2 correspond to the wetland types in the figures.

Table 5.1.5-2: Florida Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that is at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.	Throughout the state	6,579,138
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, often in previously disturbed areas	
Palustrine emergent wetlands	PEM	PEM have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[c] prairie potholes, and sloughs.[d]	Southern part of the state and along the coastline	3,240,369
Palustrine unconsolidated bottom	PUB	PUB and PAB are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state and along the coastline	291,484

[47] The wetland acreages were obtained from the USFWS (2014) National Wetlands Inventory. Data from this inventory was downloaded by state at https://www.fws.gov/wetlands/. The wetlands data contains a wetlands classification code, which are a series of letter and number codes, adapted to the national wetland classification system in order to map from (e.g., PFO). Each of these codes corresponds to a larger wetland type; those wetland areas are rolled up under that wetlands type. The codes and associated acres that correspond to the deepwater habitats (e.g., those beginning with M1, E1, L1) were removed. The wetlands acres were derived from the geospatial datafile, by creating a pivot table to capture the sum of all acres under a particular wetland type. The maps reflect/show the wetland types/classifications and overarching codes; the symbolization used in the map is standard to these wetland types/codes, per the USFWS and Federal Geographic Data Committee.

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep,[e] and other miscellaneous wetlands are included in this group.	Throughout the state	5,744
Riverine wetland	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state	6,510
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are less than 8.2 feet deep.	Throughout the state	178,362
Estuarine and Marine intertidal wetland	E2/M2	These intertidal wetlands include the areas between the highest tide level and the lowest tide level. Semidiurnal tides (two high tides and two low tides per day) periodically expose and flood the substrate. Wetland examples include vegetated and non-vegetated brackish (mix of fresh and saltwater), and saltwater marshes, shrubs, beaches, sandbars, or flats.	Along the coastline	1,069,302
			Total	**11,370,909**

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (FGDC, 2013)

[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. (USFWS, 2015j)

[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (Edinger, et al., 2014)

[d] Slough: "Swamp or shallow lake system, usually a backwater to a larger body of water." (NOAA, 2014f)

[e] Saline seep is an area where saline groundwater discharges at the soil surface. Saline soils and salt tolerant plants characterize these wetland types. (City of Lincoln, 2015)

Source: (Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979), (USFWS, 2015dn), (FGDC, 2013)

Palustrine Wetlands

In Florida, palustrine wetlands include the majority of vegetated freshwater wetlands (forested wetlands, freshwater marshes, swamps, and ponds). Palustrine forested wetlands (PFO) are found throughout the state and are the most common type of palustrine wetlands within Florida. Common types of PFO in Florida include cypress domes, hardwood swamps, and bay swamps (bayheads). Big Cypress Swamp is one of the largest cypress swamps in the U.S., and is located

south of the Florida Everglades. Palustrine scrub-shrub wetlands (PSS) occur throughout Florida, usually found in previously disturbed areas. Common vegetative species in Florida PSS are willow (*Salix*), wax myrtle (*Morella cerifera*), buttonbush (*Cephalanthus*), red maple (*Acer rubrum*) saplings, sweetbay (*Magnolia virginiana*), and black gum (*Nyssa sylvatica*). Palustrine emergent wetlands (PEM) (or freshwater marshes) found in Florida include wet prairies,[48] depression marshes, floodplain marshes, and bogs.[49] Florida marshes occur in shallow water or in areas subjected to extended periods of flooding, such as flatwood depressions, and along lake and river shorelines, and support diverse plant and animal species. Common marsh plants in Florida include sedges (*Cyperaceae*), sawgrass (*Cladium*), spike rush (*Eleocharis palustris*), maidencane (*Panicum hemitomon*), spatterdock (*Nuphar advena*), and duckweed (*Lemnoideae*). PEM are common in the southern part of the state and along the coastline. (FWC, 2012a)

Southern Florida is predominantly covered by wetlands associated with the Everglades and the Big Cypress Swamp, where very slow moving water flows though diverse habitats connected by wetlands and water bodies southward towards the coast. The Everglades (Figure 5.1.5-3), is the single largest freshwater marsh and wet prairie complex in the state. In central Florida, the wetlands are numerous, small in size, and widely distributed.

Isolated wetlands are more common in the central and southern portions of the state, as compared with the panhandle and northern Florida. The low, flat landscape and abundant rainfall contribute to the abundance of freshwater wetlands in central Florida. These wetlands often become isolated when sinkholes develop in the porous limestone common to this region (Haag & Lee, 2010).

In 2010, the most common palustrine (freshwater) wetland type in the state was PFO (55 percent), followed by PEM (25 percent), PSS (18 percent), and PUB/PAB (ponds) (2 percent) (Haag & Lee, 2010). Based on the USFWS NWI 2014 analysis, ratios have remained similar, with PFO/PSS being the dominant wetland type (65 percent), followed by PEM (32 percent), PUB/PAB (ponds) (3 percent), and other palustrine wetlands (1 percent) (USFWS, 2014a).

Freshwater emergent wetlands have declined at a greater rate than any other type of palustrine wetland in Florida. From 1985 through 1996, more than 260,000 acres of palustrine emergent wetlands were lost, which is more than double the rate of decline that occurred during the 1970s and 1980s (FWC, 2015a). Development and agriculture have caused the greatest amount of palustrine wetland loss. Urban growth and development have also lead to an increased threat of invasive species that disrupt native animal and plant communities. The top three harmful exotic species in Florida include esthwaite waterweed (*Hydrilla*), water hyacinth (*Eichhornia crassipes*), and Brazilian pepper (*Schinus terebinthifolius*) (Handley, Spear, Baumstark, Moyer, & Thatcher, 2010).

[48] Wet prairies are dominated by short grass/sedge vegetation and are inundated (or saturated by surface or groundwater) for no more than a few months per year (USFWS, 2014i).

[49] Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation. (Adirondack Park Agency, 2013)

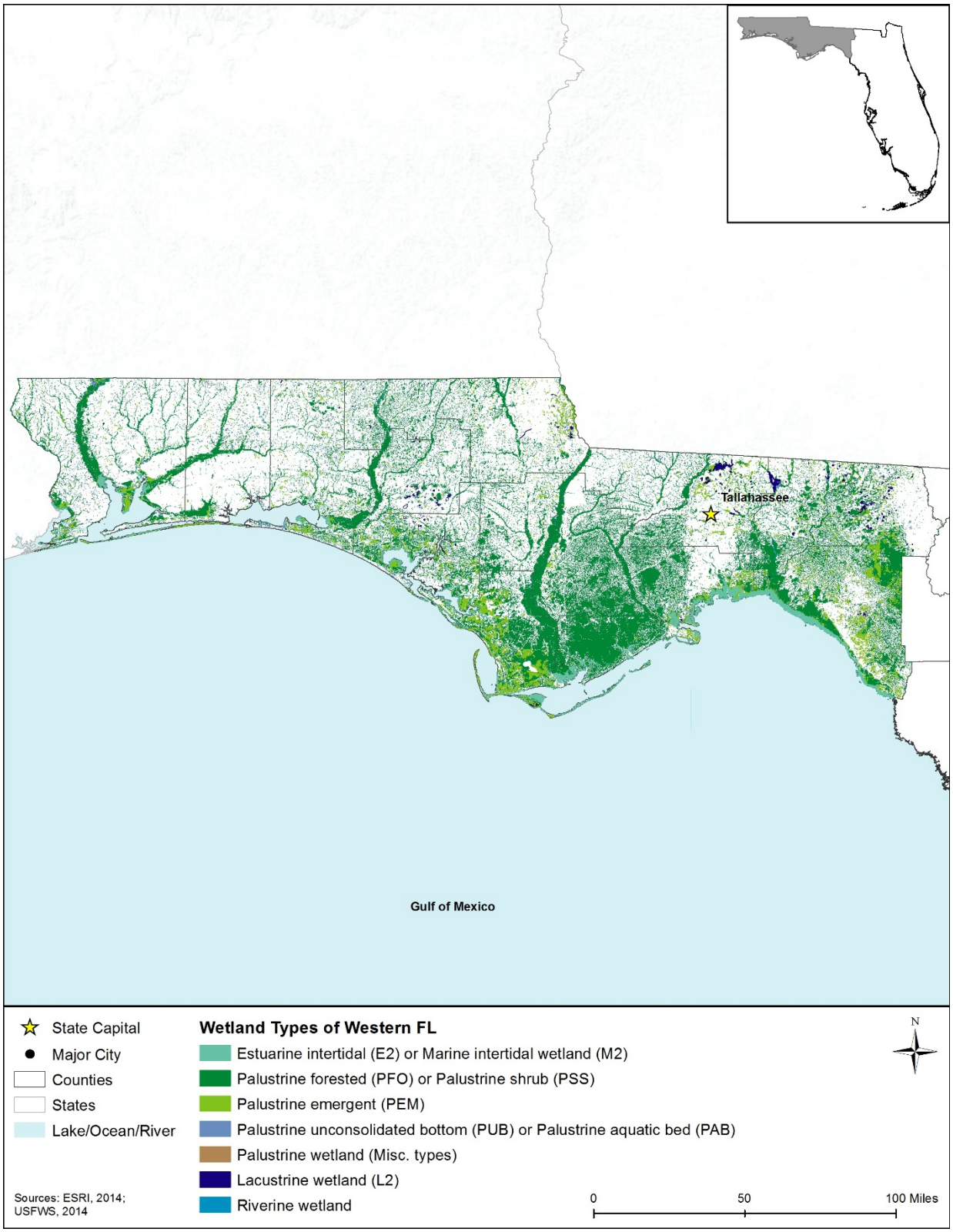


Figure 5.1.5-1: Wetlands by Type, in Western Florida, 2014

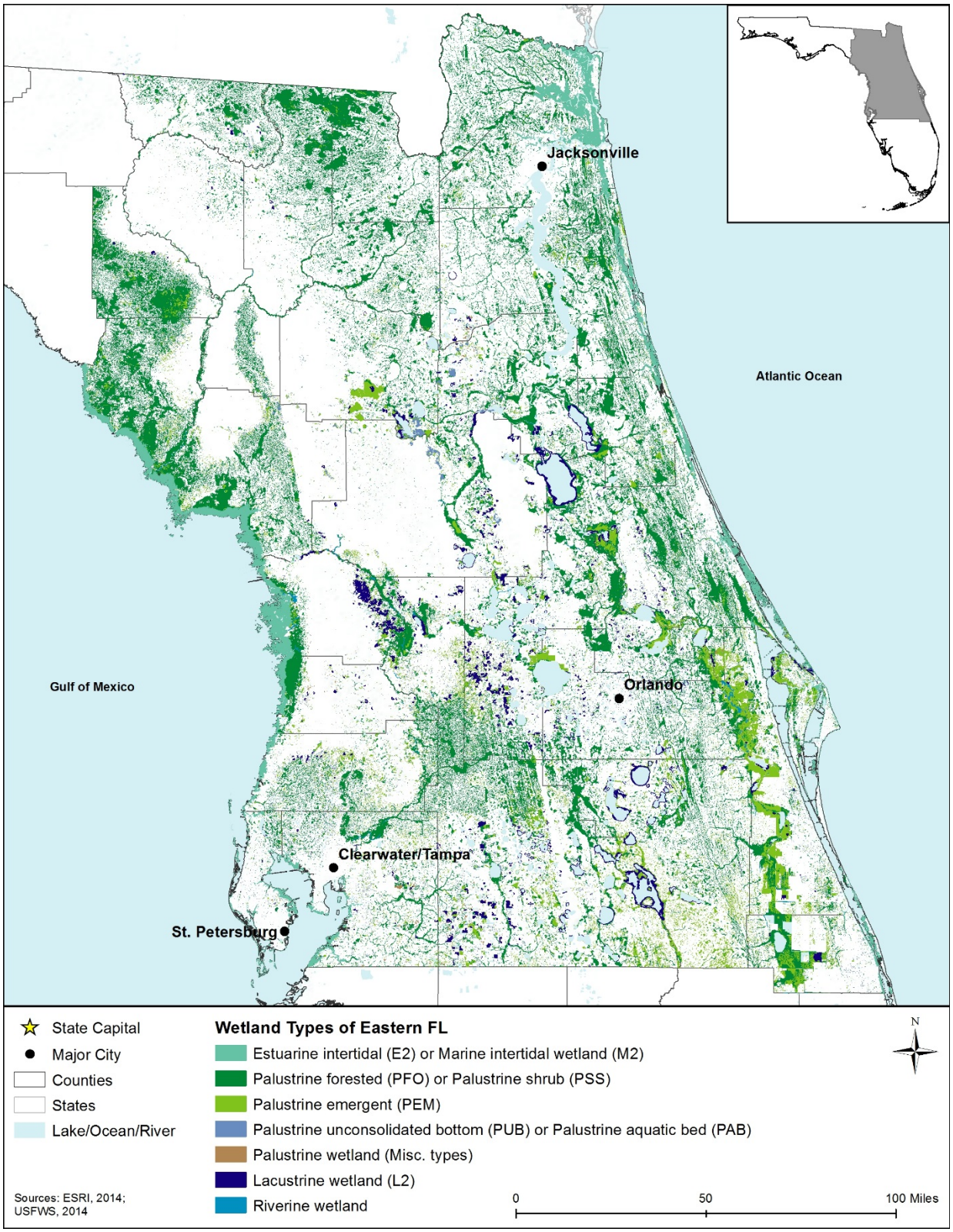


Figure 5.1.5-2: Wetlands by Type, in Eastern Florida, 2014

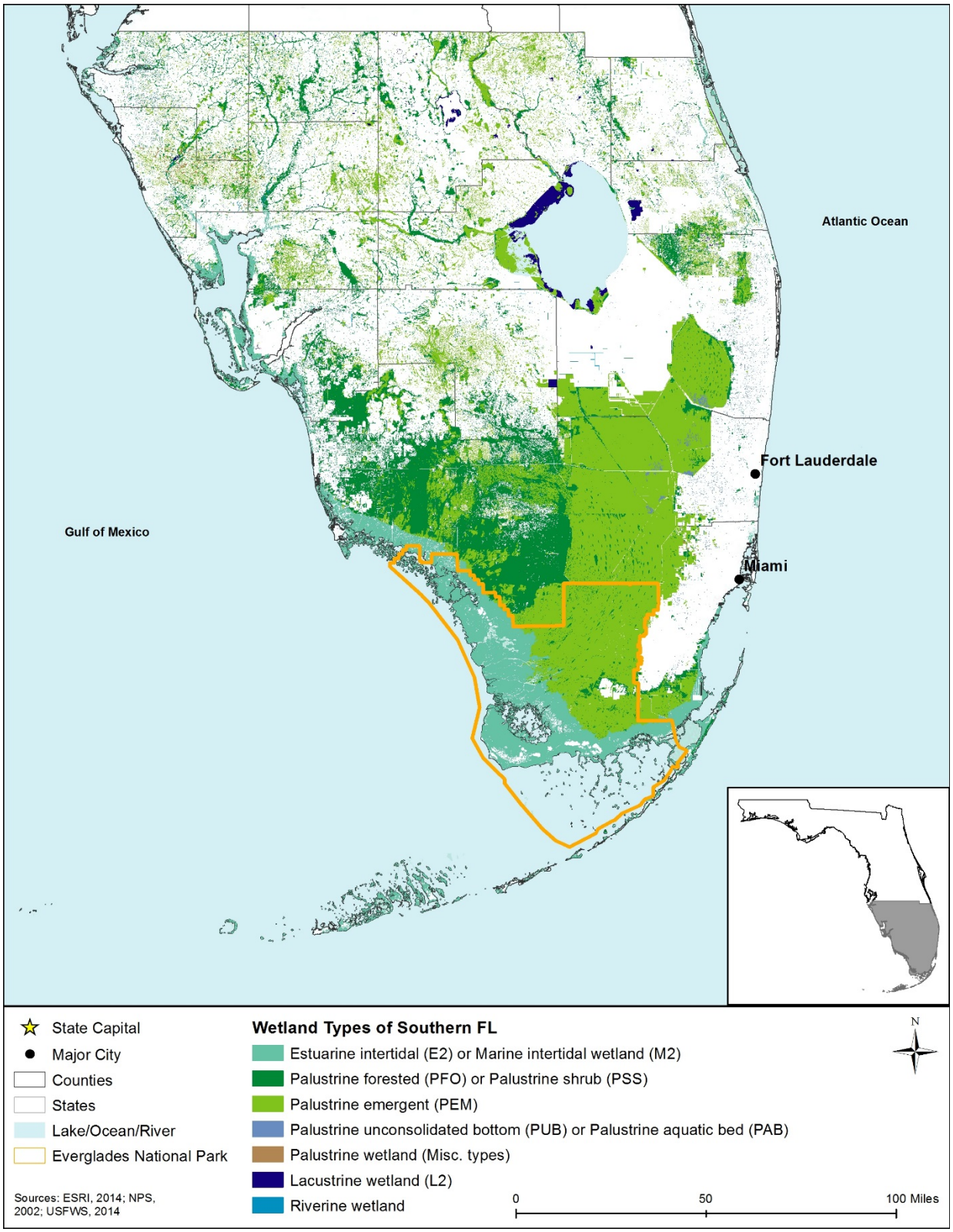


Figure 5.1.5-3: Wetlands by Type, in Southern Florida, 2014

Estuarine and Marine Wetlands

In Florida, estuarine, or tidal fringe wetlands, can be vegetated (salt marshes and mangrove forests) or unvegetated (mud and sand flats). These wetlands are found along Florida's shoreline, as shown in Figure 5.1.5-1. Salt marshes are the primary coastal habitat along the Gulf of Mexico extending from Apalachicola Bay south to Tampa Bay. Along the Florida coast, salt marshes are dominant above the winter freeze line, which are the upper limits for mangrove habitat. Salt marshes are also present on the Atlantic coast, with approximately 10 percent of Florida's salt marshes located in the Indian River Lagoon (USFWS, 2014b).

Within the U.S., mangrove forests and swamps are unique to Florida and one of the true native species in the state. Red, black and white mangroves are the three species that grow in Florida. Approximately 470,000 acres of mangrove forests are found along the southern Florida coast. Mangrove swamps extend as far north as Cedar Key on the Gulf coast and Cape Canaveral on the Atlantic coast (DEP, 2015s).

Coastal development and urban expansion has historically caused great losses to estuarine wetlands in Florida. Over the past 100 years, coastal wetlands, including both mangroves and salt marshes, in Tampa Bay have diminished by 44 percent (DEP, 2015s). Although these ecosystems are now protected by state and local regulations, such as the 1996 Mangrove Trimming and Preservation Act and Salt Marsh Restoration Program, habitat loss still occurs due to natural processes and adverse human influences (e.g., changes in upstream hydrology, inputs of excess sediments and nutrients) (DEP, 2015t) (DEP, 2012a).

5.1.5.4. Environmental Setting: Wetlands of Special Concern or Value

In addition to protections under the state's ERP program and national CWA, Florida considers certain wetland communities as areas of special value due to their global or regional scarcity, local/national importance, or habitat they support. These include seepage wetlands, as well the Florida Everglades, and wetlands associated with critical resource waters.

Sensitive Wetlands Areas

Sensitive wetland areas are regional wetlands that the state has identified as important natural resources, such as seepage wetlands. Seepage wetlands occur when rainwater moving through the soil encounters a less permeable layer (e.g., clayey sand, clay, or rock) causing the water to flow laterally until it encounters a land surface, where it collects in a topographic depression. They are also found where depression wetlands are lower than the elevation of the adjacent water table or in floodplains of large rivers.

Regulated high quality wetlands in Florida include seepage wetlands, such as bay heads, bay swamps, hydric hammocks, and flood-plain seepage swamps. Many of these types of seepage wetlands are found in central Florida, as are cutthroat seeps, named for the dominant vegetation cover. Several conservation areas have been established to protect seepage wetlands. In central Florida, these areas include the Green Swamp, which has hydric hammocks that drain into the Withlacoochee River, and natural areas in Highlands and Putnam Counties. (Haag & Lee, 2010)

The most common types of seepage wetlands in central Florida are bay heads or bay swamps, hydric hammocks, and flood-plain seepage swamps. Cutthroat seeps, named after the dominant vegetation cover (cutthroat grass, *Panicum abscissum*), are a threatened type of seepage wetland found in central Florida. These sensitive wetland areas are dependent on a high water table and seepage flow; therefore, they are easily affected by changes in local or regional hydrology. For example, local development increases impermeable surfaces that result in additional runoff, leading to inundation and a shift to hardwood swamps. The threat of invasive exotic species such as melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), Japanese climbing fern (*Lygodium japonicum*), and skunk vine (*Paederia foetida*) is also problematic for seepage wetlands. As a result, several conservation areas have been established to protect seepage wetlands. In central Florida, these areas include the Green Swamp, which has hydric hammocks that drain into the Withlacoochee River, and natural areas in Highlands and Putnam Counties. (Haag & Lee, 2010)

Protected Wetlands

Located in southern Florida, the Florida Everglades is one of the largest wetlands in the world. The Florida Everglades are made up of several wetland types, including mangrove swamps, cypress domes, marshes, and estuarine wetlands. The Everglades National Park protects only the southern one-fifth of this wetland ecosystem, composed of approximately 1.5 million acres (NPS, 2015b). Due to its special significance, the United Nations Educational, Scientific, and Cultural Organization designated the Florida Everglades as an International Biosphere Reserve and a World Heritage Site on October 26, 1976. The Ramsar Convention of Wetlands also recognized the Everglades as a Wetland of International Importance on June 4, 1987.[50]

Restoration activities within the Lake Okeechobee watershed, the Everglades, and coastal estuaries are regulated under the Long-Term Plan for Achieving Water Quality Goals (Everglades Forever Act), the Comprehensive Everglades Restoration Plan Regulation (a state-federal partnership), and the Northern Everglades and Estuaries Protection Plan. State legislature also expanded the Lake Okeechobee Protection Act in 2007 in order to increase protection measures for the Northern Everglades, which includes restoration and preservation activities within the Lake Okeechobee watershed and the Caloosahatchee and St Lucie estuaries. (DEP, 2011b)

Other Important Wetland Sites

- Wildlife Management Areas are designated for outdoor recreation totaling more than 5.8 million acres of mostly undeveloped land (FWC, 2015b). To learn more about state Wildlife Management Areas access this website (http://myfwc.com/viewing/recreation/)
- National Natural Landmarks in Florida range in size from 593 acres to approximately 14,000 acres (NPS, 2012a) and are owned by a variety of landowners including the U.S. Forest

[50] The Ramsar Convention is the "oldest of the modern global intergovernmental environmental agreements. The treaty was negotiated through the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory waterbirds." (Ramsar Convention 2014)

Service (USFS), DEP, and private individuals. To learn more about Florida's National Natural Landmarks access this website (www.nature.nps.gov/nnl/state.cfm?State=FL).

- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including the NRCS Agricultural Conservation Easement Program, and various easements managed by natural resource conservation groups such as state land trusts and The Nature Conservancy. Other non-profit organizations involved in Florida coastal wetland preservation and restoration include Florida Sea Grant, Tampa Bay Watch, and Ocean Conservancy, as well as numerous university and academic research entities. According to the National Conservation Easement database (http://conservationeasement.us/), a national electronic repository of government and privately held conservation easements; NRCS holds more than 174,800 acres in conservation easements in Florida. (NCED, 2015)

For more information on Florida's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 5.1.8, Visual Resources, and Section 5.1.7, Land Use, Recreation, and Airspace.

5.1.6. Biological Resources

5.1.6.1. Definition of the Resource

This section describes the biological resources of Florida. Biological resources include terrestrial[51] vegetation, wildlife, fisheries and aquatic[52] habitats, and threatened[53] and endangered[54] species, and communities and species of conservation concern. Because of the state's elongated peninsula spanning a wide latitudinal range and its location along both the Atlantic and Gulf of Mexico coastlines, Florida supports a wide diversity[55] of biological resources ranging from the upland ridges[56] in central Florida, to the coastal marshes along the Gulf of Mexico.

5.1.6.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of biological resources in Florida are summarized in detail in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 5.1.6-1summarizes state laws and regulations relevant to Florida's biological resources.

[51] Terrestrial: "Pertaining to land" (USEPA, 2015n).

[52] Aquatic: "Pertaining to water" (USEPA, 2015n).

[53] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" *(16 U.S.C. §1532(20)).*

[54] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. §1532(6)).

[55] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA, 2015n).

[56] Upland ridge: A long, narrow piece of "land at a higher elevation than the flood plain or low stream terrace," "usually sharp crested with steep sides and forming an extended upland between valleys" (NRCS, 2016).

Table 5.1.6-1: Relevant Florida Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Aquatic Plant Importation, Transportation, and Non-Nursery Cultivation, Possession and Collection (FAC 5B-64)	Florida Department of Agriculture and Consumer Services (FDACS)	Establishes that FDACS shall administer the aquatic plant management program of the state as necessary for the eradication, control, or prevention of the introduction and dissemination of noxious or prohibited aquatic plants, protect sovereignty lands from the improper and excessive collection of native aquatic plants for purposes of sale, revegetation, restoration, or mitigation.
Endangered and Threatened Animal Species (FAC 68A-27.003 and 68A-27.005)	Florida Fish and Wildlife Conservation Commission (FWC)	Contains the list of animals designated and maintained by the FWC as federally endangered or threatened, state threatened or state species of special concern in accordance with rules 68A-27.003 and 68A-27.005 FAC, respectively.
Rules Relating to Non-Native Species (FAC 68-5)	FWC	Contains the list of non-native species that are regulated by the state, including lists of conditional non-native species and prohibited non-native species.
Illegal importation or possession of nonindigenous marine plants and animals; rules and regulations (Chapter 379.26, Florida Statutes [FS])	FWC	Regulates import or possession of nonnative marine plants and animals that have the potential to endanger the marine ecosystems.
Imported Fish (Chapter 379.28 FS)	FWC	Regulates the import or placement of freshwater fish species into state waters by requiring a permit issued by FWC.
Regulation of Nonnative Animals (Chapter 379.231 FS)	FWC	Regulates the import or release of any nonnative animals; such acts are illegal unless authorized by FWC.
Florida Endangered and Threatened Species Act (Chapter 379.2291, FS)	Florida Department of Environmental Protection (DEP), FWC	Established to conserve and protect fish and wildlife in the state, with particular attention to those species defined by the FWC, DEP, or the USFWS as being endangered or threatened.

State Law/Regulation	Regulatory Agency	Applicability
Florida Manatee Sanctuary Act (FAC 68C.22 and Section 370.12, FS)	FWC	Declares Florida a refuge and sanctuary for the manatee, the Florida state marine mammal. The Act declares it unlawful for any person at any time, by any means, or in any manner to intentionally or negligently annoy, molest, harass, or disturb or attempt to molest, harass, or disturb any manatee; injure or harm or attempt to injure or harm any manatee; capture or collect or attempt to capture or collect any manatee; pursue, hunt, wound, or kill or attempt to pursue, hunt, wound, or kill any manatee; or possess, literally or constructively, any manatee or any part of any manatee. Provides guidelines for counties to establish manatee speed zones on county waters, as well as manatee protection zones. Sets forth rules by county where manatee protection applies.
Florida Mangrove Trimming and Preservation Act (Section 403.9321 et seq. of F.S.)	DEP	Regulates the trimming of mangroves; requires a professional mangrove trimmer; identifies acceptable circumstances for trimming.
Introduction or Release of Plant Pests, Noxious Weeds, Arthropods[a] and Biological Control Agents (FAC 5B-57)	FDACS	Established control for the introduction into, or movement or spread within this state of any plant pest, noxious weed, or arthropod, and to establish procedures under which the field release of plant pests, noxious weeds, arthropods, and biological control agents or biomass plantings are permitted. Such procedures will assist in confirming that introductions and field releases are conducted in a manner which provides for public and environmental protection.
Preservation of Native Flora of Florida (FAC 5B-40)	FDACS	Contains the list of plants designated and maintained by FDACS Division of Plant Industry as endangered, threatened and commercially exploited.

[a] Arthropods: "Any member of the phylum Arthropoda, which are characterized by jointed appendages, an exoskeleton, and segmented body parts. Arthropods are the most diverse group of animals on Earth and include insects, crustaceans, arachnids, myriapods, and onychophorans as well as extinct forms like trilobites."[b] (Smithsonian Institute, 2016a)

[b] Trilobite: "Any member of Trilobita, an extinct class of marine arthropods. Trilobites are known from the Cambrian to the Permian. They had segmented, oval-shaped bodies and were the first animals to have complex eyes (similar to the compound eyes in modern insects)." (Smithsonian Institute, 2016a)

5.1.6.3. Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology,[57] soils, climate, and water of a given geographic area and correlates with distinct areas identified as ecoregions.[58] Ecoregions are broadly defined areas that share similar characteristics, such as

[57] "Geology is the study of the planet earth- the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin" (USEPA, 2015n).

[58] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015n).

climate,[59] geology, soils, and other environmental conditions and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities. (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015)

Ecoregion boundaries often coincide with physiographic[60] regions of a state. The ecoregions mapped by the USEPA are the more commonly referenced, although individual states and organizations have also developed ecoregions that may differ slightly from those designated by the USEPA. The USEPA divides North America into 15 broad Level I ecoregions. These Level I ecoregions are further divided into 50 Level II ecoregions. These Level II ecoregions are further divided into 182 smaller Level III ecoregions (USEPA, 2016a). This section provides an overview of the terrestrial vegetation resources for Florida at USEPA Level III (USEPA, 2016a).

As shown in Figure 5.1.6-1, the USEPA divides Florida into three Level III ecoregions: the Southeastern Plains, the Southern Coastal Plain, and the Southern Florida Coastal Plain. These three ecoregions support a diversity of plant communities based on their general location within the state; these locations translate to differences in climate which is a major driver of the distribution of vegetative communities in Florida. The Southeastern Plains occur throughout the eastern U.S., with the southernmost area found in the Florida panhandle along the state's borders with Alabama and Georgia. The Southern Coastal Plains are also found throughout the southeastern U.S., extending from coastal South Carolina into peninsular Florida and the Gulf of Mexico coastal regions of the panhandle. The Southern Florida Coastal Plain is the only Level III ecoregion located entirely within Florida and is composed of the southern tip of the peninsula, including the Florida Keys. The vegetative communities within the three ecoregions range from upland plains and hills in the panhandle and northern Florida to the ridges and pine flatwoods along the Atlantic and Gulf Coasts in peninsular Florida, to the marshes, swamps, and mangrove islands in the Everglades in southern Florida. The Florida Keys are also characterized by distinctive vegetation communities, including mangroves, beach berm[61] and dunes, wetlands, and hammocks[62] plant species. Table 5.1.6-2 provides a summary of the general abiotic[63] characteristics, vegetative communities, and the typical vegetation found within each of the three Florida ecoregions (Griffith, 2007).

[59] Climate: "Climate in a narrow sense is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years. The classical period is 3 decades, as defined by the World Meteorological Organization (WMO)" (USEPA, 2015n).

[60] Physiographic: "The natural, physical form of the landscape" (USEPA, 2015n).

[61] Berm: "a raised earthen area" (University of Florida, 2006).

[62] Hammock: "used in Florida to describe forest habitats that are typically higher in elevation than surrounding areas and that are characterized by hardwood forests of broad-leaved evergreens" (Karim & Main, 2004).

[63] Abiotic: "Characterized by absence of life; abiotic materials include non-living environmental media (e.g., water, soils, sediments); abiotic characteristics include such factors as light, temperature, pH, humidity, and other physical and chemical influences" (USEPA, 2016f).

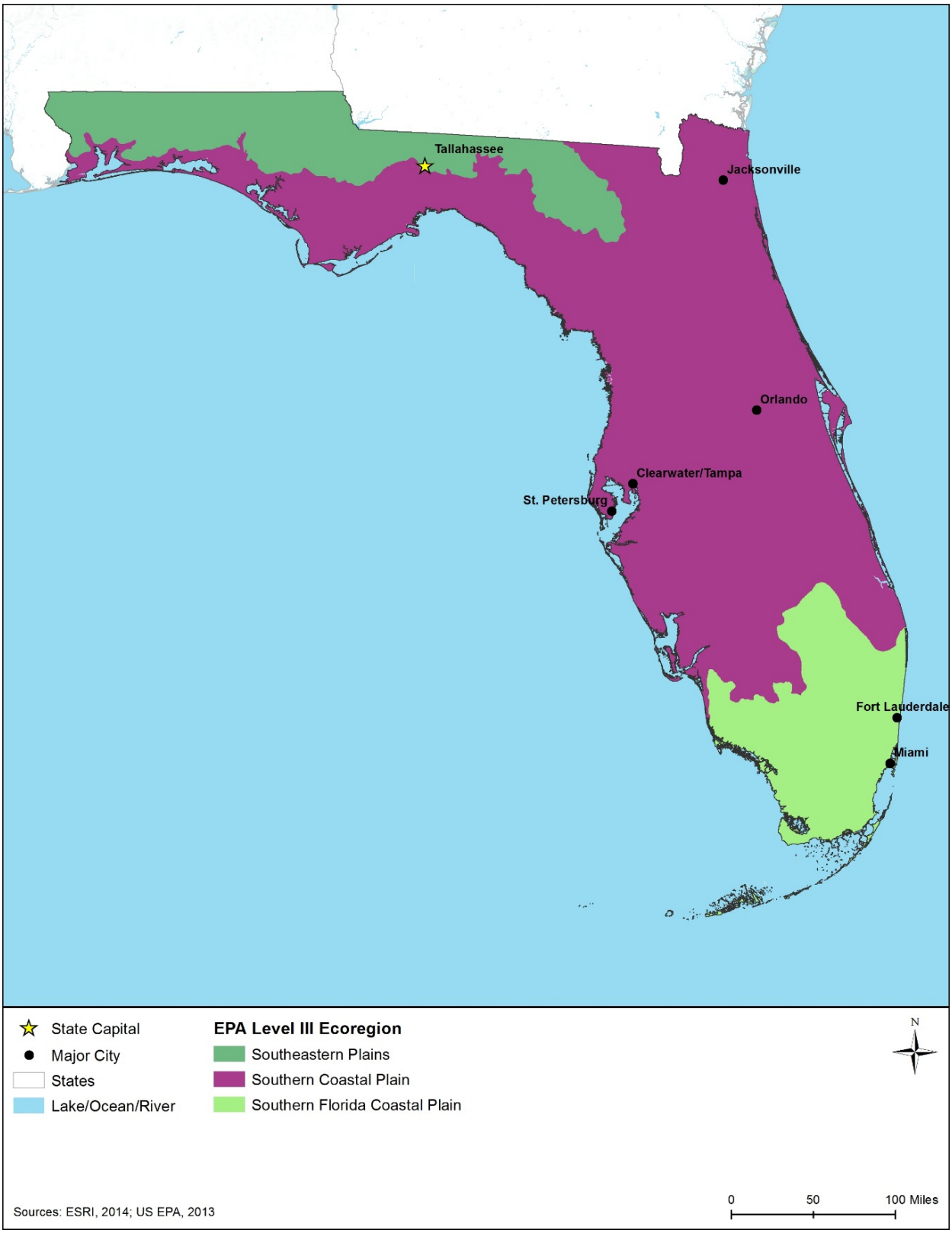


Figure 5.1.6-1: USEPA Level III Ecoregions in Florida

Table 5.1.6-2. USEPA Level III Ecoregions of Florida

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Panhandle				
65	Southeastern Plains	Greater elevation and relief than that found in the adjacent Southern Coastal Plain. Sands, silts, and clays in the Southeastern Plains contrast with metamorphic and igneous rocks found to the north.	Longleaf pine and areas of oak-hickory-pine	**Conifer Trees** – Longleaf pine (*Pinus palustris*), loblolly pine (*Pinus taeda*), slash pine (*Pinus elliottii*) **Hardwood Trees –** Laurel oak (*Quercus laurifolia*), live oak (*Quercus virginiana*), water oak (*Quercus nigra*), water hickory (*Carya aquatica*), shagbark hickory (*Carya ovata*), swamp hickory (*Carya glabra*)
75	Southern Coastal Plain	Composed primarily of flat plains, but also contains barrier islands, lagoons, marshes, and swamps. Soils are wetter and elevation is lower than in the Southeastern Plains to the north.	Variety of forest communities, including pine flatwoods and hardwood forests. Savannas and citrus groves are now common.	**Conifer Trees** – Longleaf pine, pond pine (*Pinus serotina*), slash pine **Hardwood Trees** – pond cypress (*Taxodium ascendens*), beech (*Fagus* sp.), sweetgum (*Liquidambar styraciflua*), southern magnolia (*Magnolia grandiflora*), white oak (*Quercus alba*), and laurel oak **Palm Trees** – Cabbage palm (*Sabal palmetto*)
Geographic Region: Atlantic/Gulf Coasts and Flatwoods[a]				
75	Southern Coastal Plain	Composed primarily of flat plains, but also contains barrier islands, lagoons, marshes, and swamps. Soils are wetter and elevation is lower than in the Southeastern Plains to the north.	Native vegetation is a variety of forest communities, including pine flatwoods and hardwood forests. Citrus groves are now common.	**Conifer Trees** – Longleaf pine, pond pine (*Pinus serotina*), slash pine **Hardwood Trees** – pond cypress (*Taxodium ascendens*), beech (*Fagus* sp.), sweetgum (*Liquidambar styraciflua*), southern magnolia (*Magnolia grandiflora*), white oak (*Quercus alba*), and laurel oak **Palm Trees** – Cabbage palm (*Sabal palmetto*)
Geographic Region: Everglades and Florida Keys				
76	Southern Florida Coastal Plain	Generally frost free region with slight differences in elevation and landform. Characterized by wet soils.	Marshes, swamps, everglades, and palmetto prairie	**Conifer Trees** – South Florida slash pine (*Pinus elliottii* var. *densa*) **Hardwood Trees** – bald cypress (*Taxodium distichum*) and mangrove [red (*Rhizophora mangle*), black (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*)] **Shrubs** – saw palmetto (*Serenoa repens*) **Forbs/Grasses** – sawgrass (*Cladium jamaicense*)

[a] Flatwoods: Flatwoods are a terrestrial ecosystem dependent on fire and typically comprised of "saw palmetto (*Serenoa repens*), wiregrass (*Aristida stricta*), and slash, loblolly, and longleaf pines (*Pinus elliottii*,*Pinus taeda, and Pinus palustris*)" (University of Florida, 2016).

Sources: (Fenneman N. , 1916) (FNAI, 2010a) (Griffith, 2007) (CEC, 2011)

Communities of Concern

The state of Florida contains vegetative communities of concern that include rare natural plant communities, plant communities with greater vulnerability or sensitivity to disturbance, and communities that provide habitat for rare plant and wildlife species. The ranking system for these communities gives an indication of the relative rarity, sensitivity, uniqueness, or vulnerability of these areas to potential disturbances. This ranking system also gives an indication of the level of potential impact to a particular community[64] that could result from implementation of an action.

The Florida Natural Areas Inventory (FNAI) has documented the types of communities that are known to occur, or have historically occurred, in the state. Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Each natural community is assigned a rank based on its rarity and vulnerability. As with most state heritage programs, the FNAI ranking system assesses rarity using a state rank (S1, S2, S3, S4, S5) that indicates its rarity within Florida. Communities ranked as an S1 by FNAI are of the greatest concern. This rank is assigned to critically imperiled communities with extremely low occurrences/low area covered, or communities that are extremely vulnerable (FNAI, 2015).

Four vegetative communities are ranked as S1 communities[65] in Florida (Keys Cactus Barren, Pine Rockland, Slope Forest, and Upland Glade). These S1 communities represent the rarest terrestrial habitat in the state and have been documented in two of the three USEPA Level III ecoregions in Florida. Keys Cactus Barrens and Pine Rocklands are endemic to Florida and are found only in extreme southern Florida. Slope Forests and Upland Glades are found in the panhandle of Florida and in Georgia.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive plants. Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (GPO, 2011). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S. (88 terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2015b).

Noxious weeds are a threat to forests and ecosystems throughout southeastern U.S. In Florida, these plants displace native plants and wildlife, alter the natural hydrology and fire regimes, affect forest health and productivity, and increase forest management costs (FDACS, 2015). In

[64] Community: "In ecology, an assemblage of populations of different species within a specified location in space and time. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake or the soil arthropod community in a forest" (USEPA, 2015n).

[65] S1 – Communities that are "critically imperiled in Florida because of extreme rarity (5 or fewer occurrences) or because of extreme vulnerability to extinction due to some natural or manmade factor" (FNAI, 2010a).

order to control the introduction or spread of noxious weeds in Florida, the Florida Department of Agriculture and Consumer Services (FDACS) maintains a list of 78 noxious weeds (referred to as the "Noxious Weeds and Invasive Plants List") (FAC, FAR, 2014) which are regulated at the state level. The following species, by vegetation type, are regulated as noxious weeds in Florida:

- **Trees and Shrubs** – African boxthorn (*Lycium ferocissimum*); Australian pine (*Casuarina equisetifolia*); beach naupaka (*Scaevola taccada*); bramble blackberry (*Rubus fruticosus*); Brazilian pepper (*Schinus terebinthifolius*); carrotwood (*Cupaniopsis anacardioides*); cat's claw mimosa (*Mimosa pigra*); Chinese privet[66] (*Ligustrum sinense*); Chinese tallow tree (*Sapium sebiferum*); coral ardisia (*Ardisia crenata*); downy myrtle (*Rhodomyrtus tomentosa*); Indian rhododendron (*Melastoma malabathricum*); jointed prickly pear (*Opuntia aurantiaca*); latherleaf (*Colubrina asiatica*); lead tree (*Leucaena leucocephala*); melaleuca (*Melaleuca quinquenervia*); *Prosopis* spp.; shoebutton ardisia (*Ardisia elliptica*); suckering Australian pine *(Casuarina glauca*); turkeyberry (*Solanum torvum*); and wild raspberry (*Rubus molluccanus*).
- **Forbs and Grasses –** Aeginetia (*Aeginetia* spp.); African couchgrass, fingergrass (*Digitaria scalarum*); African feathergrass (*Pennisetum macrourum*); alectra (*Alectra* spp.); animated oat, wild oat (*Avena sterilis*); annual couchgrass (*Digitaria velutina*); Asian sprangletop (*Leptochloa chinensis*); Benghal dayflower (*Commelina benghalensis*); Brazilian satintail (*Imperata brasiliensis*); broadleaf buttonweed (*Borreria alata*); broomrapes[67] (*Orobanche* spp.); Burma reed (*Neyraudia reynaudiana*); cattail grass (*Setaria pallidefusca*); coat buttons (*Tridax procumbens*); cogongrass (*Imperata cylindrica*); common crupina (*Crupina vulgaris*); crested floating heart (*Nymphoides cristata*); crofton weed (*Ageratina adenophora*); devil's thorn (*Emex spinosa*); giant hogweed (*Heracleum mantegazzianum*); giant sensitive plant (*Mimosa invisa*); goat's rue (*Galega officinalis*); itchgrass (*Rottboellia cochinchinensis*); Kikuyu grass (*Pennisetum clandestinum*); kodomillet (*Paspalum scrobiculatum*); Kyasuma grass (*Pennisetum pedicellatum*); lightning weed (*Drymaria arenarioides*); liverseed grass (*Urochloa panicoides*); missiongrass/thin napiergrass (*Pennisetum polystachyon*); murainograss (*Ischaemum rugosum*); onionweed (*Asphodelus fistulosus*); painted euphorbia (*Euphorbia prunifolia*); pilipiliula (*Chrysopogon aciculatus*); red rice (*Oryza longistaminata*); red rice (*Oryza punctata*); rosary pea (*Abrus precatorius*); serrated tussock (*Nassella trichotoma*); sessile joyweed (*Alternanthera sessilis*); three-corner jack (*Emex australis*); tropical soda apple (*Solanum viarum*); velvet fingergrass, wetland nightshade (*Solanum tampicense*); wild red rice (*Oryza rufipogon*); wild safflower (*Carthamus oxyacantha*); wild sugarcane (*Saccharum spontaneum*); wormleaf salsola (*Salsola vermiculata*); and yellow floating heart (*Nymphoides peltata*).

[66] With the exception of the cultivar 'Variegatum,' which is not included on the noxious weeds list. (*Introduction or Release of Plant Pests, Noxious Weeds, Arthropods and Biological Control Agents (FAC 5B-57)* 2014).

[67] With the exception of *O. uniflora*, which is not included on the noxious weed list. (*Introduction or Release of Plant Pests, Noxious Weeds, Arthropods and Biological Control Agents (FAC 5B-57)* 2014).

- **Vines** – air potato (*Dioscorea bulbifera*); climbing hempweed (*Mikania micrantha*); *Cuscuta* spp.;[68] Japanese climbing fern (*Lygodium japonicum*); kudzu (*Pueraria montana*); little bell, aiea morning glory (*Ipomoea triloba*); mile-a-minute (*Mikania cordata*); sewer-vine (*Paederia cruddasiana*); skunk-vine (*Paederia foetida*); Small-leaved climbing fern (*Lygodium microphyllum*); and white yam (*Dioscorea alata*).

In addition to these noxious weeds, FDACS also maintains a list of 27 prohibited aquatic plants (FDACS, 2008). These species, which are divided into two classes with different regulatory requirements, are listed below:

- **Class I**[69] **Prohibited Aquatic Plants**: African elodea (*Lagarosiphon* spp.); alligatorweed, green lead plant (*Alternanthera philoxeroides*); arrowleaf falsepickerelweed (*Monochoria hasata*); Australian Pine (*Casuarina* spp.); Brazilian-pepper (*Schinus terebinthifolius*); bush morning glory (*Ipomoea fistulosa*); Eurasian watermilfoil (*Myriophyllum spicatum*); exotic bur-reed (*Sparganium erectum*); giant sensitive plant, cat's claw (*Mimosa pigra*); heartshape false pickerelweed (*Monochoria vaginalis*); hippo grass (*Vossia cuspidata*); hydrilla, Florida elodea, stargrass, oxygen grass (*Hydrilla verticillata*); melaleuca (*Melaleuca quinquenervia*); nechamandra (*Nechamandra alternifolia*); purple loosestrife (*Lythrum salicaria*); *Salvinia* spp. (excluding *S. minima*); sawah flowing rush (*Limnocharis flava*); swamp stone crop (*Crassula helmsii*); tropical pickerelweed (*Pontederia rotundifolia*); water chestnut (*Trapa* spp.); water spinach (*Ipomoea aquatica*); water-aloe, soldier plant (*Stratiotes aloides*); waterhyacinth (*Eichhornia* spp.); and wild red rice (*Oryza rufipogon*).
- **Class II**[70] **Prohibited Aquatic Plants**: ambulia (*Limnophila sessiliflora*); hygro (*Hygrophila polysperma*); and waterlettuce (*Pistia stratiotes*) (FDACS, 2008).

The following plant species appear in both the Noxious Weeds List and the Prohibited Aquatic Plants lists: Australian pine, Brazilian pepper, cat's claw, melaleuca, and wild red rice. Sixty-four of the noxious weeds and prohibited aquatic plants regulated in Florida also appear on the Federal Noxious Weed List (USDA, 2014).

[68] Species native to Florida are excluded from the FLDACS noxious weed list. (*Introduction or Release of Plant Pests, Noxious Weeds, Arthropods and Biological Control Agents (FAC 5B-57)* 2014).

[69] Class I Prohibited Aquatic Plants – "Under no circumstances will these species be permitted for possession, collection, transportation, cultivation, and importation except as provided in Rule 5B-64.004, F.A.C." (FDACS, 2008)

[70] Class II Prohibited Aquatic Plants – "These species are considered to be highly invasive and noxious in localized areas of the State of Florida. These plants may be cultured in a nursery regulated by the Department of Agriculture and Consumer Services pursuant to Sections 581.031, 581.131 and 581.145, F.S., and shall only be sold out of state upon approval by the department. These species shall not be imported or collected from the wild. They must be contained in such a manner so as to prevent the dissemination from the nursery premises" (FDACS, 2008).

5.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Florida, divided among mammals,[71] birds,[72] reptiles[73] and amphibians,[74] and invertebrates.[75] Terrestrial wildlife consists of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include game species (mammals and avian species); nongame animals such as furbearers, nongame waterfowl, wading and shore birds, pelagic birds (i.e., sea birds), and songbirds (migratory and non-migratory). A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or associated habitats. According to the Florida Fish and Wildlife Conservation Commission (FWC), there are over 570 native species in Florida: 54 mammal, 89 reptile, 54 amphibian, 377 bird, and more than 15,000 described invertebrate species (approximate species counts) (FWC, 2012b).

Mammals

Some of the most abundant and widespread native mammal species include: Virginia opossum (*Dedelphis virginiana*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). Other mammal species are highly local and found only in specific environments. For example, endangered key deer (*Odocoileus virginianus clavium*) are found only in the Florida Keys. A number of other threatened and endangered mammals are located in Florida. Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

There are a number of large and small game species that are legally hunted in Florida, including white-tailed deer, wild hog (*Sus scrofa*), American alligator (*Alligtor mississippiensis*), gray squirrel (*Sciurus carolinensis*), and rabbit (*Sylvilagus* spp.) (FWC, 2015c). Numerous furbearers are also legally hunted in the state, including raccoon, opossum, skunk (*Spilogale putorius* and *Mephitis mephitis*), nutria (*Myocastor coypus*), beaver (*Castor canadensis*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and river otter (*Lontra canadensis*). In addition to these mammal species, Florida also allows hunting of specific resident and migratory birds and native and nonnative reptiles. Fifty-two of Florida's 54 native mammal species are considered Species of Greatest Conservation Need (SGCN). Species identified as SGCN are either currently imperiled or at risk of becoming imperiled in the future and can include federal and state listed taxa, rare

[71] Mammals: "Warm-blooded vertebrates that give birth to and nurse live young; have highly evolved skeletal structures; are covered with hair, either at maturity or at some stage of their embryonic development; and generally have two pairs of limbs, although some aquatic mammals have evolved without hind limbs" (USEPA, 2015n).
[72] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves" (USEPA, 2015n).
[73] Reptiles: "Cold-blooded, air breathing vertebrates belonging to the class Reptilia, usually covered with external scales or bony plates" (USEPA, 2015n).
[74] Amphibian: "A cold-blooded vertebrate that lives in water and on land. Amphibians' aquatic, gill-breathing larval stage is typically followed by a terrestrial, lung-breathing adult stage" (USEPA, 2015n).
[75] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015n).

species,[76] biologically vulnerable species,[77] keystone species,[78] and taxa of concern.[79] Caribbean monk seal (*Monachus tropicalis*), gray wolf (*Canis lupus*), red wolf (*Canis rufus*), Indiana bat (*Myotis sodalis*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), Bachman's warbler (*Vermivora bachmanii*), eskimo curlew (*Numenius borealis*), and American burying beetle (*Nicrophorus americanus*) were not considered for inclusion as SGCN because they are either considered incidental in the state or their occurrence in the state has not been documented. Nonnative taxa are not considered for inclusion as SCGN (FWC, 2012b).

Birds

The number of native bird species documented in Florida varies according to the timing of the data collection effort, changes in bird taxonomy,[80] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (e.g., freshwater lakes and wetlands, estuaries and coastlines, scrublands, and hardwood forests) found in Florida support a large variety of bird species.

There are approximately 377 native bird species in Florida (FWC, 2015d) and approximately 216 of these species are believed to breed in Florida (USGS, 2015j). Almost half (161 species) of the 377 native bird species in Florida have been identified as SGCN.

Florida is located within the Atlantic Flyway, which generally follows the Atlantic Coast and Appalachian Mountains. The Atlantic Flyway extends from the Arctic islands and coast of Greenland south to eastern Mexico and the Caribbean Sea. Large numbers of migratory birds utilize these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations" (USFWS, 2013e). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013e).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found throughout the year along the coast as well as near large rivers and lakes throughout in the state (eBird, 2015a).

[76] Rare species are "taxa with an FWC species ranking system Population Size Score ≥ 4 (0–10,000 individuals range-wide)" (FWC, 2012b).

[77] Biologically vulnerable species are "taxa with an FWC species ranking system Biological Score ≥ 19, or taxa on the International Union for Conservation of Nature (IUCN) list as "near threatened" or above, or taxa on the FNAI list as at least S3 or G3" (FWC, 2012b).

[78] Keystone species are "species that play a critical role in maintaining the structure of an ecological community and whose impact on the community is greater than would be expected based on its relative abundance or total biomass" (FWC, 2012b).

[79] Taxa of Concern are "taxa that did not meet other SGCN criteria that can be demonstrated by scientific evidence or expert consensus to have at least a moderate risk of extinction in the future" (FWC, 2012b).

[80] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013d).

The range of golden eagles does not include Florida; therefore, transient golden eagles are only observed occasionally during the summer months (eBird, 2015b).

A number of Important Bird Areas (IBAs) have been identified in Florida (NAS, 2011). The IBA program is an international bird conservation initiative with a goal to conserve birds and bird habitat. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat[81] for native bird populations.

Florida's IBA Program was launched in 1999 and now includes 100 IBAs that encompass over 10 million acres in Florida (Figure 5.1.6-2). These areas include migration stopover sites, areas important to overwintering birds, and areas important to breeding birds. In Florida, the primary goal of the IBA Program is supporting the preservation of native birds; sites selected as Florida IBAs are documented to support a high diversity of native species or significant populations of at least one native species. IBAs are found throughout the state and include long stretches of Atlantic and Gulf of Mexico coastlines and the Everglades National Park, which is the largest IBA in the state. There are also several sites supporting Florida's only endemic bird, the Florida scrub-jay (*Aphelocoma coerulescens*) (Pranty, 2002).

A number of threatened and endangered birds are located in Florida. Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Reptiles and Amphibians

There are at least 143 native amphibians and reptiles in Florida and an additional 56 species of non-native herpetofauna that are established in the state (Krysko, Enge, & Moler, 2011). The taxonomic reptile and amphibian orders represented in Florida include newts and salamanders, frogs and toads, turtles and tortoises, alligators and crocodiles, lizards, and snakes. A number of the reptiles and amphibians native to Florida are also endemic to the state, including species of sirens[82], frogs, turtles, and snakes. Fifty-six species of reptiles and twenty-one species of amphibians are identified as SGCN (FWC, 2012b). While some species are found throughout the state (e.g., southern leopard frog *[Lithobates sphenocephalus]*), there are also highly localized species that occur only in specific environments or areas of the state (e.g., alligator snapping turtle *[Macrochelys temminckii]*), which is found only in the panhandle (FWC, 2016b) and the rim rock crowned snake which is found only in south Florida and the Keys (FFWCC, 2013).

The American alligator *(Alligator mississippiensis)*, the official state reptile, is found throughout the state and is the only large native game reptile in Florida. There are also occasional state-regulated hunting events of nonnative, invasive reptile species such as the Burmese python

[81] Critical habitat: "A designated area that is essential to the conservation of an endangered or threatened species that may require special management considerations or protection" (USEPA, 2015n).
[82] Sierns: A type of amphibian with "long eel-like bodies and external gils" (Smithsonian Institute, 2016b).

(Python bivittatus) (FWC, 2015c). In addition, various nongame reptile and amphibian species are legally harvested in Florida, including several species of frogs (e.g., Gopher frogs (*Rana capito*)) and turtles (FWC, 2015e). The Cuban tree frog (*Osteopilus septentrionalis*) is an invasive species known to frequently prey on native species and compete with native species for food and habitat (FWC, 2015e) (FWC, 2015f).

Florida is also home to the endangered American crocodile *(Crocodylus acutus)*, similar in appearance to the American alligator. In Florida, crocodiles are found only in extreme south Florida, often in and around mangrove forests (USFWS, 1999au). Crocodiles and other threatened and endangered herpetofauna are discussed in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invertebrates

There are over 15,000 invertebrate species that have been officially described in Florida, including 410 known endemic species (both terrestrial and aquatic) and a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes. The actual number of invertebrate species present in the state may be greater than 15,000 by an order of magnitude (FWC, 2012b).

Although more research is needed on invertebrate species in Florida, many of these organisms are known to perform critical ecosystem and agricultural functions. In the U.S., one third of all agricultural output depends on pollinators.[83] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity. "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009). In Florida, there are 22 SGCN bee species and a total of 668 SGCN invertebrates (FWC, 2012b). Nearly 40 percent of the invertebrate SGCN are either declining or their population trend is unknown (FWC, 2012b).

Florida is also home to several species of semi-terrestrial land crabs, including the giant land crab *(Cardisoma guanhumi)*, which is the largest land crab found in Florida. These crabs lay eggs in the ocean and live out their adult life in terrestrial environments. They may be found up to five miles inland (Hostetler, Mazzotti, & Taylor, 2013).

Invasive Wildlife Species

Florida has more nonnative wildlife species than any other state, with over 400 species of terrestrial and aquatic organisms observed and 123 species currently established[84] in the state. These established nonnative species include 18 mammals, 12 birds, 36 reptiles, and 4 amphibians (Hardin, 2007). Florida has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select wildlife species. According to

[83] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2015n).
[84] Established: "Unlikely to be extirpated without human intervention" (Hardin, 2007).

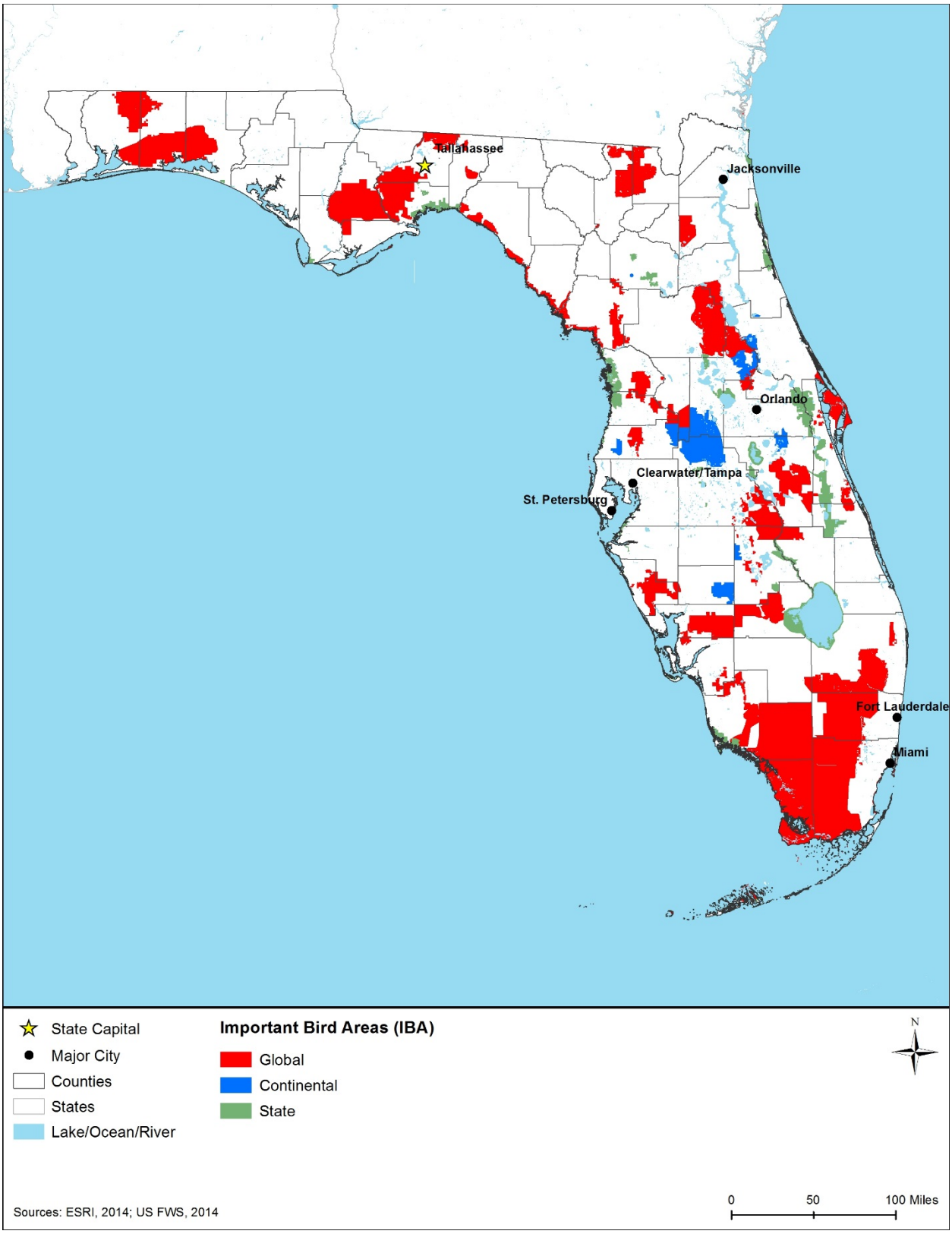


Figure 5.1.6-2: Important Bird Areas in Florida

the FAC Chapter 68-5, "No person shall transport into the state, introduce, or possess, for any purpose that might reasonably be expected to result in liberation into the state, any freshwater fish, aquatic invertebrate, marine plant, marine animal, or wild animal life not native to the state, without having secured a permit from the Commission"[85, 86] (State of Florida, 2010). The FWC maintains a list of conditional[87] and prohibited[88] species, as included in FAC Chapter 68-5 which are specifically regulated. These lists include a total of nine reptile species (i.e., seven snakes, one turtle, and one lizard) and two mammal species (i.e., nutria and African giant pouched rats *[Cricetomys gambianus]*) (State of Florida, 2010). Invasive wildlife species are important to consider when proposing a project since project activities may result in conditions that favor the growth and spread of invasive wildlife populations. These situations may result from directly altering the landscape or habitat to a condition that is more favorable for an invasive species, or by altering the landscape or habitat to a condition that is less favorable for a native species. (USFWS, 2012d)

5.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in Florida, including freshwater mammals, fish, and aquatic invertebrates. A summary of non-native and/or invasive aquatic species is also presented in this discussion. A distinctive feature of the Florida landscape with regard to aquatic wildlife is the salinity and temperature variations of available habitats. These diverse aquatic habitats include freshwater springs that maintain a year-round temperature of approximately 72 degrees Fahrenheit (°F), numerous inland rivers, lakes, and wetlands, brackish estuaries, mangroves, coral reefs, and warm ocean waters of south Florida.

Fish

Fishing is an important industry in Florida, with an annual economic impact of over $9 billion (FWC, 2015g). There are over 1,177 native fish species in Florida's waters (over 1,000 marine species and 177 freshwater species), including 78 SGCN species (FWC, 2012b).

Florida's regulated freshwater game fish are: black bass *(Micropterus salmoides)* (which include largemouth and smallmouth bass), crappie *(Pomoxis* spp.*)*, bluegill *(Lepomis macrochirus)*, redear sunfish *(Lepomis microlophus)*, warmouth *(Lepomis gulosus)*, redbreast sunfish *(Lepomis auritus)*, spotted sunfish *(Lepomis punctatus)*, flier *(Centrarchus macropterus)*, mud sunfish (*Acantharchus pomotis*), longear sunfish (*Lepomis megalotis*), shadow bass (*Ambloplites ariommus*), peacock bass *(Cichla* spp.*)*, white bass *(Morone chrysops)*, striped bass *(Morone*

[85] Commission: Florida Fish and Wildlife Conservation Commission.

[86] The following species are exempt: fathead minnow, variable platy, coturnix quail, ring-necked pheasant (FWC, Rules relating to non-native species (FAC 68-5), 2008).

[87] Conditional species "(formerly referred to as restricted species) may be imported and possessed for research purposes, commercial use, or public exhibition. They may not be acquired or kept as personal pets, with the exception of red-eared sliders" (FWC, 2015f).

[88] Prohibited Species "may be imported and possessed for research, following approval of the research plan that must include detailed security measures to prevent escape, and for public exhibition by applicants that meet strict biosecurity measures. They may not be acquired or kept as pets" (FWC, 2015f).

saxatilis), and sunshine bass *(Morone saxatilis* x *M. chrysops)* (FWC, 2015f). Many of these freshwater game species are found throughout the southeastern states.

Nongame fish include all species not designated as game fish (FWC, 2015f). This includes the four species of freshwater fish that are endemic to Florida: Okaloosa darter *(Etheostoma okaloosae),* Seminole killifish *(Fundulus seminolis),* flagfish *(Jordanella floridae),* and blackmouth shiner *(Notropis melanostomus)* (LandScope America, 2015).

Regulated saltwater gamefish taxa with size and/or bag limits include (FWC, 2015h):[89]

- Reef fish: snappers, groupers, other reef fish including greater and lesser amberjack (*Seriola dumerili* and *Seriola fasciata*), banded rudderfish (*Seriola zonata*), black sea bass (*Centropristis striata*), triggerfish, red porgy (*Pagrus pagrus*), golden tilefish (*Lopholatilus chamaeleonticeps*), lionfish (*Pterois* spp.), and hogfish (*Lachnolaimus maximus*);
- Pelagic fish: billfish (including sailfish and marlin [*Istiophorus* spp.]), swordfish (*Xiphias gladius*), king and Spanish mackerel (*Scomberomorus cavalla* and *Scomberomorus maculatus*), wahoo (*Acanthocybium solandri*), cobia (*Rachycentron canadum*), tripletail (*Lobotes surinamensis*), and dolphinfish (*Coryphaena hippurus*);
- Coastal fish: bluefish (*Pomatomus saltatrix*), blue runner (*Caranx crysos*), bonefish (*Albula vulpes*), African pompano (*Alectis ciliaris*), sheepshead (*Archosargus probatocephalus*), weakfish (*Cynoscion regalis*), snook (*Centropomus undecimalis*), spotted seatrout (*Cynoscion nebulosus*), permit (*Trachinotus falcatus*), tarpon (Megalops spp.), black drum (*Pogonias cromis*), flounder (*Paralichthys*), black and silver mullet (*Mugil cephalus* and *Mugil curema*), Florida pompano (*Trachinotus carolinus*), and red drum (*Sciaenops ocellatus*); and
- Sharks: bull (*Carcharhinus leucas*), nurse (*Ginglymostoma cirratum*), common thresher (*Alopias vulpinus*), spinner (*Carcharhinus brevipinna*), Atlantic sharpnose (*Rhizoprionodon terraenovae*), bonnethead (*Sphyrna tiburo*), blacknose (*Carcharhinus acronotus*), finetooth (*Carcharhinus isodon*), blacktip (*Carcharhinus limbatus*), smooth dogfish (*Mustelus canis*).

Additionally, possession, landing, selling, or exchanging of the following saltwater species is prohibited (FWC, 2015h):

- Grouper: goliath grouper (Epinephelus itajara), Nassau grouper (Epinephelus striatus);
- Shark: Atlantic angel shark *(Squatina dumeril*), basking shark (*Cetorhinus maximus*), bigeye sand tiger shark (*Odontaspis noronhai*), bigeye sixgill shark (*Hexanchus nakamurai*), bigeye thresher shark (*Alopias superciliosus*), bignose shark (*Carcharhinus altimus*), Caribbean reef shark (*Carcharhinus perezii*), Caribbean sharpnose shark (*Rhizoprionodon porosus*), dusky shark (*Carcharhinus obscurus*), Galapagos shark (*Carcharhinus galapagensis*), lemon shark (*Negaprion brevirostris*), longfin mako shark (*Isurus paucus*), narrowtooth shark (*Carcharhinus brachyurus*), night shark (*Carcharhinus signatus*), silky shark (*Carcharhinus falciformis*), sand tiger shark (*Carcharias taurus*), sandbar shark (*Carcharhinus plumbeus*),

[89] Possession of marine species without harvest limits is restricted to 100 pounds or two fish (whichever is greater). Otherwise, a commercial license is required. (FWC, 2015f)

sevengill shark (*Notorynchus cepedianus*), sixgill shark (*Hexanchus griseus*), smalltail shark (*Carcharhinus porosus*), spiny dogfish (*Squalus acanthias*), whale shark (*Rhincodon typus*), white shark (*Carcharodon carcharias*), tiger shark *(Galeocerdo cuvier*), great hammerhead shark (*Sphyrna mokarran*), scalloped and smooth hammerhead shark (*Sphyrna lewini* and *Sphyrna zygaena*);

- Rays: manta ray (*Manta birostris*), devil ray (*Manta birostris*), spotted eagle ray (*Aetobatus narinari*); and
- Other fish: sawfish, longbill spearfish *(Tetrapturus pfluegeri),* Mediterranean spearfish *(Tetrapturus belone),* sturgeon, puffer fish (select counties).

Florida is also home to a number fish species that move between fresh and saltwaters during their lifecycle, such as the striped bass *(Morone saxatilis),* which are catadromous[90], and the American eel *(Anguilla rostrate),* which are anadromous.[91] In addition, some marine species are known to make excursions into freshwater environments, including bull sharks (*Carcharhinus leucas*), Atlantic stingrays (*Dasyatis sabina*), and snook (*Centropomus undecimalis*). (USFWS, 1996) (SAFMC, 1998)

A number of threatened and endangered marine and freshwater fish species are located in Florida. Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Shellfish and Other Invertebrates

Florida is home to over 60 species of freshwater mussels and clams, including mussel species that are found only in rivers in the northern portion of the state (as well as in other southeastern U.S. locations) (FWC, 2015i). The caves and springs found in the limestone regions in north and central Florida also support many rare aquatic invertebrates (FWC, 2012b), including species found only in specific caves (Walsh S. , 2001). Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known Florida freshwater invertebrates include a variety of crayfish, shrimp, and amphipods.

The estuarine and saltwater environments of coastal Florida are also home to a variety of aquatic invertebrate species, including crustaceans, mollusks, marine worms, sea urchins, and a multitude of soft and hard coral species. Some of the more notable estuarine and saltwater invertebrates include blue crab (*Callinectes sapidus*), spiny lobster (*Panulirus interruptus*), calico scallop (*Argopecten gibbus*), eastern oyster (*Crassostrea virginica*), Florida and Gulf stone crabs (*Menippe mercenaria* and *Menippe adina*), hard clams (*Mercenaria mercenary*), rock shrimp (*Sicyonia brevirostris*), and penaeid shrimp. Recreational and commercial harvest of these species is regulated by the FWC (FWC, 2015h). Additionally, possession, landing, selling, or exchanging of the following species is prohibited: queen conch (*Lobatus gigas*), calico scallop (*Argopecten gibbus*), stony, hard, and fire corals, sea fans, Bahama starfish (*Oreaster reticulatus*), and longspine urchin (*Diadema setosum*) (FWC, 2015j).

[90] Catadromous: migrate from freshwater environments to spawn in marine environments (USFWS, 1996c).
[91] Anadromous: migrate from marine environments to spawn in freshwater environments (USFWS, 1996c).

Marine Mammals

Florida's near coastal waters, estuaries, and freshwater environments are home to two exclusively aquatic mammals including dolphins and manatees (*Trichechus manatus*). While there are several species of dolphins that occur in Florida's coastal waters, the bottlenose dolphin (*Tursiops* spp.) is the most common and can be observed in Florida's estuaries and coastal ocean waters (FWC, 2015k). Manatees live in Florida's rivers and coastal waters, easily moving from fresh to estuarine to marine environments (FWC, 2015l). Manatee critical habitat has been designated in rivers, estuaries, and bays of peninsular Florida (USFWS, 2016b).

In addition, there are several species of whales that can be observed off the coast of Florida, including finback whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaeangliae*), and North Atlantic right whales (*Eubalaena glacialis*). The waters of coastal Georgia and Florida are the only known calving grounds for the North Atlantic right whale and these areas have been designated as right whale critical habitat by the National Marine Fisheries Service (NMFS) (FWC, 2015m). "Florida does not have seal colonies, but stray [deceased] seals have been known to wash ashore in Florida occasionally" (World Heritage Encyclopedia, 2016).

Florida's threatened and endangered aquatic mammals are discussed further in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Sea Turtles

There are seven species of sea turtles in the world and five of these air-breathing aquatic reptile species are found in coastal Florida waters and nest on the sandy beaches of Florida's Gulf and Atlantic coasts: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), and hawksbill sea turtle (*Eretmochelys imbricata*) (FWC, 2015n). Kemp's Ridley sea turtles did not historically nest on Florida beaches; however, nests or nest attempts have been observed in eight Florida counties. The remaining turtle species nest from spring into late summer or fall, with hatchlings emerging from late spring into fall (USFWS, 2016c).

Sea turtles are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and NMFS. The loggerhead turtle is a state and federally threatened species; the four other species listed above are federally endangered species (Fletcher, 2012). Florida's sea turtle species are discussed further in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Aquatic Species

As previously discussed, Florida has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals. The FWC maintains a list of conditional and prohibited species, as included in which are specifically regulated. The list of conditional aquatic species includes 17 freshwater fish species or taxa and two crustaceans. The list of prohibited species includes 13 freshwater fish species/taxa, seven marine fish species/taxa, two mussel species, one marine crab, and all sea

snakes from the *Hydrophiidae* family. The invasive lionfish, which is found in marine waters, is also regulated under F.A.C. Chapter 68-5 (State of Florida, 2010).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act identifies and protects those fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. NOAA provides an online mapping application and website to provide the public a means to obtain illustrative representations of EFH (NOAA, 2015d) (NOAA, 2015e). This tool is used to identify the existing conditions for a project location to identify sensitive resources.[92] Florida Appendix B, Biological Resources, presents a summary of EFH for Mid-Atlantic, South Atlantic, and Gulf of Mexico species of the Florida coast.

Under the Magnuson-Stevens Act, the National Marine Fisheries Service also considers a second, more limited habitat designation for each species in addition to EFH. Habitat Areas of Particular Concern (HAPC) are described as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. In general, HAPCs include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish. HAPCs are not afforded any additional regulatory protection under the Magnuson-Stevens Act; however, federal actions with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process and will be subject to more stringent EFH conservation recommendations (NOAA, 2010). Table 5.1.6-3 presents a summary of HAPC along or near the Florida coast.

Table 5.1.6-3: Habitat Areas of Particular Concern for Florida

Species	Description of EFH – HAPC
Tilefish – Atlantic	Generally offshore, but some nearshore habitat near Miami, Florida.
Coastal Migratory Pelagic – Atlantic	The Point off Jupiter Inlet (Florida); *Phragmatopoma* (worm reefs) reefs off the central east coast of Florida; nearshore hard bottom south of Cape Canaveral; The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; The "Wall" off of the Florida Keys; Pelagic *Sargassum*; and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the ELMR Program.
Coral, Coral Reef and live/ hardbottom habitat – Atlantic	The *Phragmatopoma* (worm reefs) reefs off the central east coast of Florida; nearshore (0-4 meters; 0-12 feet) hard bottom off the east coast of Florida from Cape Canaveral to Broward County); offshore (5-30 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary. Oculina Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral.
Dolphin/Wahoo – Atlantic	Offshore (The Point off Jupiter Inlet (Florida); The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; and The "Wall" off of the Florida Keys).

[92] NOAA's Essential Fish Habitat Mapper v 3.0 was used to identify "EFH areas of particular concern" and "EFH areas protected from fishing." As of July 2016, the procedure to use this interactive tool is as follows: 1) Visit http://www.habitat.noaa.gov/protection/efh/habitatmapper.html. 2) Select "EFH Mapper" under Useful Links. 3) After closing the opening tutorial, select the "Region" of interest from the drop-down menu. 4) Select the species under "Essential Fish Habitat" to view the areas in the selected region protected for the various life states (i.e., eggs, larvae, juvenile, adult, or all).

Species	Description of EFH – HAPC
Snapper/Grouper – Atlantic	Medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard bottom areas; mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper grouper; pelagic and benthic *Sargassum*; all hermatypic coral habitats and reefs; and Council-designated Artificial Reef Special Management Zones (SMZs).
Shrimp – Atlantic	All coastal inlets, all state-designated nursery habitats of particular importance to shrimp, and state-identified overwintering areas
Red Drum – Atlantic	All coastal inlets, all state-designated nursery habitats of particular importance to red drum; documented sites of spawning aggregations in North Carolina, South Carolina, Georgia, and Florida; other spawning areas identified in the future; and habitats identified for submerged aquatic vegetation.
Spiny Lobster – Atlantic	Florida Bay, Biscayne Bay, Card Sound, and coral/hard bottom habitat from Jupiter Inlet, Florida through the Dry Tortugas, Florida.
Oculina Banks	Offshore from the eastern coast of Florida from Cape Canaveral south to Fort Peirce.
Additional Specific HAPCs in the Gulf of Mexico	Offshore areas that include Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, and Pulley Ridge.

Source: (NOAA, 2015e)

5.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C. §1531 et seq.) in Florida. The USFWS has identified 88 federally endangered and 37 federally threatened species known to occur in Florida (USFWS, 2015v). Of these federally listed species, 38 have designated critical habitat[93] (USFWS, 2015h). Seven candidate[94] species are identified by USFWS as occurring within the state (USFWS, 2015v). Candidate species are not afforded statutory protection under the ESA; however, the USFWS recommends taking these species into consideration during environmental planning because they could be listed in the future (USFWS, 2014h). The 124 federally listed species include 16 mammals, 12 birds, 9 reptiles, 3 fishes, 2 amphibians, 22 invertebrates, and 60 plants (USFWS, 2015v), and are discussed in detail under the following sections.

Federal land management agencies maintain lists of species of concern for their landholdings; these lists are not discussed below as they are maintainted independently from the ESA. For future site-specific analysis on those lands, consultation with the appropriate land management agency could be required.

[93] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species" (16 U.S.C. §1532(5)(A)) (USFWS, 2015c).

[94] Candidate species are plants and animals that the USFWS has "sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities" (USFWS, 2014h).

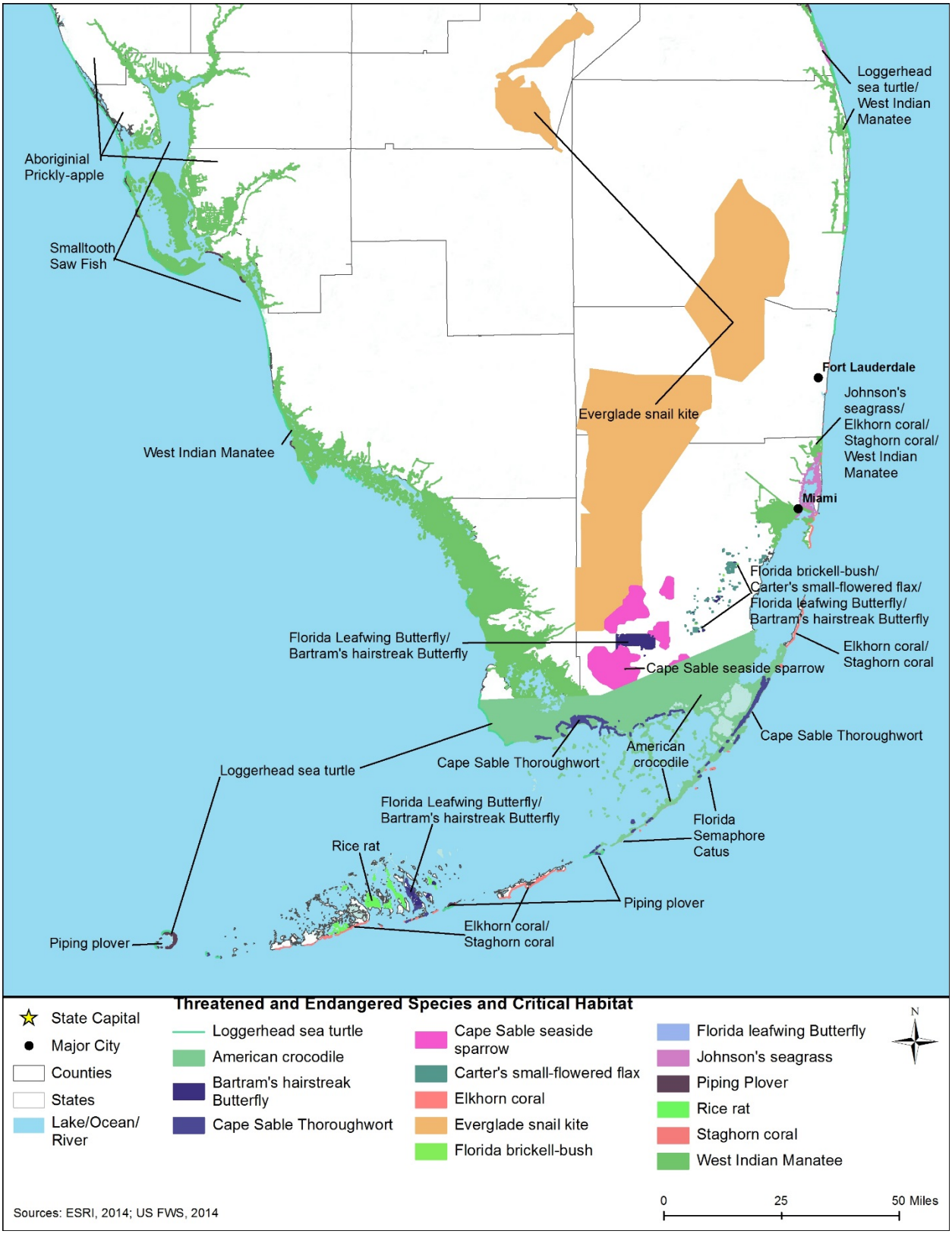


Figure 5.1.6-3: Critical Habitat in South Florida

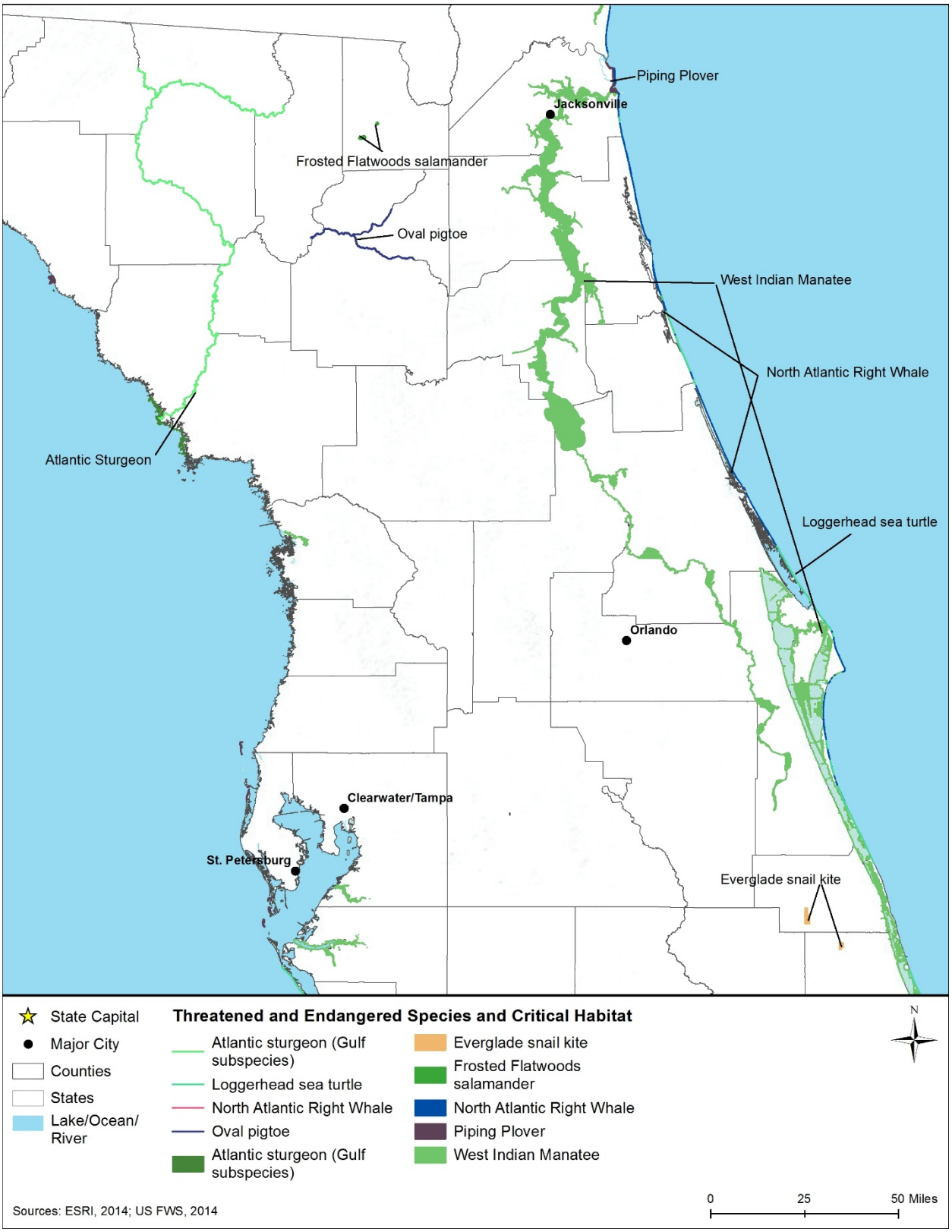


Figure 5.1.6-4: Critical Habitat in Central Florida

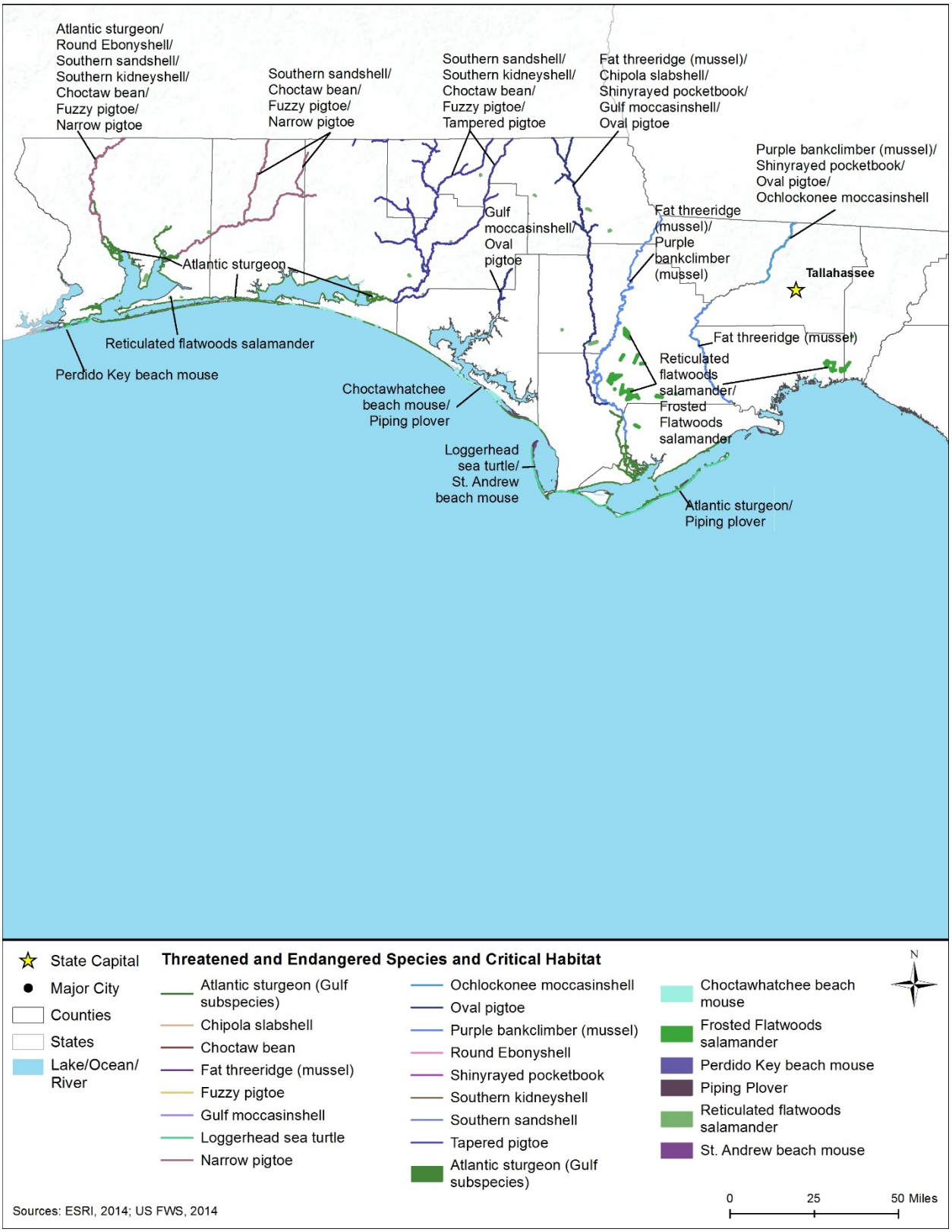


Figure 5.1.6-5: Critical Habitat in the Florida Panhandle

Mammals

There are 15 endangered and 1 threatened mammal species that are federally listed and known to occur in the state of Florida as summarized in Table 5.1.6-4. The Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) is found only in one known coastal marsh site in Waccasassa Bay, near Cedar Key, Levy County. The beach mouse species: the Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*), Anastasia Island beach Mouse (*Peromyscus polionotus phasma*), Choctawhatchee beach Mouse (*Peromyscus polionotus allophrys*), Perdido Key beach Mouse (*Peromyscus polionotus trissyllepsis*), Southeastern beach Mouse (*Peromyscus polionotus niveiventris*), and St. Andrew beach Mouse (*Peromyscus polionotus peninsularis*) and rats: Key Largo woodrat (*Neotoma floridana smalli*) and silver rice rat (*Oryzomys palustris natator*) are distributed throughout Florida and the Keys in coastal areas containing necessary sand dune habitat. The gray bat (*Myotis grisescens*) is found in four northern counties of Florida, with other populations occurring in the panhandle region, while the Florida bonneted bat (*Eumops floridanus*) can be found in six counties in south Florida. The Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*) is found in the grassy marshes and prairies of the Lower Florida Keys, and the Key deer (*Odocoileus virginianus clavium*) can be found in Monroe County, including throughout 26 islands in the Florida Keys (USFWS, 1999au). The Florida panther (*Puma concolor coryi*) is found in 16 counties in south Florida, particularly forested cover areas. The Red wolf (*Canis rufus*) exists mostly in captivity, but its large historic range includes Florida. The West Indian manatee (*Trichechus manatus*) is known as the Florida manatee in the U.S., and can be commonly found during the summer anywhere in Florida in appropriate water depths (USFWS, 2016b). Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below (USFWS, 2015v).

Table 5.1.6-4: Federally Listed Mammal Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Anastasia Island Beach Mouse	*Peromyscus polionotus phasma*	E	No	Sand dunes covered with grasses and sea oats only on Anastasia Island, Florida and the beaches immediately adjacent to the north of Anastasia Island.
Choctawhatchee Beach Mouse	*Peromyscus polionotus allophrys*	E	Yes; Henderson Beach, Topsail Hill, Grayton Beach, Deer Lake, and West Crooked Island/Shell Island.	Sand dunes covered with grasses and sea oats found only in Florida from Choctawhatchee Bay in Okaloosa County to St. Andrew Bay in Bay County.
Florida Bonneted Bat	*Eumops floridanus*	E	No	Forests, wetlands, open water, residential and urban areas in 6 counties in south Florida.
Florida Panther	*Puma concolor coryi*	E	No	Forested cover areas, particularly cypress swamp, pinelands, hardwood swamp, and hardwood forests; found in 16 counties in south Florida.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Florida Salt Marsh Vole	*Microtus pennsylvanicus dukecampbelli*	E	No	Only found in 1 known coastal marsh site in Waccasassa Bay, near Cedar Key, Levy county, Florida.
Gray Bat	*Myotis grisescens*	E	No	Found in caves in limestone karst regions and near rivers in 4 counties in the northern region of Florida, with noted additional populations in the panhandle.
Key Deer	*Odocoileus virginianus clavium*	E	No	Pine flatwoods, pine rocklands, hardwood hammocks, buttonwood wetlands, mangrove wetlands, and freshwater wetlands in the Florida Keys. Also known to occur in the Great White Heron National Wildlife Rufuge and National Key Deer Refuge.
Key Largo Cotton Mouse	*Peromyscus gossypinus allapaticola*	E	No	Forested communities located on the northern portion of Key Largo.
Key Largo Woodrat	*Neotoma floridana smalli*	E	No	Tropical hardwood hammocks found on Key Largo, Monroe County, Florida Keys.
Lower Keys Marsh Rabbit	*Sylvilagus palustris hefneri*	E	No	Found in the grassy marshes and prairies of the Lower Florida Keys.
Perdido Key Beach Mouse	*Peromyscus polionotus trissyllepsis*	E	Yes; Gulf State Park, West Perdido Key, Perdido Key State Park, Gulf Beach, and Gulf Islands National Seashore.	Coastal dunes and high areas above the dunes along Perdido Key in Escambia County, Florida.
Red Wolf	*Canis rufus*	E	No	Historicaly occurred in the Southeast region of the U.S. in Florida, North Carolina, and South Carolina; experimental populations only exist in North Carolina and a breeding pair was reintroduced to St. Vincent Islandk, Florida (FWC, 2016a).
Silver Rice Rat	*Oryzomys palustris natator*	E	Yes; Monroe County, FL on Little Pine Key, Water Keys (north of Big Torch key, not the Water Key west of Big Pine Key), Big Torch Key, Middle Torch Key, Summerland Key, Cudjoe Key, Johnston Key, Raccoon Key, and Saddlebunch	Low intertidal areas, salt marsh flooded by spring or storm tides, and buttonwood transitional areas that are slightly more elevated and only flooded by storm tides; found in the lower Florida Keys.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
			Keys. Their critical habitat includes all lands and waters above mean low tide.	
Southeastern Beach Mouse	*Peromyscus polionotus niveiventris*	T	No	Sand dunes covered with grasses and sea oats located in Volusia, Brevard, Indian River, St. Lucie, and Martin Counties in Florida.
St. Andrew Beach Mouse	*Peromyscus polionotus peninsularis*	E	Yes; East Crooked Island, Palm Point, and St. Joseph Peninsula.	Sand dunes covered with grass and sea oats from St Andrews' Bay, Bay County, FL to St. Joseph Peninsula, Gulf County, FL.
West Indian Manatee	*Trichechus manatus*	E	Yes; several of the U.S. territorial waters adjoining the coast including coastal lagoons, canals, waterways, and rivers located within Brevard, Charlotte, Citrus, Collier, Miami-Dade, De Soto, Duvall, Hillsborough; Lee, Manatee, Martin, Monroe,Nassau, Palm Beach, Sarasota, St, Mary's, Volusia, Counties in Florida.	Coastal waters, estuaries, and warm water outfalls

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015v).

Anastasia Island Beach Mouse. The Anastasia Island beach mouse can reach a length of 5.5 inches. It is a subspecies of the small old-field mouse (*Peromyscus polionotus*). The beach mouse has a yellowish-brown to gray-pink color along its back, a white belly, white tail, white nose as well as white spots over both eyes (FWC, 2015o). The Anastasia Island beach mouse was federally listed as endangered in 1989 (54 FR 20598 20602, May 12, 1989) (USFWS, 2015c).

The Anastasia Island beach mouse inhabits sand dunes only on Anastasia Island and the beaches immediately adjacent to the north of Anastasia Island. The Anastasia Island beach mouse inhabits sand dunes that are covered with grasses and sea oats, species typical lives in small burrows and eats insects or seeds or fruit of dune vegetation. Alternative areas where the beach mouse may be observed include areas supporting sand live oaks and the former burrows of ghost

crabs. Their use of areas covered with sand live oaks is especially likely to occur during and following hurricanes (USFWS, 1993b).

Development along Florida's coastline is the main threat facing the Anastasia Island beach mouse. Habitat degradation from traffic on sand dunes and feral cats are also threats to the beach mouse. Prescribed conservation measures include the construction of boardwalks over dunes, banning the practice of driving vehicles on the dunes, and the removal feral cats (USFWS, 1993b).

Choctawhatchee Beach Mouse. "The Choctawhatchee beach mouse has a small body, haired tail, and relatively large ears" (USFWS, 2016e). Body length is approximately 3 to 3.5 inches and the tail is, on average, 2 inches long. "The upper parts are colored orange-brown to yellow-brown, the underparts are white, and the tail has a stripe on the top side" (USFWS, 2016e). The Choctawhatchee Beach mouse feeds at night. Their diet consist of seeds from sea oats and bunch-grass which grow on the sand dunes. The Choctawhatchee beach mouse was federally listed as endangered in 1985 (50 FR 23872 23889, June 06, 1985) (USFWS, 2016e).

The Choctawhatchee beach mouse lives on sand dunes covered with grasses and sea oats found only in Florida from Choctawhatchee Bay in Okaloosa County to St. Andrew Bay in Bay County (FWC, 2015p). Alternative areas where the beach mouse may be observed include areas supporting sand live oak (*Quercus geminata*) trees (FNAI, 2001b). The main threat facing the Choctawhatchee beach mouse is development along beaches. Additional threats include hurricanes, feral and free-ranging cats, foxes, raccoons, and coyotes (USFWS, 2007b). Recommended protections for the Choctawhatchee beach mouse include removal of feral cats and preservation of sand dunes (FNAI, 2001b).

Florida Bonneted Bat. "The Florida bonneted bat is the largest bat in Florida" (USFWS, 2015ds), reaching a length of approximately "6.5 inches with a wingspan of 20 inches" (USFWS, 2015ds). It is dark gray to brownish-gray in color, and its tail extends beyond a short tail membrane. It gets the name "bonneted bat" from its large ears, which stick out over the eyes (USFWS, 2015ds). The Florida bonneted bat was federally listed as endangered in 2013 (78 FR 61003 61043, October 2, 2013). This species does not migrate and is found in six counties in south Florida (USFWS, 2015ar). The Florida bonneted bat uses forests, wetlands, open water, and other natural habitats, and has also been seen in residential and urban areas. No active, natural roost sites are known; all known roosts are artificial structures such as bat houses (USFWS, 2015ds).

Major threats to the Florida bonneted bat are "habitat loss, degradation, and modification from human population growth and the associated development and agriculture" (USFWS, 2015ds). "Effects resulting from climate change, such as sea level rise" (USFWS, 2015ds), are expected to pose as a greater threat in the future, resulting in additional habitat losses, including the loss of roost sites and foraging habitat. The Florida bonneted bat is also vulnerable due to its small population size, restricted range, few colonies, slow reproduction, low fertility, and isolation (USFWS, 2015ds).

Florida Panther. The Florida panther is a large cat with a long tail. It has "pale brown or rusty upper parts, dully white or buffy under parts" (USFWS, 2015aw), with dark brown or blackish backs of ears, sides of ears, and tail tip. Mature male panthers weigh up to approximately 154 pounds and measure up to 7 feet from nose to tip of tail. Females are smaller, weighing up to approximately 108 pounds and measure about 6 feet. The Florida panther was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967). This species is known to occur in 16 counties in south Florida (USFWS, 2015aw). There are regular sightings of panthers throughout the Southeast of the U.S., but no reproducing populations have been found outside of south Florida.

Florida panthers are "wide-ranging, secretive, and occur at low densities" (USFWS, 2008e), needing large areas to meet their social, reproductive, and energetic needs. "Dense understory vegetation provides some of the most important feeding, resting, and denning cover for panthers" (USFWS, 2008e). The most popular habitat types for panthers are forested cover areas, particularly cypress swamp, pinelands, hardwood swamp, and hardwood forests. Their main prey is white-tailed deer and feral hog (*Sus scrofa*). They also eat raccoons, nine-banded armadillos (*Dasypus Novemcinctus*), marsh rabbits (*Sylvilagus palustris*), and alligators. (USFWS, 2008e)

Spotlight: Florida Panther on the Brink of Extinction

With approximately 20 Florida panthers living in southern Florida in the early 1970s, the USFWS has been working to recover the species population and protect its habitat. In 1995, eight female Texas pumas (*Puma concolor*) were released in south Florida as part of a genetic management program to increase the population and genetic health of the Florida panther. Since that time, the Florida panther has grown to approximately 200 panthers in 2014. The current recovery goal is to reach three populations of 240 individuals each and establish enough habitat for the species to achieve recovery. (USFWS, 2016h)

The survival of Florida panthers is limited by "habitat availability, prey availability, and lack of human tolerance" (USFWS, 2008e). The greatest threats to panther survival are habitat loss, degradation, and fragmentation, with lack of human tolerance threatening panther recovery. Potential habitat is affected by urbanization, residential development, road construction, conversion to agriculture, mining and mineral exploration, and lack of land use planning that recognizes the needs of this species. Additionally, diseases such as feline immunodeficiency virus, have caused the death of numerous Florida panthers. (USFWS, 2008e)

Florida Salt Marsh Vole. The Florida salt marsh vole is a small rodent with a blunt head and a short tail and ears, measuring up to approximately 8 inches in length. It has black-brown fur on its back and upper parts, with dark grey fur on its belly. It is closely related to the meadow vole (*Microtus pennsylvanicus*), but is distinguishable by its larger size, darker fur coloring, smaller ears, and by some characteristics of the skull. The Florida salt marsh vole was federally listed as endangered in 1991 (56 FR 1457 1459, January 14, 1991). This species is believed to occur only in the Levy county of Florida (USFWS, 2015ay).

The Florida salt marsh vole lives in one known coastal marsh site in Waccasassa Bay, near Cedar Key, Levy County, Florida. The vegetation in this salt marsh is mostly salt grass, with some smooth cordgrass and glasswort. They eat a variety of plant matter, including bark, grass, roots, and seeds. The lifespan of voles is short; few voles live longer than 6 months (USFWS, 1997a). This species appears to have declined because of changes in climate and a subsequent sea level rise (USFWS, 2015ay). Current threats to this species are its extremely limited range with only one population, and the threat of losing this population due to a storm event or fluctuations in the population (USFWS, 1997a).

Gray Bat. The endangered gray bat is relatively large in size, insectivorous[95] bat weighing approximately 0.25 to 0.56 grams and is longer than any other species in the genus *myotis*. The gray bats have dark gray fur after molt in July or August and then the fur transitions to a chestnut brown. This species was federally listed as endangered in 1976 (41 FR 17736 17740, April 28, 1976). Regionally, this species is known to occur in limited geographic regions of limestone karst within southeastern states from Kansas and Oklahoma east to Virginia and North Carolina (USFWS, 1997b) (USFWS, 2015bm). In Florida, the gray bat is known to occur in four counties in the northern region of the state (USFWS, 2015bm).

The gray bats live in caves all year. They hibernate in deep vertical caves in the winter and roost in caves scattered along rivers the rest of the year. Most caves are in limestone karst regions and near rivers where these bats feed on flying aquatic and terrestrial insects. Current threats to this species include human disturbance, habitat loss and degradation due to flooding, and commercialization of caves such as adding gates that alter the air flow, humidity, and temperature of caves (USFWS, 1982a).

Key Deer. The Key deer is the smallest subspecies of North American deer. Adult deer measure up to 30 inches at the shoulder. Males weigh up to 75 pounds and females weigh up to 65 pounds. It can be distinguished from other species of white-tailed deer by its stockier body, shorter legs, and wider skull. "The coat varies from a deep reddish brown to a grizzled gray color" (USFWS, 2015bt). Bucks usually get antlers by their second year, and eight pointed antlers by their fifth year. The Key deer primarily feeds on the red mangrove, but other plants form part of its diet. The Key deer was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967) (USFWS, 2015bt).

The Key deer is located only with Monroe County, FL in the Florida Keys. Their range is "approximately 26 islands from Big Pine Key to Sugarloaf Key" (USFWS, 1999au), which they access by swimming between keys. Habitat types include "pine flatwoods, pine rocklands, hardwood hammocks, buttonwood wetlands, mangrove wetlands, and freshwater wetlands" (USFWS, 1999au). Pine rocklands are especially important because they provide critical freshwater sources. Threats to the Key deer include loss of habitat to residential and commercial construction, and high rates of human-related mortality and disturbances, such as roadkill and illegal feeding. The species is also highly vulnerable to events such as hurricanes and disease (USFWS, 1999au).

[95] Insectivorous: "An animal that feeds on insects" (USEPA, 2015n)

Key Largo Cotton Mouse. The Key Largo cotton mouse is the largest of all subspecies of cotton mouse found in peninsular Florida. Key Largo cotton mouse is found only on the island of Key Largo. The Key Largo cotton mouse can reach a body length of approximately 7 inches (FWC, 2015q). Key Largo cotton mice have a dark hazel back with reddish brown sides, a white belly, white feet, and a 3 inch tail that is brown on top and white on the bottom (USFWS, 1999a). The Key Largo cotton mouse was federally listed as endangered in 1983 (48 FR 43040 43043, September 21, 1983) (USFWS, 2015bu).

The Key Largo cotton mouse lives in forested communities located on the northern portion of Key Largo. "The Key Largo cotton mouse builds leaf-lined nests in logs, tree hollows, and rock crevices. The holes occupied by the Key Largo cotton mouse measure 2 to 4 inches in diameter, are covered by leaves or bark, and located at the bases of trees and near or in woodrat (*Neotoma floridana smalli*) nests" (USFWS, 1999a). The Key Largo cotton mouse communicates through "short musical barking sounds" (USFWS, 1999a). Key Largo cotton mice will eat a variety of plant and animal material. (USFWS, 1999a).

Threats to the Key Largo cotton mouse habitat come from residential and commercial development. Other threats include the "dumping of trash, possible competition with black rats (*Rattus rattus*), and predation by domesticated cats. Dumping of trash increases the size of black rat populations and rodent control agents used for black rats kill the Key Largo cotton mouse" (USFWS, 1999a).

Key Largo Woodrat. The Key Largo woodrat is a medium-sized rat ranging is size from approximately four to nine inches in length (excluding the tail) (USFWS, 1999ac). Its back and head are gray-brown, its belly, chest, and throat is white, and it has a hairy tail. This species feeds on the buds, leaves, and fruit of many plant species, and emerges at night. The Key Largo woodrat was federally listed as endangered in 1984 (49 FR 34504 34510, August 31, 1983) (USFWS, 2015bv).

The Key Largo woodrat is only found on the northern portion the island of Key Largo, Monroe County, in the Florida Keys. Its habitat is tropical hardwood hammocks on Key Largo, on which it depends for building stick nests and sufficient cover. "Stick nests are used for resting, feeding, and breeding, and ground cover provides travel and escape routes" (USFWS, 1999b). Urbanization, resulting in habitat loss and fragmentation, is the primary threat to the Key Largo woodrat, making the species "more vulnerable to genetic isolation, and natural catastrophes such as hurricanes or fire" (USFWS, 1999b). Other threats include "predation by feral cats, dumping of trash, and competition with black rats" (USFWS, 1999b).

Lower Keys Marsh Rabbit. The Lower Keys marsh rabbit is the subspecies of the marsh rabbit (*S. palustris*), a species found widely in the southeastern U.S. The Lower Keys marsh rabbit is distinguishable from the Upper Keys marsh rabbit subspecies, *Paludicola spp*, in skull proportions and shape and in its darker fur coloration. Its body is brownish in color, with greyish fur on the belly, and is about 16 inches in length. The Lower Keys marsh rabbit was federally listed as endangered in 1990 (55 FR 25588 25591, June 21, 1990) (USFWS, 2015cd).

The Lower Keys marsh rabbit is only found in the Lower Florida Keys. The species primarily occurs in the grassy marshes and prairies of the Lower Keys, where it depends "upon a transition zone of grasses and sedges for feeding, shelter, and nesting" (USFWS, 1999c). Threats to the Lower Keys marsh rabbit are "habitat alteration, contaminants, vehicular traffic, dumping, poaching, domestic animals, feral hogs (*Sus scrofa*), fire ants, and exotic vegetation" (USFWS, 1999c). The primary threat to this species is habitat loss, due to construction of residential housing, commercial facilities, utility lines, roads, or other infrastructure in the Lower Keys (USFWS, 1999c).

Perdido Key Beach Mouse. "The Perdido Key beach mouse is a subspecies of the small oldfield mouse" (*Peromyscus polionotus*) (FWC, 1987). The Perdido Key beach mouse's has a length of up to 5.5 inches, including a tail length of approximately 2 to 2.5 inches, and gray-colored fur on the back with white cheeks, tail, feet, and belly (FWC, 1987). The Perdido Key beach mouse was federally listed as endangered in 1985 (50 FR 23872 23889, June 6,1985) (USFWS, 2015cj).

"The Perdido Key beach mice inhabit the coastal dunes along Perdido Key in Escambia County, Florida and Baldwin County, Alabama." The mice eat "dune plant seeds and insects" (FWC, 1987). Alternative habitat for the Perdido Key beach mouse includes high areas behind the dunes, or scub dunes (USFWS, 2014f).

The main threat facing the Perdido Key beach mouse is from residential and commercial development along the beach. Additional threats to the beach mouse are from hurricanes, attacks from feral and free-ranging cats, foxes, raccoons, and coyotes (USFWS, 2014f). Conservation measures include the construction of boardwalks over dunes, banning the practice of driving vehicles on the dunes, and the removal feral cats (USFWS, 1987a).

Red Wolf. The red wolf is known for the reddish color of its fur most obvious "behind the ears and along the neck and legs" (USFWS, 2015co). Overall, the species is "mostly brown and buff colored with some black along their backs" (USFWS, 2015co). "The average adult red wolf weighs 45 to 80 pounds, stands about 26 inches at the shoulder, and is about 4 feet long from the tip of the nose to the end of the tail" (USFWS, 2015co). The red wolf was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967). (USFWS, 2015co)



Red wolf Photo credit: USFWS

"Presently, the only wild population is a reintroduced population in northeastern North Carolina; although, a breeding pair was reintroduced to St. Vincent Island, Florida also" (FWC, 2016a). This species requires large areas of habitat of at least 170,000 acres in size. "The red wolf was exterminated from most of its range by the early part of this century, … and there were no definitive descriptions of the species' appearance or life history. Because of this, we know very little of the animal under natural conditions" (USFWS, 1990). Most of the existing population lives in various captive facilities. The biggest threat to the survival of the red wolf is that the

species cannot survive in any association with coyotes, due to hybridization and interbreeding between the two species. This threat is a challenge to reintroduction efforts due to "the fact that at least 80 percent of the red wolf's historic range is now occupied by coyotes" (USFWS, 1990).

Silver Rice Rat. The silver rice rat, or rice rat, has a slender skull and coarse silver-gray fur along its back. Its tail is sparsely haired and the rat reaches up to 10 inches in total length. The silver rice rat was federally listed as endangered in 1991 (56 FR 19809 19814, April 30, 1991) (USFWS, 2015cq). Critical habitat for the silver rice rat is located in Monroe County, FL on Little Pine Key, Water Keys, Big Torch Key, Middle Torch Key, Summerland Key, Cudjoe Key, Johnston Key, Raccoon Key, and Lower Saddlebunch Keys. Their critical habitat includes all lands and waters above mean low tide. "Within these areas the major constituent elements that are known to require special management considerations or protection are mangrove swamps containing red (*Rhizophora mangle*), black (*Avicennia germinans*), and white (*Laguncularia racemosa*) mangroves, and buttonwood (*Conocarpus erectus*); salt marshes, swales, and adjacent transitional wetlands" (USFWS, 2000).

The silver rice rat lives on the 12 islands in the Lower Florida Keys within freshwater and saline wetlands. "Silver rice rats use low intertidal areas, salt marsh flooded by spring or storm tides, and buttonwood transitional areas that are slightly more elevated and only flooded by storm tides" (USFWS, 1999av). The threats to the silver rice rat are "residential and commercial activities, recent habitat loss, and the introduction or increase of non-native predators and competitors," such as domestic cats and black rats (USFWS, 1999av). "The main threat to the silver rice rat is habitat degradation and loss due to urbanization" (USFWS, 1999av).

Southeastern Beach Mouse. "The southeastern beach mouse is a subspecies of the small oldfield mouse" (*Peromyscus polionotus*) (USFWS, 1999d). The southeastern beach mouse's physical characteristics are as follows: total body length up to 5.5 inches with 2 inch long tail. The fur on the southeastern beach mouse is light brown and grayish on their backs and tails, while white on their belly and cheeks and underneath their tails (USFWS, 1999d). The southeastern beach mouse was federally listed as threatened in 1989 (54 FR 20598 20602, May 12,1989) (USFWS, 2015db).

The southeastern beach mouse lives on sand dunes covered with grasses and sea oats located in Volusia, Brevard, Indian River, St. Lucie, and Martin Counties in Florida. Following hurricanes, the southeastern beach mouse may be observed in coastal palmetto flats and scrub oak communities. The southeastern beach mouse constructs burrows or uses old crab holes located on the sand dunes as refuges, nesting sites, and food storage areas. A single southeastern beach mouse may have up to 20 burrows. (FNAI, 2001a)

The main threat facing the southeastern beach mouse is from residential and commercial development along the beach. Additional threats to the beach mouse are from hurricanes, coastal erosion, and attacks from mammals, birds, and insects. Prescribed conservation measures include the construction of boardwalks over dunes, banning the practice of driving vehicles on the dunes, and the removal feral cats. (USFWS, 1999d)

St. Andrew Beach Mouse. The St. Andrew beach mouse is a subspecies of the small oldfield mouse (*Peromyscus polionotus*). The St. Andrew beach mouse has an average size of: "head and body length, 2.95 in (75 mm); tail length, 2.05 in (52 mm); and hind foot length, 0.73 in (18.5 mm)" (USFWS, 2010), and yellowish-brown colored fur on its back that extends from the eyes down to the thighs. The mouse's feet, belly, and tail are white (USFWS, 2010). The St. Andrew beach mouse was federally listed as endangered in 1998 (63 FR 70053 70062, December 18,1998). (USFWS, 2015dc)

"The St. Andrew beach mouse is federally listed as endangered. Currently, there are two populations of the St. Andrew beach mouse: East Crooked Island, Bay County, and St. Joseph Peninsula, Gulf County, Florida" (USFWS, 2010). The beach mouse lives on sand dunes covered with grass and sea oats. The diet of the St. Andrew beach mouse consists primarily of seeds and insects (USFWS, 2010).

The main threat facing the St. Andrew beach mouse is the continued coastal development along beaches. Additional threats include hurricanes, pedestrian and vehicular traffic across the dunes, natural shoreline erosion, artificial lighting, and attacks from feral hogs, cats (both domestic and feral), red foxes (*Vulpes vulpes*), and coyotes (*Canis latrans*). Prescribed conservation measures include the construction of boardwalks over dunes, banning the practice of driving vehicles on the dunes, and the removal feral cats. (USFWS, 2010)

West Indian Manatee. The West Indian Manatee (*Trichechus manatus*) averages 9 feet in length and weighs about 1,000 pounds (USFWS, 2015dg). The manatee was listed as endangered in 1967 (32 FR 4001, March 11, 1967). The West Indian manatee is also protected under the Marine Mammal Protection Act (MMPA). The manatee has a large, seal-shaped body with flippers and a large tail, and is usually gray in color (USFWS, 2015dg). Manatees found in mainland U.S. waters are recognized as a separate subspecies known as the Florida manatee *(Trichechus manatus latirostris)* (USFWS, 2001a).



West Indian manatee Photo credit: USFWS

Critical habitat for the Florida manatee is found in U.S. territorial waters adjoining the coast including coastal lagoons, canals, waterways, and rivers located within Brevard, Charlotte, Citrus, Collier, Miami- Dade, De Soto, Duvall, Hillsborough; Lee, Manatee, Martin, Monroe, Nassau, Palm Beach, Sarasota, St, Mary's, Volusia Counties in Florida (USFWS, 1977a). West Indian manatees are found in tropical and subtropical coastal and river waters along the southeast U.S. coast, the Caribbean coast of Central and South America, and locally throughout the West Indies. During summer, manatees may be commonly found almost anywhere in Florida with appropriate water depths (3 to 6 feet). Shallow grass beds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving (USFWS, 2001a).

The greatest threats to West Indian manatees include death or serious injury from boat strikes, decreased availability of warm-water refuges for manatees, and intensive coastal development. Other human-related threats include mortality from tide gates and dredges, habitat destruction, and entanglement in fishing gear (USFWS, 2001a).

Birds

There are six endangered and six threatened bird species that are federally listed and known to occur in the state of Florida as summarized in Table 5.1.6-5. The Audubon's crested caracara (*Polyborus plancus audubonii*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), and the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) are found in prairie lands in south-central Florida and the Everglades. The Everglade snail kite (*Rostrhamus sociabilis plumbeus*), Florida scrub-jay (*Aphelocoma coerulescen*), Kirtland's warbler (*Setophaga kirtlandii*), and roseate tern (*Sterna dougallii*) are found in peninsular Florida, and the red knot (*Calidris canutus rufa*) is found around the coast of Florida. The piping plover (*Charadrius melodus*), red-cockaded woodpecker (*Picoides borealis*), and wood stork (*Mycteria americana*) are found throughout Florida. The Bachman's warbler (*Vermivora bachmani*) is so rare it could be extinct. "The last sighting of Bachman's warbler in Florida was reported in 1977" (USFWS, 1999aw). Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-5: Federally Listed Bird Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Audubon's Crested Caracara	*Polyborus plancus audubonii*	T	No	Dry or wet prairie areas with scattered cabbage palms in the south-central region of Florida.
Bachman's Warbler	*Vermivora bachmanii*	E	No	Breeds throughout the southeastern U.S. and winters in western Cuba and the Isle of Pines. It nested near the ground in low, wet, forested areas, usually with some permanent water sources.
Cape Sable Seaside Sparrow	*Ammodramus maritimus mirabilis*	E	Yes; marl prairie[b] habitats in the vicinity of the Main Park Road, Shark River Slough, Taylor Slough, and the State-owned Southern Glades Wildlife and Environmental Area.	A mixed marl prairie community that often includes muhly grass. They are found in 3 counties in south Florida, in the Everglades.
Everglade Snail Kite	*Rostrhamus sociabilis plumbeus*	E	Yes; in South Florida and confined to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (NWR), Water Conservation Area (WCA) 2, WCA 3, Everglades National Park,	Freshwater marshes and shallow vegetated edges of lakes where apple snails can be found, in humid, tropical regions of peninsular Florida.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
			western portions of Lake Okeechobee in Hendry and Glades County, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and the St. Johns Reservoir in Indian River County.	
Florida Grasshopper Sparrow	*Ammodramus savannarum floridanus*	E	No	Large, treeless, poorly drained grasslands that have a history of frequent fires, in the prairie region of south-central Florida.
Florida Scrub-jay	*Aphelocoma coerulescens*	T	No	Small, isolated dense thickets of scrub oaks, intermixed with bare sand, in peninsular Florida.
Kirtland's Warbler	*Setophaga kirtlandii*	E	No	They nest in the southern region of the jack pine range and on the driest, most basic sand soils of lower Michigan. They migrate from their nesting grounds in the northern U.S. to the southeastern coast of the U.S. on their way to wintering grounds in the Bahamas.
Piping Plover	*Charadrius melodus*	T	Yes; within Bay, Collier, Duval, Escambia, Franklin, Gulf, Hillsborough, Lee, Martin, Monroe, Nassau, Pasco, Pinellas, Santa Rosa, Taylor and Volusia Counties. Critical habitat has also been designated within the Marquesas Keys which are included as part on Monroe County.	Open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers. Found in 18 counties in Florida.
Red Knot	*Calidris canutus rufa*	T	No	Intertidal marines, estuaries, and bays around the coast of Florida.
Red-cockaded Woodpecker	*Picoides borealis*	E	No	Mature pine forests, found in 19 counties in Florida.
Roseate Tern	*Sterna dougallii dougallii*	T	No	Salt marsh, islands, and beaches with sparse vegetation; found on the southern tip of Florida in Monroe County.
Wood Stork	*Mycteria americana*	T	No	Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps. Found throughout the whole state of Florida.

[a] E = Endangered, T = Threatened
[b] Marl prairie: "characterized by their plant species diversity rather than the dominance of a few species" (USFS, 2005).

Source: (USFWS, 2015v).

Audubon's Crested Caracara. The Audubon's crested caracara is a unique looking raptor, with a long neck, long yellow legs, and a massive gray-blue bill about 23 inches in length. The species has a "white head and throat, white wing tips, and white tail, with a dark body, red face, and signature black crest" (USFWS, 2015dy). The Audubon's crested caracara was federally listed as threatened in 1987 (52 FR 25229 25232, July 6, 1987). (USFWS, 2015dy)

"The overall range of the crested caracara is from Florida, southern Texas, southwestern Arizona, northern Baja California, and through Mexico and Central America to Panama, including Cuba and the Isle of Pines" (USFWS, 1999e). This species may be found within 22 counties of Florida (USFWS, 2015dy); primarily in the prairie area of the south-central region of the state with scattered cabbage palms, tall or shrubby vegetation, or lightly wooded areas (USFWS, 1999e)

The primary threat to the Audubon's crested caracara is habitat loss, due to "its dry prairie habitat being destroyed or modified for agriculture and residential development" (USFWS, 1999e). "Large areas of native prairie have been lost in south-central Florida to citrus operations, tree farms, improved pasture, other forms of agriculture, and real estate development" (USFWS, 1999e).

Bachman's Warbler. The Bachman's warbler is a small songbird, about 5 inches in length, with a slender, curved downward bill. Adult males have a black head, gray back of the neck, and yellow forehead, eye-ring, and throat. They have "yellow underparts with a black patch on the upper breast and a white under tail" (USFWS, 2016f). Their upperparts are olive-green, with gray wings with fringes of olive and yellow coloring. The top of the tail is gray with white spots. Adult females are "duller with a whitish eye-ring, no black, and a less well marked head" (USFWS, 2016f). Juveniles are "brownish, with buffy-yellow underparts, whiter on the throat, and two buffy wing-bars" (USFWS, 2016f). The Bachman's warbler was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967) (USFWS, 2016f).

The Bachman's warbler is believed to occur in two counties in south Florida, Monroe and Miami-Dade Counties (USFWS, 2015ea). It breeds throughout the southeastern U.S. and winters in western Cuba and the Isle of Pines. The last sighting of Bachman's warbler in Florida was reported in 1977. The last confirmed sighting anywhere in the U.S. was in 1988. "Based on this, it is widely believed that Bachman's warbler is either extinct or on the verge of extinction" (USFWS, 1999f). This species typically nested near the ground in low, wet, forested areas, usually with some permanent water sources. Nesting habitat was characterized by "openings in the forest canopy with a ground cover of dense thickets of cane (*Arundinaria gigantea*), palmetto (*Serenoa minor*), blackberry (*Rubus cuneifolius*), gallberry (*Ilex glabra*), and other shrubs and vines" (USFWS, 1999f). Theories of threats to the population decline of the Bachman's warbler include the destruction of breeding and wintering areas due to land clearing and development activities. "The greatest threat to the species is probably its large historic breeding range and low population size" (USFWS, 1999f), which makes it extremely difficult for breeding birds to find mates. This could lead to its extinction (USFWS, 1999f).

Cape Sable Seaside Sparrow. The Cape Sable seaside sparrow is a small bird, about 5 inches long. Its upper parts are dark olive-gray with olive-brown on the tail and wings. The under parts

are light gray to almost white with dark olive-gray streaks on the breast and sides. "There is a dark whisker on either side of the white throat … and a small patch of yellow on the edge of the wing" (USFWS, 2015af). The Cape Sable seaside sparrow was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967) (USFWS, 2015af).

The Cape Sable seaside sparrow may be found in three counties in south Florida (USFWS, 2015af). Five areas of critical habitat for the sparrow have been identified within marl prairie habitats located primarily in the Everglades National Park (USFWS, 2007d). The sparrow is a non-migratory inhabitant of freshwater to brackish marshes. "The currently preferred nesting habitat of the Cape Sable seaside sparrows appears to be a mixed marl prairie community that often includes muhly grass (*Muhlenbergia filipes*)…These short-hydroperiod prairies contain moderately dense, clumped grasses, with open space allowing for ground movements by the sparrows" (USFWS, 1999ax). The main threat to the Cape Sable seaside sparrow is destruction of its habitat due water management practices in the Everglades, and the large scale conversion of land in South Florida to agricultural uses. Competition and predation also threaten the Cape Sable seaside sparrow (USFWS, 1999g).

Everglade Snail Kite. The Everglade snail kite is a medium-sized hawk with a wingspan of about 45 inches. The beak is slender and very hooked, perfect for eating their almost exclusive diet of freshwater apple snails. "The adult males are a slate gray color with a black head and wing tips, a white patch at the base of a square tail, and red legs. The female has a buffy body, streaked with dark lines, a white line above the eye, a white tail patch, yellow legs, and red eyes. The immatures resemble the females, only they are darker and their eyes are brown" (USFWS, 2015aq). The Everglade snail kite was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967). (USFWS, 2015aq)

The Everglade snail kite is believed or known to occur within 17 counties of south Florida (USFWS, 2015aq). Regionally, it is found in Florida, Cuba, and northwestern Honduras. Critical habitat for the snail kite is located in South Florida and confined to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (NWR), Water Conservation Area (WCA) 2, WCA 3, Everglades National Park, western portions of Lake Okeechobee in Hendry and Glades County, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and the St. Johns Reservoir in Indian River County. Their habitat is "freshwater marshes and shallow vegetated edges of lakes where apple snails can be found… in humid, tropical regions of peninsular Florida" (USFWS, 1999h). Threats to the Everglade snail kite are its "very small population and increasingly limited amount of fresh marsh with sufficient water to ensure an adequate supply of snails on which it depends for food" (USFWS, 1999h). Another threat to the snail kite is the "degradation of water quality, especially due to runoff of phosphorous from agricultural and urban sources" (USFWS, 1999h).

Florida Grasshopper Sparrow. The Florida grasshopper sparrow is a small, short-tailed bird, about 5 inches long. They are mostly black and gray colored, with light streaks of brown on the upper back. The underparts on adults are whitish with some buff on the throat and breast, while juveniles have a streaked breast. "The bend of the wing is yellow; the feet are flesh colored" (USFWS, 2015au). There are no obvious color differences between males and females. The

Florida grasshopper sparrow was federally listed as endangered in 1986 (51 FR 27492 27495, July 31, 1986). (USFWS, 2015au)

The Florida grasshopper sparrow is known or believed to occur in six counties in Florida (USFWS, 2015au). It is a non-migratory bird, and only occurs in the prairie region of south-central Florida. Their habitat consists of large, treeless, poorly drained grasslands that have a history of frequent fires; they rely on fire every two to three years to maintain this specific habitat. The biggest threat to the Florida grasshopper sparrow is "habitat loss and degradation resulting from conversion of native vegetation to improved pasture and agriculture" (USFWS, 1999i). Other threats are overgrazing and too much water in prairie areas, which may prevent nesting and alter the vegetation of the habitat. (USFWS, 1999i)

Florida Scrub-jay. The Florida scrub-jay looks similar to other jays, but lacks a crest, white-tipped wings or tail feathers, or black barring on its body. The coloring of males and females is the same, but the males are slighter larger in size. The bird is pale blue, expect for its grey back and belly. The throat and chest are white with light stripes and accented by a blue gray boarder, resembling a "bib." Juveniles have dull or dark brown upper parts. The Florida scrub-jay was federally listed as threatened in 1987 (52 FR 20715 20719, June 3, 1987). (USFWS, 1999ar)

The Florida scrub-jay is known to occur throughout 33 counties in peninsular Florida (USFWS, 2015az). Its habitat is "small, isolated dense thickets of scrub oaks less than 3 meters in height, interspersed with bare sand used for foraging and storing acorns" (USFWS, 1986a). The greatest threat to the Florida scrub-jay is habitat loss due to housing development. Most of the scrub lands that this species favors are in areas of high real estate value, and much coastal scrub has been cleared to make way for beachfront hotels, houses, and condominiums. Scrub habitats in the central area of Florida are also subject to "development for citrus groves and housing" (USFWS, 1986a).

Kirtland's Warbler. The Kirtland's warbler is a small songbird, less than 6 inches in length, that nests in young jack pine stands. The male has a "bright yellow colored breast streaked in black, bluish gray back feathers, a dark mask over its face with white eye rings, and a bobbing tail" (USFWS, 2015bx). The female is less bright in coloring, and has no dark mask. The Kirtland's warbler was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967). (USFWS, 2015bx)

Regionally, the Kirtland's warbler is known to occur in Canada, Michigan, Wisconsin, South Carolina, and Florida. They migrate from their nesting grounds in the northern U.S. "to the southeastern coast of the U.S. on their way to wintering grounds in the Bahamas" (USFWS, 2015bx). Within Florida, they are found in five counties on the southern tip of the peninsula (USFWS, 2015bx). The main threat to the Kirtland's warbler is the degradation of the special habitat and circumstances they require for nesting. Forest fire control has reduced both the total amount of jack pine stands burned, and also the size of each burn. Another threat is parasitism of Kirtland's warbler nests by the brown-headed cowbird (USFWS, 1985a).

Piping Plover. The piping plover is a small, pale brown-colored shorebird with a short beak and black band across the forehead, measuring approximately 7.25 inches in length. The piping

plover was listed as endangered in 1985 for the Great Lakes watershed of both the United States and Canada, and as threatened in the remainder of its range in the U.S., which includes the Northern Great Plains, Atlantic and Gulf Coasts, Puerto Rico, and the Virgin Islands. Piping plovers are believed or known to occur in 18 counties in Florida. The piping plover was federally listed as endangered and threatened in 1985 (50 FR 50726 50734, December 11, 1985). (USFWS, 2015cl)

Critical habitat for the piping plover within Florida has been designated within Bay, Collier, Duval, Escambia, Franklin, Gulf, Hillsborough, Lee County, Martin County, Monroe County, Nassau, Pasco, Pinellas, Santa Rosa, Taylor, and Volusia Counties. Critical habitat has also been designated within the Marquesas Keys which are included as part on Monroe County. (USFWS, 2001b)

Piping plover are found on open, sandy beaches and on tidal mudflats and sandflats along both the Atlantic and Gulf coasts. (USFWS, 2001b). Suitable habitat consists of open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers (USFWS, 1996a). Nesting often occurs in wetlands in the Northern Great Plains. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates. Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation, flooding from coastal storms, and environmental contaminants (USFWS, 2015dr) (USFWS, 2015dq).

Red Knot. The red knot is approximately 9 inches in length with a wing span up to 20 inches, making it among the largest of the small sandpipers (USFWS, 2005c). It was federally listed as a threatened species in 2014 (79 FR 73705 73748, December 11, 2014). The red knot migrates annually from its breeding grounds above the Arctic Circle to the tip of South America where it winters. During spring and fall migration, the red knot travels in "non-stop segments of 1,500 miles and more, ending at stop sites called staging areas" (USFWS, 2013c). Some have been documented to fly more than 9,300 miles from south to north every spring and return south in autumn (USFWS, 2005c) (USFWS, 2014c). It is known to occur in 21 counties around the coast of Florida.



Red knot Photo credit: USFWS

The preferred habitat is intertidal marines, estuaries, and bays. Mussel beds are important food sources for the red knot. The red knots primarily eat mussels and other mollusks; however, during migration season they eat horseshoe crab (USFWS, 2005c). Current threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at their migration stopovers; and disturbance by humans, dogs, vehicles, and climate change (USFWS, 2014c).

Red-cockaded Woodpecker. The red-cockaded woodpecker is a small black and white woodpecker that grows approximately 7 inches with a wingspan of about 15 inches. It is characterized by its black cap and white cheek patches (USFWS, 2015dt). The red-cockaded woodpecker was listed as endangered in 1970 under early endangered species legislation (35 FR 16047 16048, October 13, 1970). Regionally, this species is known to occur in open pine forests in the southeast from Virginia south to Florida and west to Oklahoma and Texas. It can be found in 19 counties in Florida. (USFWS, 2015cp)



Red-cockaded woodpecker
Photo credit: USFWS

The preferred habitat for the red-cockaded woodpecker is mature pine forests, with the preferred pine species being the longleaf pines (*Pinus palustris*). This species forages on pine trunks and branches and flakes away bark in search of insects. Its diet is primarily composed of insects, including beetles, ants, spiders, other insect found on pine trees, and occasional wild fruits and pine seeds. The major threat to the red-cockaded woodpecker is a lack of suitable habitats as a result of fire suppression (which results in hardwood encroachment) and timber harvesting. Additional threats include population fragmentation and lack of suitable foraging habitat. (USFWS, 2003a)

Roseate Tern. The roseate tern is approximately 15 inches in length (not including the tail) with light-gray wings and a black cap. During breeding season, the roseate tern's white chest gains a rosy tinge, and its bill and legs turn from black to orange-red (USFWS, 2011a). The roseate tern was listed as endangered in 1987 in the northeast region and threatened in the southeast region (52 FR 42064 4206, November 2,1987*)* (USFWS, 1987b). This bird nests in colonies on sand/gravel beaches or pebbly/rocky offshore barrier islands along the Atlantic coast from Nova Scotia south to Long Island, New York, and on the southern tip of Florida. "The birds migrate south throughout the West Indies to winter of the northern and eastern coasts of South America; the winter quarters are still not well defined. Recent findings have located birds along the Brazilian coast" (USFWS, 1998a).

This species is a marine bird that breeds along the coasts on salt marsh islands and beaches with sparse vegetation. The roseate tern feeds on small fish such as the American sand lance (*Ammodytes americanus*). Present threats include vegetation changes in breeding areas, disturbances from human activities in coastal areas, competition with gulls for suitable nest sites, and predation (USFWS, 2011a).

Wood Stork. The wood stork is a "large, long-legged wading bird, about 50 inches tall, with a wingspan of 60 to 65 inches. The plumage is white except for black primaries and secondaries and a short black tail. The head and neck are largely unfeathered and dark gray in color. The bill is black, thick at the base, and slightly curved. Immature birds are dingy gray and have a yellowish bill" (USFWS, 2015dk). The bird was federally listed as a threatened species in 1984 (49 FR 7332 7335, February 28, 1984). "The breeding range of the species extends from the

southeastern United States south through Mexico and Central America, Cuba and Hispaniola, and through South America to western Ecuador, eastern Peru, Bolivia, and northern Argentina" (USFWS, 1997c). This species is found throughout the entire state of Florida (USFWS, 2015dk).

The preferred habitat includes a variety of freshwater and estuarine wetlands for nesting, feeding, and roosting. Freshwater colony sites must remain inundated throughout the nesting cycle to protect against predation and abandonment. Foraging sites occur in shallow, open water where prey concentrations are high, such as "freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads or swamp sloughs" (USFWS, 1997c). Current threats to the wood stork include loss of feeding habitat, water level manipulations affecting drainage, predation and/or lack of nest tree regeneration, human disturbance, and pesticides/chemical pollutants (USFWS, 1997c).

Reptiles

There are four endangered and six threatened species that are federally listed and known to occur in the state of Florida as summarized in Table 5.1.6-6. The American crocodile or Florida crocodile (*Crocodylus acutus*) can be found in swamps, bays, and creeks in extreme south Florida. The Atlantic salt marsh snake (*Nerodia clarkii taeniata*) lives in salt marshes in three counties on the east coast of Florida, while the eastern indigo snake (*Drymarchon corais couperi*) inhabits pineland, hammocks, and fields throughout Florida. The bluetail mole skink (*Eumeces egregious lividus*) lives in three counties along the Lake Wales Ridge in Florida, and the sand skink (*Neoseps reynoldsi*) lives in the sandy ridges of interior central Florida. The hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), and the loggerhead sea turtle (*Caretta caretta*) appear off the coast of Florida and some nest on its beaches. The eastern gopher tortoise (*Gopherus polyphemus*) has been identified a candidate species in Florida. Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-6: Federally Listed Reptiles Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
American Crocodile	*Crocodylus acutus*	T	Yes; all land and water within an area encompassing the extreme southern tip of Florida, Florida Bay, and the Keys; in Miami-Dade, Monroe, Collier, and Lee Counties.	Mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps in the extreme south of Florida, including the cooling canals at Turkey Point Nuclear Power Plant.
Atlantic Salt Marsh Snake	*Nerodia clarkii taeniata*	T	No	Salt marshes of Volusia, Brevard, and Indian River Counties

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
				on the east coast of Florida.
Bluetail Mole Skink	*Eumeces egregius lividus*	T	No	Sandhill and dry hammocks, oak and sand pine scrubs, and turkey oak barrens in the Highlands, Polk, and Osceola Counties along the Lake Wales Ridge in Florida.
Eastern Indigo Snake	*Drymarchon corais couperi*	T	No	High pineland, flatwoods, dry glades, tropical hammocks, and muckland fields in Florida.
Green Sea Turtle	*Chelonia mydas*	E	No	Warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation.
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	No	Warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation.
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	No	Muddy or sandy bottoms where prey items can be found, in waters rarely greater than 160 feet deep.
Leatherback Sea Turtle	*Dermochelys coriacea*	E	No	Coastal waters and the open sea environment.
Loggerhead Sea Turtle	*Caretta caretta*	T	Yes; Bay, Brevard, Charlotte, Collier, Duval, Escambia, Flagler, Franklin, Gulf, Indian River, Lee, Manatee, Martin, Monroe, Palm Beach, Sarasota, St. John's, and Volusia Counties in Florida. Critical habitat in Florida also includes floating sargassum mats located in the Atlantic Ocean.	Open sea environment and inshore area such as salt marshes, creeks, bays, and lagoons.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Sand Skink	*Neoseps reynoldsi*	T	No	Sandy ridges of interior central Florida from Marion County south to Highlands County.

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015v) (USFWS, 2015h).

American Crocodile. The American crocodile is a large, greenish-gray reptile with black mottling that closely resembles the alligator. Hatchlings are about 10 inches long, and adults can grow longer than 15 feet. Males are larger than females. Florida crocodiles are more slender than alligators and have a tapered snout with an exposed fourth tooth when the jaw is closed, unlike the alligator's rounded snout with no exposed teeth when its jaw is closed (USFWS, 1999j). Crocodiles generally eat anything that can be caught and overpowered (USFWS, 1999j). The Florida crocodile was federally listed as threatened in 1975 (40 FR 44149 44151, September 25, 1975) (USFWS, 2015dv).

The American crocodile can be found in coastal habitats of the Caribbean, Mexico, Central America, northern South America, and extreme south Florida. Critical habitat for the American crocodile is located in Miami-Dade, Monroe, Collier, and Lee Counties in Florida, and includes all land and water within an area encompassing the extreme southern tip of Florida, Florida Bay, and the Keys (USFWS, 1977b). Their primary habitat is mangrove swamps and along low-energy bays, creeks, and inland swamps. Breeding populations can be found in Florida at Crocodile Lake National Wildlife Refuge, the Everglades National Park, and Turkey Point Nuclear Power Plant cooling canals (USFWS, 2015b). Threats to the American crocodile include habitat loss and fragmentation due to increased urbanization and agricultural land uses, hurricanes, cold weather, and road mortality (USFWS, 1999j).

Atlantic Salt Marsh Snake. The Atlantic salt marsh snake is a slender, pale olive colored water snake with a pattern of dark brown stripes running down the back broken up with blotches. The belly is black with a series of yellowish spots. It reaches about 2 feet in total length and is most active at night, during low tide. The Atlantic salt marsh snake was federally listed as threatened in 1977 (42 FR 60743 60745, November 29, 1977) (USFWS, 2015dx).

The Atlantic salt marsh snake can be found in the salt marshes of Volusia, Brevard, and Indian River Counties on the east coast of Florida. Its habitat consists of brackish coastal marshes mostly vegetated with glasswort and salt grass. One threat to this species is the drainage and development in coastal salt marshes, which result in loss of habitat. Another threat is the potential interbreeding and hybridization with the Florida banded water snake (USFWS, 1993a).

Bluetail Mole Skink. "The bluetail mole skink is a small, shiny, and brownish to pink, cylindrical lizard" (USFWS, 2015ad), about 5 inches in length. Juveniles usually have a blue tail, while regenerated tails and the tails of older skinks are usually pinkish. "During breeding season, males develop a colorful orange pattern on their sides" (USFWS, 2015ad). The bluetail

mole skink was federally listed as threatened in 1987 (52 FR 42658 42662, November 6, 1987) (USFWS, 2015ad).

Because bluetail mole skinks need loose sand for burrowing, their habitat consists of "sandhill and xeric hammocks, oak and sand pine scrubs, and turkey oak barrens … in the Highlands, Polk, and Osceola Counties along the Lake Wales Ridge" in Florida (FWC, 2015s). The main threat to the bluetail mole skink is habitat loss due to "agricultural, residential, and commercial development…The limited range of the bluetail mole skink also makes it more vulnerable to natural or environmental catastrophes" (FWC, 2015s).

Eastern Indigo Snake. "Adults are large and thick bodied. The body is glossy black and in sunlight has iridescent blue highlights. The chin and throat is reddish or white, and the color may extend down the body. The belly is cloudy orange and blue-gray. The scales on its back are smooth, but some individuals may possess some scales that are partially keeled. There are 17 dorsal scale rows at midbody. The pupil is round. Juveniles are black-bodied with narrow whitish blue bands" (USFWS, 2015ao). The species was listed as threatened in 1978 (43 FR 4026-4029, January 31, 1978). In the U.S., its range includes the coastal plain areas of Alabama, Florida, and Georgia. In Florida, the eastern indigo snake is known to occur in 64 counties throughout the state (USFWS, 2015ao).



Eastern indigo snake Photo credit: USFWS

Preferred habitat of the indigo snake includes high pineland (in central and north Florida) and flatwoods , dry glades, tropical hammocks, and muckland fields[96] in south Florida. Eastern indigo snakes are commonly associated with gopher tortoise burrows, which they use as refuges and overwintering sites (USFWS, 1982b). Breeding occurs from November until April, and females typically lay 5-10 eggs during May or June; these are often placed in the moist sand of tortoise burrows. Major threats to the eastern indigo snake include fire suppression, habitat conversion to agriculture, pine plantation, or housing; highway fatalities; and human predation from both outright killing of the snake to collection for the pet trade (USFWS, 1982b).

Green Sea Turtle. The green sea turtle is "the largest of all of the hard-shelled sea turtles" (NOAA, 2016b). It was listed as endangered in Florida in 2016 (81 FR 20057 20090, May 6, 2016) (NOAA, 2016a). "Their top shell is smooth with shades of black, gray, green, brown, and yellow; their bottom shell is yellowish white" (NOAA, 2016b). The adults grow to approximately 3 feet and weight between 300-350 pounds. The green sea turtle is found throughout all of the major oceans of the world, but "generally found in tropical and subtropical water along continental coasts and islands between 30 degree North and 30 degree South"

[96] Muckland field: an agricultural field with muck soil ("lake bottom and march organic matter") (NYDEC, 2000).

(NOAA, 2016b). Critical habitat includes the "waters surrounding the island of Culebra, Puerto Rico" and the island's outlying Keys (USFWS, 2016r).

This species "are the only marine turtles to exclusively eat plants" (NOAA, 2016b). "They feed primarily on seagrasses and algae" (NOAA, 2016b). Nesting season typically occurs between June and September, with females laying eggs in 2 to 4 year cycles. "In Florida, green turtle nests contain an average of 135 eggs, which will incubate for approximately 2 months before hatching" (NOAA, 2016b). Current threats to the green sea turtle include "harvest of eggs and adults, incidental capture in fishing gear, fibropapillomatosis (disease)," "loss or degradation of nesting habitat, disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations" (NOAA, 2016b) (USFWS, 2016r).

Hawksbill Sea Turtle. The hawksbill sea turtle is one of the smaller sea turtles. It was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970). The hawksbill sea turtle has overlapping plates that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 25 to 36 inches and weigh up to 300 pounds (although typically no more than 150 pounds). Its upper shell is dark brown with faint yellow streaks and a yellow under shell. The hawksbill is found throughout all of the major oceans of the world (NOAA, 2014a) (USFWS, 2015s). NMFS has designated the waters surrounding Culebra, Mona, Cayo Norte, Island Culebrita, and Monito Islands, Puerto Rico, as critical habitat necessary for the continued survival and recovery of hawksbill turtles (63 FR 46693 46701, September 2, 1998) (USFWS, 2015bq; USFWS, 2016g).

This species prefers warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation. As an omnivore, the hawksbill sea turtles feed primarily on sponges, algae, and invertebrates and are most often associated with the coral reef community. Nesting for these turtles occurs on remote beaches in the Gulf of Mexico and the Caribbean Sea in 2 to 3 year cycles, where females will lay between 140 to 200 eggs (USFWS, 2015s). Current threats to the hawksbill sea turtle include loss of nesting sites to coastal development, artificial lighting impacting hatchlings ability to successfully enter the water, nest predation by native and non-natives species, marine debris, accidental capture in fishing lines, and vessel strikes (USFWS, 2016g). Outside of the U.S., a current threat is the harvest of their shell, meat and eggs, which was the historic cause of their decline (NOAA, 2014a) (USFWS, 2016g).

Kemp's Ridley Sea Turtle. The Kemp's Ridley sea turtle is considered the smallest sea turtle species and the most endangered. These sea turtles can grow to more than 2 feet long and weigh up to 100 pounds. They have an olive-grey shell that is almost round and a head that is triangular. (NOAA, 2015g) (USFWS, 2015t). The Kemp's Ridley sea turtle was first federally listed in 1970 (35 FR 18319 18322, December 2, 1970) under the Endangered Species Conservation Act (USFWS, 2015bs). Their range includes the Gulf of Mexico and the U.S. Atlantic seaboard, from Nova Scotia to Florida. They prefer nearshore habitats characterized by muddy or sandy bottoms where their prey items can be found, in waters rarely greater than 160

feet deep. They feed mostly on crabs, but also consume jellyfish, fish, and various mollusks (NOAA, 2015g).

Kemp's Ridley sea turtle gather in large groups in Tamaulipas, Mexico where approximately 95 percent of this species' breeding occurs. Nesting occurs as early as April and into July. Some males migrate yearly between breeding and feeding grounds, whereas others remain near breeding grounds throughout the year. Hatchlings drift with the currents or float with plant material rafts for approximately 2 years (NOAA, 2015g). Historically, harvesting of the turtles eggs during their nesting was the main cause for the decline of this species while current threats to this species includes the direct harvest of adults and eggs, inadvertent capture in fishing gear, human activity on beaches, and pollution (USFWS, 2015t).

Leatherback Sea Turtle. The leatherback sea turtle is the deepest-diving and most wide-ranging sea turtle, growing 4 to 8 feet long and weighing 500 to 2000 pounds (USFWS, 2015u). The leatherback sea turtle was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970). (USFWS, 2015bz). The leatherback sea turtle is capable of tolerating a wide range of water temperatures; hence, it has the widest global distribution of all reptiles, including parts of the Atlantic, Pacific, and Indian Oceans. The occurrence in the United States is rare for the Atlantic population, with the most significant location within the east coast being in southeastern Florida (NOAA, 2015h) (USFWS, 2015u). USFWS has designated Sandy Point Beach on St. Croix in the U.S. Virgin Islands as critical habitat necessary for the continued survival and recovery of leatherback sea turtles. In Florida, it can be found in 27 counties off the coast (USFWS, 2015bz) (USFWS, 1979).

The preferred habitat for this species includes open oceans but also occur in coastal waters. The leatherback sea turtle diet consists of jellyfish, squid, and other soft-bodied animals. This species will forage in both coastal waters and the open sea environment (NOAA, 2015h). For reproduction the female leatherback sea turtles nest at 2 to 3 year intervals during the months of March to July. Creation of nesting site occur during the night and each turtle will nest up to 11 nest per nesting season (USFWS, 2015u). Current major threats to the species include harvesting of their eggs, loss of nesting habitat to coastal development, artificial lighting confusing hatchlings, nest predation, hunting, incidental capture in fishing gear, and marine pollution and debris (USFWS, 2015u).

Loggerhead Sea Turtle. The loggerhead sea turtle is a smaller sea turtle that can grow to an average length of 3 feet and weight of 250 pounds. This species has a reddish-brown carapace[97] and flippers, and is characterized by its large head (USFWS, 2015x). The loggerhead sea turtle was initially listed as threatened throughout its range in 1978 (43 FR 32800 32811, July 28, 1978), and by 2011 nine different distinct populations were listed and the northwester Atlantic Ocean population remained listed as threatened (76 FR 58868 58952, September 22, 2011) (USFWS, 2015cb).

This turtle is known to occur throughout temperate and tropical regions in the Atlantic, Pacific, and Indian Oceans with the most nesting areas located in the western Atlantic Ocean. Nesting by

[97] Carapace: upper shell (USFWS, 2008d)

the loggerhead sea turtle occurs from Texas to Virginia along the southeastern coast of the United States (USFWS, 2008a). Loggerhead sea turtles can be found year-round in the Florida Bay (NOAA, 2014b). The sea turtles nest on coastal sand beaches, often near the dune line. Hatchlings use offshore floating sargassum mats; juveniles frequent coastal bays, inlets, and lagoons. Nesting occurs along the entire Atlantic coast, in the Keys, and along the Gulf coast from Pinellas County south and in the panhandle from Franklin County west. The northern border stretches from shore to the 98 foot depth contour. The southern seaward border follows 656 foot depth contour. The Florida counties where critical habitat has been designated for the Loggerhead sea turtle include Bay, Brevard, Charlotte, Collier, Duval, Escambia, Flagler, Franklin, Gulf, Indian River, Lee, Manatee, Martin, Monroe, Palm Beach, Sarasota, St. John's, and Volusia. Loggerhead sea turtle critical habitat also includes floating sargassum mats located in the Atlantic Ocean (NMFS, 2014).

The preferred habitat for the loggerhead sea turtle is the open sea environment, but they also occur in inshore area such as salt marshes, creeks, bays, and lagoons. Open beaches are the preferred location for nesting along the coast and coral reefs and rocky places are the preferred feeding areas for the loggerhead sea turtles (NOAA, 2014b). Current threats to the logger head sea turtle include incidental captures in fishing gear, directed harvesting of eggs, nest predation, marine pollution and debris, watercraft strikes, disease, and loss and degradation of habitats (NOAA, 2014b) (USFWS, 2008a) (USFWS, 2015w).

Sand Skink. The sand skink is a gray/gray-white lizard that lives underground and measures 4 to 5 inches in length. "Its forelegs are tiny and bear only one toe; its hindlegs are small and have two toes. The tail comprises about half of the animal's total length. The sand skink has a wedge-shaped head, a partially countersunk lower jaw, body grooves into which the forelegs can be folded, and small eyes which have transparent windows in the lower lids" (USFWS, 2015cs). The sand skink was federally listed as threatened in 1987 (52 FR 42658 42662, November 6, 1987) (USFWS, 2015cs).

The sand skink can be found on the sandy ridges of interior central Florida from Marion County south to Highlands County. It spends most of its time below the surface swimming in loose sand in search of food, shelter, and mates. Threats to the sand skink are habitat loss due to agricultural and residential uses and habitat degradation due to fire exclusion. (USFWS, 1999as)

Fish

There is one endangered and two threatened fish species that are federally listed and known to occur in the state of Florida as summarized in Table 5.1.6-7. The Gulf sturgeon *(Acipenser oxyrinchus desotoi)* are anadromous fish, migrating from salt water to fresh water rivers to spawn, and are found in rivers on the coast of Florida. The Okaloosa darter *(Etheostoma okaloosae)* is found in only six stream systems in two counties in Florida. The smalltooth sawfish *(Pristis pectinate)* is only found in shallow coastal waters in the Everglades region at the southern tip of Florida. Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-7: Federally Listed Fish Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	T	Yes; the Apalachicola, Suwanee, Yellow, and Choctawhatchee River systems; the nearshore of the Gulf of Mexico; the Pensacola, Apalachicola, and Choctawhatchee Bays, and the Santa Rosa and Suwannee Sounds.	Migrates from marine environment to fresh water coastal rivers to spawn. Rest near the bottom of riverbeds and oceans. Found in 29 counties on the coast of Florida.
Okaloosa Darter	*Etheostoma okaloosae*	T	No	The borders of small streams in only 6 stream systems in 2 counties in Florida.
Smalltooth Sawfish	*Pristis pectinata*	E	Yes; in the Charlotte Harbor Estuary and the Ten Thousand Islands/Everglades Unit along the southwestern coast of Florida between Charlotte Harbor and Florida Bay.	Shallow coastal waters of tropical seas and estuaries; in the peninsula of Florida, in the Everglades region at the southern tip of the state.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015v).

Gulf Sturgeon. The gulf sturgeon (gulf subspecies of Atlantic sturgeon) can grow up to 9 feet long and weigh up to 300 pounds (USFWS, 2015o). It is a bony fish with a long bladelike snout, this species is light brown to dark brown with a pale belly (USFWS 1995). The gulf sturgeon was federally listed as threatened in 1991 (56 FR 49653 49658, September 30, 1991) (USFWS, 2015bo). The sturgeon migrates in the spring from salt water into fresh water rivers to spawn and spend the summer. Due to strong instincts, individual sturgeons often return to their river they were born in to spawn. When they're not migrating, they prefer to rest near the bottom of riverbeds and oceans (USFWS, 2016d).

Gulf sturgeons used to be common in rivers from Tampa Bay, Florida to the Mississippi River; now they can be found only in a number of large fresh water rivers from the Suwannee River in Florida to the Pearl River in Louisiana (USFWS, 2015o). It is known to occur in 29 counties on the coast of Florida bordering the Gulf of Mexico (USFWS, 2015bo). The critical habitats for the gulf sturgeon in Florida are:

1. the Apalachicola River system in Franklin, Gulf, Liberty, Calhoun, Gadsden, and Jackson Counties;
2. the Suwannee River system in Hamilton, Suwanee, Madison, Lafayette, Gilchrist, Levy, Dixie, and Columbia Counties;

3. the nearshore of the Gulf of Mexico in Escambia, Santa Rose, Okaloosa, Walton Bay, and Gulf Counties;
4. the Pensacola Bay in Escambia and Santa Rosa Counties;
5. the Santa Rosa Sound in Escambia, Santa Rosa, and Okaloosa Counties;
6. the Choctawhatchee River system in river system in Holmes, Washington, Walton Counties;
7. the Apalachicola Bay in Gulf and Franklin Counties;
8. the Suwannee Sound in Dixie and Levy Counties;
9. the Yellow River system in Santa Rosa and Okaloosa Counties; and
10. the Choctawhatchee bay in Okaloosa and Walton Counties (USFWS, 2003c).

Major threats to the gulf sturgeon are barriers (such as dams) to historical spawning habitats, loss of habitat, poor water quality, incidental catch, and overfishing for sturgeon eggs and meat (USFWS, 1995).

Okaloosa Darter. The Okaloosa darter is a small fish about 2 inches long (USFWS, 2015p). The Okaloosa darter was federally listed as threatened in 1973 (38 FR 14678, June 4, 1973) (USFWS, 2015cg). It is only found in six stream systems in Okaloosa and Walton Counties of northwest Florida, mostly located on Eglin Air Force Base (USFWS, 1998b) (USFWS, 2015p). "Okaloosa darters typically inhabit the margins of small streams fed by groundwater seeping from surrounding sandhills" (USFWS, 1998b). It uses vegetation and woody debris as shelter for spawning. Threats to the Okaloosa darter are siltation due to urbanization, ground and surface water withdrawal, and hazardous material spills (USFWS, 1998b).

Smalltooth Sawfish. The smalltooth sawfish belongs to a group of fish called elasmobranchs, which include sharks, skates, and rays. Sawfish are modified rays with a shark-like body and gill slits on their underside. Sawfish get their name from their saw-like snouts; long, flat, and edged with teeth that are used to locate, stun, and kill prey. They can reach up to 25 feet in length, and weigh up to 770 pounds (NOAA, 2014c). The smalltooth sawfish was federally listed as endangered in 2003 (68 FR 15674, April 1, 2003).

Historically, smalltooth sawfish were found throughout the Gulf of Mexico from Texas to New York. With the largest historic populations being off the coast of Florida from Charlotte Harbor to the Dry Tortugas (NMFS, 2009). Now they are only generally found in the peninsula of Florida, in the Everglades region at the southern tip of the state, however, there have been some reports since 1998 of individuals being sighted in Georgia, Alabama, Louisiana, and Texas (NOAA, 2014c) (NMFS, 2009). Critical habitat has been designated along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. It includes the Charlotte Harbor estuary and the Ten Thousand Islands/Everglades Unit (NMFS, 2009).

"Smalltooth sawfish inhabit shallow coastal waters of tropical seas and estuaries throughout the world. They can usually be found in shallow waters (less than 32 feet (10m)), close to shore over muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths" (NOAA, 2014c). This species uses shallow areas with lots of

vegetation, such as mangrove forests, as nurseries for its young. Threats include bycatch by fisheries, especially in gill nets, and the loss of nursery habitat for juveniles (NOAA, 2014c).

Amphibians

There is one endangered and one threatened amphibian species that are federally listed and known to occur in Florida, as summarized in Table 5.1.6-8. The frosted flatwoods salamander *(Ambystoma cingulatum)* and the reticulated flatwoods salamander *(Ambystoma bishop)* live in pine flatwoods habitats in Florida. The striped newt *(Notophthalmus perstriatus)* has been identified a candidate species in Florida. Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-8: Federally Listed Amphibian Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Frosted Flatwoods Salamander	*Ambystoma cingulatum*	T	Yes; Baker, Franklin, Jefferson, Liberty, and Wakulla Counties.	Longleaf pine and wiregrass flatwoods and savannas in the lower southeastern Coastal Plain.
Reticulated Flatwoods Salamander	*Ambystoma bishopi*	E	Yes; in Calhoun, Holmes, Jackson, Santa Rosa, Walton, and Washington Counties.	Breeds in isolated pond cypress dominated depressions generally within pine forests. A relatively open canopy resulting from seasonal prescribed burns is necessary to maintain appropriate vegetation.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015v) (USFWS, 2015h).

Frosted Flatwoods Salamander. "The flatwoods salamander is medium-sized, reaching an adult length of 5 inches (13 centimeters). Body color ranges from silvery gray to black, with the back heavily mottled with a variable gray cross-band pattern. The underside is plain gray with faint creamy blotches" (USFWS, 2015bh). The species was listed as threatened in 1999 (64 FR 15691 15704, April 1, 1999). Its range includes coastal plain areas in Florida, Georgia, and South Carolina. In Florida, frosted flatwoods salamander is known to occur in five counties (USFWS, 2015bh). USFWS has designated critical habitat necessary for the continued survival and recovery of the frosted flatwoods salamander in Baker, Franklin, Jefferson, Liberty, and Wakulla Counties in Florida (USFWS, 2015h).

Preferred habitat of the frosted flatwoods salamander includes historically longleaf pine and wiregrass flatwoods and savannas in the lower southeastern Coastal Plain. Adults are terrestrial and live underground most of the year. They breed in relatively small, isolated temporary ponds where the larvae develop until metamorphosis.[98] "Post-metamorphic salamanders migrate out of the ponds and into the uplands where they live until they move back to ponds to breed as adults" (USFWS, 2009a). Threats to the frosted flatwoods salamander include destruction and

[98] The process of transformation from an immature form to an adult form in two or more distinct stages.

modification of the pine flatwoods habitat (including fire suppression) and disease/predation (USFWS, 2009a).

Reticulated Flatwoods Salamander. The reticulated flatwoods salamander is a medium-sized salamander, slightly smaller than the frosted flatwoods salamander, reaching an adult length of about 5 inches. Body color ranges from "black to chocolate-black, with fine, irregular light gray lines and specks that form a net-like cross-banded pattern across their backs" (USFWS, 2009a). The species was listed as endangered in 2009 (74 FR 6700 6774, February 10, 2009). Its range includes coastal plain areas in Florida and Georgia. In Florida, reticulated flatwoods salamander is known to occur in 10 counties in the northwestern portion of the state (USFWS, 2015bh). USFWS has designated critical habitat necessary for the continued survival and recovery of the frosted flatwoods salamander in Florida and Georgia (USFWS, 2015h). Critical habitat in Florida consists of eight units throughout the reticulated flatwoods salamander's range in Calhoun, Holmes, Jackson, Santa Rosa, Walton, and Washington Counties in Florida (USFWS, 2009a).

Preferred habitat of the reticulated flatwoods salamander is the same as that of the frosted flatwoods salamander and includes historically longleaf pine and wiregrass flatwoods and savannas in the lower southeastern Coastal Plain. Reticulated flatwoods salamanders generally occur west of the Apalachicola River drainage basin, while frosted flatwoods salamanders occur east of this basin. "Adults are terrestrial and live underground most of the year" (USFWS, 2009a). "They breed in relatively small, isolated ephemeral ponds[99] where the larvae develop until metamorphosis. Post-metamorphic salamanders migrate out of the ponds and into the uplands where they live until they move back to ponds to breed as adults" (USFWS, 2009a). Threats to the reticulated flatwoods salamander include destruction and modification of the pine flatwoods habitat (including fire suppression), habitat fragmentation, and disease/predation (USFWS, 2009a).

Invertebrates

There are 12 endangered and 10 threatened invertebrate species that are federally listed and known to occur in the state of Florida, as summarized in Table 5.1.6-9. The Bartram's hairstreak butterfly (*Strymon acis bartrami*), Florida leafwing butterfly (*Anaea troglodyta floridalis*), Miami blue butterfly (*Cyclargus thomasi bethunebakeri*), and Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*) can all be found in south Florida. The Chipola slabshell (*Elliptio chipolaensis*), Choctaw bean (*Villosa choctawensis*), fat threeridge mussel (*Amblema neislerii*), fuzzy pigtoe (*Pleurobema strodeanum*), gulf moccasinshell (*Medionidus penicillatus*), narrow pigtoe (*Fusconaia escambia*), Ochlockonee moccasinshell (*Medionidus simpsonianus*), oval pigtoe (*Pleurobema pyriforme*), purple bankclimber mussel (*Elliptoideus sloatianus*), round ebonyshell (*Fusconaia rotulata*), shinyrayed pocketbook (*Lampsilis subangulata*), southern sandshell (*Hamiota australis*), southern kidneyshell (*Ptychobranchus jonesi*), and tapered pigtoe (*Fusconaia burkei*) are all freshwater mussels occurring in creeks, streams, and rivers throughout Florida. The elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) can be

[99] Lasting a very short time; short-lived; transitory.

found in reef environments off the coast of southern Florida. The Squirrel Chimney cave shrimp (*Palaemonetes cummingi*) can only be found in a single sinkhole in Alachua County, Florida. The Stock Island tree snail (*Orthalicus reses*) can be found in the Florida Keys portion of Monroe County. The highlands tiger beetle (*Cicindelidia highlandensis*) has been identified a candidate species in Florida. Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-9: Federally Listed Invertebrate Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Bartram's Scrub-Hairstreak Butterfly	*Strymon acis bartrami*	E	Yes; Miami- Dade and Monroe Counties.	Pine rockland habitat of south Florida and the Florida Keys.
Chipola Slabshell	*Elliptio chipolaensis*	T	Yes; Chipola River in Calhoun, Gulf, and Jackson Counties.	Silty sand sloping banks of large creeks and the main channel of the Chipola River in slow to moderate current.
Choctaw Bean	*Villosa choctawensis*	E	Yes; Lower Escambia River Drainage, Yellow River Drainage, the Lower Pea River, and the Choctawhatchee River.	Medium creeks to medium rivers with moderate current in stable substrates of silty sand to sandy clay; in the Escambia, Yellow, and Choctawhatchee River drainages of Alabama and Florida.
Elkhorn Coral	*Acropora palmata*	T	Yes; coastal waters of Palm Beach, Monroe, Miami-Dade, and Broward County.	Shallow water (3 ft.-16 ft. deep) in areas of heavy surf and preferably exposed reef crest environments; in the Florida Reef Tract in southern Florida.
Fat Threeridge Mussel	*Amblema neislerii*	E	Yes; Chipola River and Apalachicola River.	The main channel of small to large rivers in a slow to moderate current and in material varying from gravel to sand and mud.
Florida Leafwing Butterfly	*Anaea troglodyta floridalis*	E	Yes; parts of south Florida and the Florida Keys.	Pine rockland habitat of south Florida.
Fuzzy Pigtoe	*Pleurobema strodeanum*	T	Yes; Lower Escambia River Drainage, Yellow River Drainage, Choctawhatchee River and Lower Pea River Drainages.	Medium creeks to medium rivers with slow to moderate current in stable substrates of sand and silty sand; in the Escambia, Yellow, and Choctawhatchee River drainages in Alabama and Florida.
Gulf Moccasinshell	*Medionidus penicillatus*	E	Yes; Econfina Creek and Chipola River.	The channels of small to medium-sized creeks to large rivers with sand and gravel or silty sand in slow to moderate currents.
Miami Blue Butterfly	*Cyclargus thomasi bethunebakeri*	E	No	Tropical hardwood hammocks, beachside scrub, and tropical pine rocklands in south Florida.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Narrow Pigtoe	*Fusconaia escambia*	T	Yes; Lower Escambia River Drainage, Yellow River Drainage.	Medium creeks to medium rivers with slow to moderate current in stable substrates of sand, sand and gravel, or silty sand; in the Escambia River drainage in Alabama and Florida, and the Yellow River drainage in Florida.
Ochlockonee Moccasin shell	*Medionidus simpsonianus*	E	Yes; Upper Ochlockonee River.	Large creeks and the Ochlockonee River main stem in areas with current and in sand with some gravel.
Oval Pigtoe	*Pleurobema pyriforme*	E	Yes; Econfina Creek, Chipola River, Upper Ochlockonee River, and Santa Fe and New Rivers.	Small to medium-sized creeks to small rivers usually in slow to moderate current and in silty sand to sand and gravel.
Purple Bankclimber Mussel	*Elliptoideus sloatianus*	T	Yes; Apalachicola River, and Upper and Lower Ochlockonee River.	Small to large river channels in slow to moderate current in sand or sand mixed with mud or gravel.
Round Ebonyshell	*Fusconaia rotulata*	E	Yes; Lower Escambia River Drainage.	Small to medium rivers with slow to moderate currents, usually in firm substrates of sand, small gravel, or sandy mud; only in the main channel of the Escambia-Conecuh River drainage in Alabama and Florida.
Schaus Swallowtail Butterfly	*Heraclides aristodemus ponceanus*	E	No	South Florida
Shinyrayed Pocketbook	*Lampsilis subangulata*	E	Yes; Chipola River and Upper Ochlockonee River.	Small to medium-sized creeks or rivers in clean or silty sand in a slow to moderate current.
Southern Sandshell	*Hamiota australis*	T	Yes; Lower Escambia River Drainage, Yellow River Drainage, Choctawhatchee River, and Lower Pea River Drainages.	Small creeks and rivers with slow to moderate current in stable substrates of sand or mixtures of sand and fine gravel; in the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee River drainages in Alabama and Florida.
Southern Kidneyshell	*Ptychobranchus jonesi*	E	Yes; Lower Escambia River Drainage, Yellow River Drainage, Choctawhatchee River, and Lower Pea River Drainages.	Medium creeks to small rivers with slow to moderate current in firm sand substrates, preferably near bedrock outcroppings; only in the Choctawhatchee River drainage in Alabama and Florida.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Squirrel Chimney Cave Shrimp	*Palaemonetes cummingi*	T	No	A single sinkhole (Squirrel Chimney) in Alachua County, Florida.
Staghorn Coral	*Acropora cervicornis*	T	Yes; coastal waters of Monroe, Miami-Dade, Palm Beach, and Broward Counties.	Back and fore reef environments from 0-100 feet deep; found throughout the Florida Keys.
Stock Island Tree Snail	*Orthalicus reses*	T	No	Hammock forests with smooth-barked native trees that support large quantities of lichens and algae; found in the Florida Keys portion of Monroe County.
Tapered Pigtoe	*Fusconaia burkei*	T	Yes; Choctawhatchee River and Lower Pea River Drainages.	Medium creeks to medium rivers with slow to moderate current in stable substrates of sand, small gravel, or sandy mud; in the Choctawhatchee River drainage in Alabama and Florida, and several oxbow lakes in Florida.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015v) (USFWS, 2015h).

Bartram's scrub-hairstreak butterfly. Bartram's scrub-hairstreak is a federally endangered butterfly that is native to the pine rockland habitat of south Florida and the Florida Keys. The butterfly is almost exclusively found on the National Key Deer Refuge on Big Pine Key and on Long Pine Key within the Everglades National Park in Florida (USFWS, 2015do). A pine rockland is characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with an understory composed of shrubs, palms, and herbs. Limestone is sporadically observed poking out of the pine rockland's forest floor (FNAI, 2010b). The Bartram's scrub-hairstreak butterfly is a small butterfly (approximately one inch in length) that has "white bands with a black edges that can be seen when the wings are closed." The underside of the wings are pale gray with bold white markings with a red patch near the slender hind wings (NPS, 2015c) (USFWS, 2015dm). The color of the upper side of the wings is a deep gray that can appear blue and purple. The Bartram's scrum-hairstreak butterfly was federally listed as endangered in 2014 (79 FR 49023 49024, September 11, 2014) (USFWS, 2015aa). Critical habitat was established in Miami-Dade and Monroe Counties (79 FR 47179 47220, August 12, 2014) (USFWS, 2015dm).

This species is dependent on the health of their host plant which is the pineland croton (*Croton linearis*). The pineland croton is a shrub that grows within the pine rockland. Caterpillars of the Bartram's scrub-hairstreak feed only on pineland croton. Pineland croton are "dependent on periodic fires that maintain an open understory, reduce competition from other plant species, and help prevent infestations of nonnative plants" (NPS, 2015c). Bartram's scrub-hairstreaks will be observed flying in close proximity to their host plant. The reason for the decline in the Bartram's scrub-hairstreak butterfly includes the destruction of pine rockland habitat, introduction of exotic plant and insect species, fire suppression, climate change, disease, predation, use of insecticides for mosquito control, and collecting. To date, collaborative research, monitoring and recovery

efforts for the Bartram's scrub-hairstreak have focused largely on 1) conducting comprehensive surveys of historic locations for presence or absence of the Bartram's scrub-hairstreak and pineland croton; 2) establishing fire management and other restoration plans to include conservation measures for the subspecies, pineland croton and the pine rockland habitat; 3) evaluating techniques to accurately estimate abundance and distribution of extant butterfly populations and their hostplants within the pine rocklands; 4) expanding the buffer and no-spray zones on Big Pine Key (including within NKDR) to prevent adverse impacts to the butterfly and its habitat; 5) evaluating the influence of pesticide applications on imperiled butterfly populations; and 6) increasing public awareness of this endangered butterfly (USFWS, 2015dm).

Chipola Slabshell. "The Chipola slabshell is a medium-sized species reaching a length of about 3.3 inches" (USFWS, 2003d). The shell is smooth and chestnut colored, and may have alternating light and dark bands across it (USFWS, 2003d). The Chipola slabshell was federally listed as threatened in 1998 (63 FR 12664 12687, March 16, 1998). This species occurs only in the Chipola River system in Florida (USFWS, 2003d). In Florida, it can be found in Calhoun, Gulf, and Jackson Counties in the panhandle (USFWS, 2015aj). Critical habitat in Florida has been designated in the Chipola River (USFWS, 2007a).

"Adult mussels are ideally found in localized patches (beds) in streams and almost completely burrowed in the sediment" (USFWS, 2003d). "The Chipola slabshell inhabits silty sand substrates of large creeks and the main channel of the Chipola River in slow to moderate current" (USFWS, 2003d). Threats to the Chipola slabshell include significant habitat loss, range restriction, and population fragmentation and size reduction "due to erosive land practices,[100] construction of new impoundments, water withdrawals, and nonnative species" (USFWS, 2003d).

Choctaw Bean. The Choctaw bean is a small oval shaped freshwater mussel about 2 inches in length. It has a shiny outer shell that is greenish-brown in color with thin green rays, and an inner shell color of "bluish white to smoky brown with some iridescence" (USFWS, 2012a). The Choctaw bean was federally listed as endangered in 2012 (77 FR 61663 61719, October 10, 2012) (USFWS, 2012a).

This species is found in medium creeks to medium rivers with moderate current in stable substrates of silty sand to sandy clay. Its current range is the Escambia, Yellow, and Choctawhatchee River drainages of Alabama and Florida. Critical habitat was designated in at the time of this listing in the Lower Escambia River Drainage, Choctawhatchee and Lower Pea Rivers, and Yellow River Drainage in Florida and Alabama. The greatest threat to the Choctaw bean is "habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants" (USFWS, 2012a).

Elkhorn Coral. "Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches" which can reach over 6 feet in length and grow by 2 to 4 inches per year, with colonies of coral reaching their maximum size in about 10 to 12 years. "Elkhorn coral has been one of the

[100] Erosive land practices: "Unsuitable land use and inappropriate land management practices" that results in erosion (FOA, 1994).

three most important Caribbean corals contributing to reef growth and development and providing crucial fish habitat." The elkhorn coral was federally listed as threatened in 2006 (71 FR 26852, May 9, 2006). (USFWS, 2016i) (NOAA, 2014d)

Critical habitat for the elkhorn coral has been designated along the southeastern coast of Florida. Elkhorn coral critical habitat encompasses the coastal waters of Palm Beach, Monroe, Miami-Dade, and Broward County. Elkhorn coral commonly grow in widespread, densely grouped thickets in turbulent shallow water on the seaward face of reefs in water ranging from 3 to 16 feet in depth but have been found to a depth of 98 feet (NOAA, 2014h). Its range consists of coral reefs in the western Atlantic Ocean, Caribbean, and the Gulf of Mexico, including southern Florida, Puerto Rico, U.S. Virgin Islands, and throughout the Caribbean (NOAA, 2014h). Threats to the elkhorn coral include disease, such as "white band disease, hurricanes, predation, bleaching, algae overgrowth, sedimentation, temperature and salinity variation, and low genetic diversity" (NOAA, 2014d).

Fat Threeridge Mussel. The fat threeridge mussel is a medium-sized to large, inflated, heavy-shelled mussel with a dark brown to black ridged shell that grows to approximately 4 inches in length. The fat threeridge mussel was federally listed as endangered in 1998 (63 FR 12664, March 16, 1998). This species occurs at 17 sites in the Apalachicola and lower Chipola Rivers in Florida and Georgia (USFWS, 2003d). It is believed or known to occur in six counties in the Florida panhandle (USFWS, 2016j). Critical habitat in Florida has been designated in the Chipola River and Apalachicola River (USFWS, 2007a).

Adult mussels live on stream beds buried underneath the sediment, typically found in groups or "mussel beds." The fat threeridge is found in flowing water of small to large rivers with various substrate, including gravel or sand and mud. Threats to the fat threeridge mussel include significant habitat loss, range restriction, contaminants introduced into the water, sedimentation, and population fragmentation and size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," and competition and predation from nonnative species (USFWS, 2003d).

Florida leafwing butterfly. The federally endangered Florida leafwing butterfly is native to the pine rockland habitat of south Florida. The Florida leafwing butterfly is thought to only be found in Everglades National Park (NPS, 2015d). A pine rockland is characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with an understory composed of shrubs, palms, and herbs. Limestone is commonly observed poking through the surface of the pine rockland's forest floor (FNAI, 2010b). The Florida leafwing butterfly reaches adult sizes of 2.75 to 3 inches (USFWS, 2015av). The female butterflies are slightly larger than males. The upper wings are bright orange or red and the lower wings look like a dead leaf.[101] "Adult leafwings can be found every month of the year" (USFWS, 2015av). The Florida leafwing butterfly was federally listed as endangered in 2014 (79 FR 49023 49024, September 11, 2014) (USFWS, 2015av).

[101] Dead leaf: a leaf with dull or pale coloring that is dried out and no longer supporting the plant.

This species is dependent on the health of their host plant, the pineland croton (*Croton linearis*) (NPS, 2015d). Caterpillars of the Florida leafwing feed only on pineland croton (*Croton linearis*), a shrub that grows in the understory of pine rockland habitat. Pineland croton are "dependent on periodic fires that maintain an open understory, reduce competition from other plant species, and help prevent infestations of nonnative plants" (NPS, 2015d). The biggest threats most likely include habitat destruction, nonnative species introduction, insecticide use, and butterfly collecting. Its South Florida habitat is also threatened by sea-level rise. Recommended conservation practices include prescribed burns to ensure the maintenance of the pine rockland habitat (NPS, 2015d).

Fuzzy Pigtoe. The fuzzy pigtoe is an oval shaped small to medium-sized mussel reaching about 3 inches in length. It has a dark brown to black outer shell, and a bluish white with slight iridescence inner shell (USFWS, 2012a). The fuzzy pigtoe was federally listed as threatened in 2012 (77 FR 61663 61719, October 10, 2012*).*

This species is "found in medium creeks to medium rivers in stable substrates of sand and silty sand with slow to moderate current" (USFWS, 2012a). Its range is the Escambia, Yellow, and Choctawhatchee River drainages in Alabama and Florida. Critical habitat was designated at the time of listing in the Lower Escambia River Drainage, Yellow River Drainage, and the Choctawhatchee River and Lower Pea River Drainages in Florida and Alabama. The greatest threat to the fuzzy pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, dams, poor water quality, and environmental contaminants (USFWS, 2012a).

Gulf Moccasinshell. The gulf moccasinshell is a small mussel that reaches a length of about 2 inches and has a smooth and yellowish to greenish brown shell interrupted with thin ridges and green rays. The gulf moccasinshell was federally listed as endangered in 1998 (63 FR 12664 12687, March 16, 1998). This species occurs in Florida in Econfina Creek and the Chipola River, (USFWS, 2003d). It is believed or known to occur in seven counties in the Florida panhandle (USFWS, 2015bn). Critical habitat in Florida has been designated in the Econfina Creek and Chipola River (USFWS, 2007a).

Adult mussels live on stream beds buried underneath the sediment, typically found in groups or "mussel beds." "The gulf moccasinshell inhabits the channels of small to medium-sized creeks to large rivers" with sand and gravel or silty sand in slow to moderate currents (USFWS, 2003d). Threats to the gulf moccasinshell include significant habitat loss, range restriction, contaminants introduced into the water, sedimentation, population fragmentation and size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," and competition and predation from nonnative species (USFWS, 2003d).

Miami Blue Butterfly. The Miami blue butterfly is 0.8 to 1.1 inches in length when fully extended. The butterfly is bright blue on the back with a gray underside. "Males have narrow black margins, while females have a wide black margin and an orange eyespot near the hindwing. On the underside of the hindwing, the Miami blue has four black spots, and a white submarginal band on both the hindwing and forewing" (FWC, 2015t). "The butterfly inhabits

tropical hardwood hammocks[102] and their tropical margins, beachside scrub, and tropical pine rocklands" (FNAI, 2010c). A pine rockland is characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with an understory composed of shrubs, palms, and herbs. Limestone rock is commonly observed poking through the pine rockland's forest floor (FNAI, 2010c). The Miami blue reproduces multiple times throughout the year. Females lay the small eggs on the flower stalks of the gray nickerbean (*Caesalpinia bonduc roxb*), blackbead (*Pithecellobium* spp.), on the developing seed pods of the balloon vine (*Cardiospermum* spp.), and possibly *Acacia* spp. (University of Florida, 2012) (USFWS, 2011b). The Miami blue butterfly was federally listed as endangered in 2012 (77 FR 20948 20986, April 6, 2012) (USFWS, 2015ce).

"The larvae of Miami blue butterfly have a slug-like shape and are mainly green with a black head capsule, red to brown mid-back line, and white lateral lines" (USFWS, 2011b). Threats include habitat loss and fragmentation, "drought, cold temperatures, and iguanas" who eat the host plants (USFWS, 2011b). Additionally, hurricanes remain a major threat to the remaining populations of the Miami blue butterfly (FWC, 2015t) (USFWS, 2011b).

Narrow Pigtoe. The narrow pigtoe is a square shaped, small to medium-sized mussel that reaches about 3 inches in length. It has a moderately thick outer shell that is usually reddish brown to black in color and a white to salmon colored inner shell with iridescence. The narrow pigtoe was federally listed as threatened in 2012 (77 FR 61663 61719, October 10, 2012).

"This species is found in medium creeks to medium rivers in stable substrates of sand, sand and gravel, or silty sand, with slow to moderate current" (USFWS, 2012a). Its current range is the Escambia River drainage in Alabama and Florida, and the Yellow River drainage in Florida. Critical habitat was designated at the time of listing in the Lower Escambia River Drainage and Yellow River Drainage in Florida and Alabama. The greatest threat to the narrow pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, dams, poor water quality, and environmental contaminants (USFWS, 2012a).

Ochlockonee Moccasinshell. The Ochlockonee moccasinshell is a small species, generally under 2.2 inches in length, with a smooth light brown to yellowish green shell, marked by dark green rays across the length. The Ochlockonee moccasinshell was federally listed as endangered in 1998 (63 FR 12664 12687, March 16, 1998). Historically, this species occurred in the Ochlockonee River system in Florida and Georgia, but only three live specimens have been collected since 1974 in this river (USFWS, 2003d). Critical habitat in Florida has been designated in the Upper Ochlockonee River and within 14 Florida counties (USFWS, 2007a).

Adult mussels live on stream beds buried underneath the sediment, typically found in groups or "mussel beds." "The Ochlockonee moccasinshell inhabits large creeks and the Ochlockonee River main stem in areas with current. Typical substrates are sand with some gravel" (USFWS, 2003d). Threats to the Ochlockonee moccasinshell include significant habitat loss, range restriction, contaminants introduced into the water, sedimentation, population fragmentation and

[102] Hardwood hammock: A hardwood hammock is a dense stand of broad-leafed trees that grow on a natural rise of only a few inches in elevation (NPS, 2016a).

size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," and competition and predation from nonnative species (USFWS, 2003d).

Oval Pigtoe. "The oval pigtoe is a small to medium-sized mussel that attains a length of about 2.4 inches" (USFWS, 2003b). The yellowish, chestnut, or dark brown shell is shiny smooth with no rays and distinct growth lines (USFWS, 2003b). The oval pigtoe was federally listed as endangered in 1998 (63 FR 12664 12687, March 16, 1998). This species occurs in Florida in Econfina Creek and Chipola Rivers and within 10 Florida counties (USFWS, 2003d). Critical habitat in Florida has been designated in the Econfina Creek, Chipola River, Upper Ochlockonee River, and Santa Fe and New Rivers (USFWS, 2007a).

Adult mussels live on stream beds buried underneath the sediment, typically found in groups or "mussel beds." The oval pigtoe is found in slow to moderately flowing creeks and small rivers with silty sand to sand and gravel substrate. Threats to the oval pigtoe include significant habitat loss, contaminants introduced into the water, sedimentation, range restriction, population fragmentation and size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," and competition and predation from nonnative species (USFWS, 2003d).

Purple Bankclimber. The purple bankclimber is a is a freshwater mussel, with a heavy, dark colored, shell with ridges, reaching lengths of 8 inches. The purple bankclimber was federally listed as threatened in 1998 (63 FR 12664 12687, March 16, 1998). This Florida species occurs in the Apalachicola, Chipola and Ochlockonee Rivers (USFWS, 2003d). It is believed or known to occur in eight counties in the Florida panhandle (USFWS, 2015cm). Critical habitat in Florida has been designated in the Apalachicola River, and Upper and Lower Ochlockonee River (USFWS, 2007a).

Adult mussels live on stream beds buried underneath the sediment, typically found in groups or "mussel beds." This "heavy-shelled species occur in stream channels with currents" (USFWS, 2003d). "The purple bankclimber inhabits small to large river channels in slow to moderate current in sand or sand mixed with mud or gravel" (USFWS, 2003d). Threats to the purple bankclimber include significant habitat loss, range restriction, contaminants introduced into the water, sedimentation, population fragmentation and size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," and competition and predation from nonnative species (USFWS, 2003d).

Round Ebonyshell. The round ebonyshell is a round to oval medium-sized freshwater mussel reaching almost 3 inches in length. It has a thick, smooth, dark brown to black outer shell with a white to silvery and iridescent inside shell (USFWS, 2012e). The round ebonyshell was federally listed as endangered in 2012 (77 FR 61663 61719, October 10, 2012).

This species can be found in small to medium rivers with slow to moderate currents, usually in firm substrates of sand, small gravel, or sandy mud. Its current range consists of only the main channel of the Escambia-Conecuh River drainage in Alabama and Florida. Critical habitat was designated in 2012 in the Lower Escambia River Drainage in Florida and Alabama. Because of this very limited range, the main threats to the round ebonyshell are "catastrophic events such as

flood scour and contaminant spills, and activities that cause streambed destabilization such as gravel mining, dredging, and de-snagging for navigation" (USFWS, 2012a).

Schaus swallowtail butterfly. "Schaus swallowtail is a large black butterfly that can have a wing span of up to 2.3 inches." "This species has contrasting white or yellow markings across the forewing, and a series of yellow blotches that continue along the forewing to the hind wing." The undersides of the wings are yellow with brown markings and broad blue or rust colored stripes. The tail is black with yellow edging and an orange patch on the underside of the hind wing (FWC, 2015u) (University of Florida, 2014). The males have yellow-tipped antennae while the females do not. The females of the species are larger than males. The Schaus swallowtail looks similar to the giant swallowtail (*Papilio cresphontes*); however, the giant swallowtail is larger in size, has yellow forewing spot stripes that connect, and a yellow spot in the center of the hindwing tail. Adult Schaus swallowtails have a slow flight when compared to similar species of butterflies (University of Florida, 2014). The Schaus' swallowtail was federally listed as endangered in 1976 *(*41 FR 17736 17740, April 28, 1976*)* (USFWS, 2015cu).

The Schaus swallowtail lays eggs once a year between April and July. Adult emergence and reproduction occurs at the beginning of the Florida rainy season. The females lay the green eggs on the new growth of wild lime (*Zanthoxylum fagara*) and sea torchwood (*Amyris elemifera*). The developing larvae feed on young foliage. "The mature larvae are brown with cream and yellow lateral patches, a white patch at the end of the larvae and several vertical rows of blue spots" (University of Florida, 2014). New larvae are brown with a cream colored center and a white patch near the larvae's rear. The larvae resemble bird or lizard droppings (University of Florida, 2014).

"The diet of Schaus swallowtail consists of guava nectar, wild tamarind, torchwood trees, and cheese shrubs" (FWC, 2015u)." The eggs are laid on wild lime and sea torchwood, and the "newly hatched caterpillars feed on the young blossoms and leaves" (FWC, 2015u). Adult individuals have a life span of only one month (FWC, 2015u). The Schaus swallowtail can "stop suddenly in mid-air and fly backwards to avoid its predators" (USFWS, 2016k). Threats include "insecticide use, habitat destruction, droughts, hurricanes and illegal collection" (USFWS, 2016k).

Shinyrayed Pocketbook. The shinyrayed pocketbook is a medium-sized mussel that reaches over 3 inches in length. The smooth and shiny shell is relatively thin but solid, with a light yellowish brown color streaked in bright emerald rays over the length of the shell. The shinyrayed pocketbook was federally listed as endangered in 1998 (63 FR 12664 12687, March 16, 1998). This species is scattered throughout tributary streams of the Apalachicola-Chattahoochee-Flint Basin and in the Chipola River in Florida and the Ochlockonee River system in Florida, and Georgia (USFWS, 2003d). It can be found in Florida in 10 counties in the panhandle (USFWS, 2015cy). Critical habitat in Florida has been designated in the Chipola River and Upper Ochlockonee River (72 FR 34216 34224, June 21, 2007) (USFWS, 2007a).

"Adult mussels are ideally found in localized patches (beds) in streams and almost completely burrowed in the sediment" (USFWS, 2003b). "The shinyrayed pocketbook inhabits small to medium-sized creeks to rivers in clean or silty sand substrates in slow to moderate current"

(USFWS, 2003b). Threats to the shinyrayed pocketbook include significant habitat loss, contaminants introduced into the water, sedimentation, range restriction, population fragmentation and size reduction due to "erosive land practices, construction of new impoundments, water withdrawals," gravel mining, and competition and predation from nonnative species (USFWS, 2003d).

Southern Sandshell. The southern sandshell is a freshwater mussel with elliptical shaped shells that grow to approximately 2 inches. The shells are smooth and shiny, with a greenish color that can be dark greenish brown to black with many green rays in older specimens (USFWS, 2012e). The southern sandshell was federally listed as threatened in 2012 (77 FR 61663 61719, October 10, 2012).

This species can be "found in small creeks and rivers in stable substrates of sand or mixtures of sand and fine gravel, with slow to moderate current" (USFWS, 2012a). Its range is the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee River drainages in Alabama and Florida. Critical habitat was designated in 2012 in the Lower Escambia River Drainage, Yellow River Drainage, and Choctawhatchee River and Lower Pea River Drainages in Florida and Alabama. The greatest threat to the southern sandshell is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, dams, and environmental contaminants (USFWS, 2012a).

Southern Kidneyshell. The southern kidneyshell is a freshwater mussel with elongated, nearly tubular shells that reach a maximum length of about 3 inches (NatureServe, 2009). The southern kidneyshell was federally listed as endangered in 2012 (77 FR 61663 61719, October 10, 2012).

The suitable habitat for the southern kidneyshell is characterized by "medium creeks to small rivers with slow to moderate current in firm sand substrates," preferably near bedrock outcroppings (USFWS, 2012e). Its current range is only in the Choctawhatchee River drainage in Alabama and Florida. Critical habitat was designated in the Lower Escambia River Drainage, and Choctawhatchee River and Lower Pea River Drainages in Florida and Alabama. The greatest threat to the southern kidneyshell is habitat degradation and loss from excessive sedimentation, bed destabilization, poor water quality, dams, and environmental contaminants (USFWS, 2012a).

Squirrel Chimney Cave Shrimp. The Squirrel Chimney cave shrimp is about 1 inch in length and has a colorless body and eyes (USFWS, 2005a). The Squirrel Chimney cave shrimp was federally listed as threatened in 1990 (55 FR 25588 25591, June 21, 1990) (USFWS, 2016l).

This species can only be found in a single sinkhole (Squirrel Chimney) in Alachua County, Florida. "Squirrel Chimney is a small, deep sinkhole that leads to a flooded cave system" and supports one of the richest cave invertebrate habitats in the nation (USFWS, 2005a). Because the Squirrel Chimney cave shrimp only exists in this one location, any changes in the sinkhole or cave system could cause the species to go extinct. Some of the main threats to the Squirrel Chimney cave shrimp are stormwater runoff, septic tank drainage fields, aquifer recharge, herbicide/fertilizer use in the area, nearby urban development, and erosion/sediment deposition, all which can affect the sinkhole ecosystem (USFWS, 2005a).

Staghorn Coral. The staghorn coral is a branching coral with cylindrical branches that can grow to over 6.5 feet in length. The staghorn coral was federally listed as threatened in 2006 (71 FR 26852, May 9, 2006). (USFWS, 2016m)

Their critical habitat is located in southeast Florida and encompasses the coastal waters of Monroe, Miami-Dade, Palm Beach, and Broward Counties. The maximum northern extent of Staghorn Coral critical habitat is located within Palm Beach County, Florida. Staghorn coral commonly grows in more protected, deeper water ranging from 16 to 60 feet in depth and has been found in rare instances to 197 feet in depth (NOAA, 2014h). Staghorn coral can be found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. Threats to the staghorn coral include "disease, such as white band disease, hurricanes, predation, bleaching, algae overgrowth, sedimentation, temperature and salinity variation, and low genetic diversity" (NOAA, 2014e).

Stock Island Tree Snail. The Stock Island tree snail is a large, conical, arboreal[103] snail approximately 2 inches in length. The lightweight and somewhat translucent shell is white to buff in color, with three spiral bands and "several flame-like purple-brown stripes" (USFWS, 1999k). The Stock Island tree snail was federally listed as threatened in 1978 (43 FR 28932 28935, July 3, 1978). (USFWS, 1975)

This species prefers hammock forests "with smooth-barked native trees that support large quantities of lichens and algae" (USFWS, 1999k). Its historical range consists of only the Florida Keys portion of Monroe County. However, "most of the hardwood hammocks that could serve as suitable habitat for the snail on Stock Island and Key West have been destroyed or severely altered by human activities" (USFWS, 1999k). The hammock habitat that is left on these areas are "small in size and low in quality due to human disturbance, making them unsuitable for the tree snail" (USFWS, 1999k). Threats to the Stock Island tree snail include habitat destruction and loss due to urbanization, hurricanes, drought, pesticide use, over collecting, and predation by fire ants, black rats, birds, and raccoons (USFWS, 1999k).

Tapered Pigtoe. The tapered pigtoe is an elliptical, small to medium-sized mussel that grows to an average of 3 inches. The outer shell is greenish brown to yellowish brown with obvious parallel ridges in younger specimens, with the shell becoming dark brown to black with more subtle ridges in older specimens (USFWS, 2012e). The inside of the shell is bluish white. The tapered pigtoe was federally listed as threatened in 2012 (77 FR 61663 61719, October 10, 2012).

Habitat for the tapered pigtoe is characterized by "medium creeks to medium rivers with slow to moderate current in stable substrates of sand, small gravel, or sandy mud, with slow moderate current" (USFWS, 2012e). Its current range is the Choctawhatchee River drainage in Alabama and Florida, and also includes "several oxbow[104] lakes in Florida, some with a flowing connection to the main river channel" (USFWS, 2012a). Critical habitat was designated in the Choctawhatchee River and Lower Pea River Drainages in Florida and Alabama. The greatest

[103] Living in or among trees.
[104] Oxbow: A bow-shaped lake formed in an abandoned meander of a river (USGS, 2013a).

threat to the tapered pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, dams, and environmental contaminants. (USFWS, 2012a)

Plants

There are 49 endangered and 11 threatened plant species that are federally listed and known to occur in the state of Florida, as summarized in Table 5.1.6-10. The aboriginal prickly-apple *(Harrisia aboriginum gracilis)*, Brooksville bellflower *(Campanula robinsiae)*, and the Florida golden aster *(Chrysopsis floridana)* occur in west peninsular Florida. The beach jacquemontia *(Jacquemontia reclinata)*, etonia rosemary *(Conradina etonia)*, four-petal pawpaw *(Asimina tetramera)*, fragrant prickly-apple *(Cereus eriophorus* var. *fragrans)*, Johnson's seagrass *(Halophila johnsonii)*, Lakela's mint *(Dicerandra immaculata)*, Rugel's pawpaw *(Deeringothamnus rugelii)*, and the tiny polygala *(Polygala smallii)* occur on the eastern coast of Florida. The Avon Park harebells *(Crotalaria avonensis)*, beautiful pawpaw *(Deeringothamnus pulchellus)*, Britton's beargrass *(Nolina brittoniana)*, Carter's mustard *(Warea carteri)*, Cooley's water-willow *(Justicia cooleyi)*, Florida bristle fern (*Trichomanes punctatum* ssp. *Floridanum)*, Florida Bonamia *(Bonamia grandiflora)*, Florida perforate cladonia *(Cladonia perforata)*, Florida ziziphus *(Ziziphus celata)*, Garrett's mint *(Dicerandra christmanii)*, highlands scrub hypericum *(Hypericum cumulicola)*, Lewton's polygala *(Polygala lewtonii)*, longspurred mint *(Dicerandra cornutissima)*, pigeon wings *(Clitoria fragrans)*, pygmy fringe-tree *(Chionanthus pygmaeus)*, sandlace *(Polygonella myriophylla)*, scrub blazingstar *(Liatris ohlingerae)*, scrub buckwheat *(Eriogonum longifolium* var. *gnaphalifolium)*, scrub lupine *(Lupinus aridorum)*, scrub mint *(Dicerandra frutescens)*, scrub plum *(Prunus geniculata)*, short-leaved rosemary *(Conradina brevifolia)*, snakeroot *(Eryngium cuneifolium)*, wide-leaf warea *(Warea amplexifolia)*, and the wireweed *(Polygonella basiramia)* occur in central Florida. Apalachicola rosemary *(Conradina glabra)*, Chapman rhododendron *(Rhododendron chapmanii)*, Cooley's meadowrue *(Thalictrum cooleyi)*, Florida skullcap *(Scutellaria floridana)*, Florida torreya *(Torreya taxifolia)*, fringed campion *(Silene polypetala)*, gentian pinkroot *(Spigelia gentianoides)*, Godfrey's butterwort *(Pinguicula ionantha)*, Harper's beauty *(Harperocallis flava)*, Miccosukee gooseberry *(Ribes echinellum)*, papery whitlow-wort *(Paronychia chartacea)*, telephus spurge *(Euphorbia telephioides)*, and the white birds-in-a-nest *(Macbridea alba)* occur in the Florida panhandle. The Cape Sable thoroughwort *(Chromolaena frustrata)*, Carter's small-flowered flax *(Linum carteri)*, crenulate lead-plant *(Amorpha crenulata)*, deltoid spurge *(Chamaesyce deltoidea* ssp. *Deltoidea)*, Florida brickell-bush *(Brickellia mosieri)*, Florida semaphore cactus *(Consolea corallicola)*, Garber's spurge *(Chamaesyce garberi)*, Key tree cactus *(Pilosocereus robinii)*, Okeechobee gourd *(Cucurbita okeechobeensis* ssp. *Okeechobeensis)*, and Small's milkpea *(Galactia smallii)* occur in south Florida and the Florida Keys. The American chaffseed *(Schwalbea americana)* occurs throughout Florida. The Everglades bully *(Sideroxylon reclinatum* ssp. *Austrofloridense)*, Florida pineland crabgrass *(Digitaria pauciflora)*, Florida prairie-clover *(Dalea carthagenensis floridana)*, and pineland sandmat *(Chamaesyce deltoidea pinetorum)* have been identified as candidate species in Florida. Further information on the habitat, distribution, and threats to the survival and recovery of each of the listed species in Florida is provided below.

Table 5.1.6-10: Federally Listed Plant Species of Florida

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Aboriginal Prickly Apple	*Harrisia aboriginum gracilis*	E	Yes; 11 units along the southwest coast of Florida.	Coastal berms, coastal strand, coastal grasslands and maritime hammocks, and shell mounds; found in 3 counties in southwest Florida.
American Chaffseed	*Schwalbea americana*	E	No	Successional habitats; found in 2 counties and throughout Florida.
Apalachicola Rosemary	*Conradina glabra*	E	No	Edges of steephead ravines, upland pine-wiregrass vegetation, along roads; found in Liberty County in Florida.
Avon Park Harebells	*Crotalaria avonensis*	E	No	Scrub communities where it typically grows in full sun, on bare white sand, or with clumps of *Cladonia* lichens; found in 2 counties on central Florida's Lake Wales Ridge.
Beach Jacquemontia	*Jacquemontia reclinata*	E	No	Open areas that are typically found on the crest and lee sides of stable dunes, and also inhabit maritime hammock or beach coastal strand communities; found in 3 counties on the southeastern coast of Florida.
Beautiful Pawpaw	*Deeringothamnus pulchellus*	E	No	Dry, moist, and wet pine flatwoods in western Charlotte and Lee Counties in southwest Florida, and eastern Orange County in central Florida.
Britton's Beargrass	*Nolina brittoniana*	E	No	Scrub, high pine, and sometimes hammock and sandhill environments; found in 6 counties in central Florida.
Brooksville Bellflower	*Campanula robinsiae*	E	No	Wet prairie and along the edges of ponds near pastureland; found in Hernando and Hillsborough Counties on the west coast of Florida.
Cape Sable Thoroughwort	*Chromolaena frustrata*	E	Yes; 9 parts of Miami-Dade and Monroe Counties.	Open canopy habitats in coastal berms and coastal rock barrens, and in partially open to closed canopy habitats, including buttonwood forests, coastal hardwood hammocks, and rockland hammocks; found in the southern tip of Florida and the Florida Keys.
Carter's Mustard	*Warea carteri*	E	No	Dry, shrub-dominated habitats on the Lake Wales Ridge of central Florida in Highlands, Polk, and Lake Counties.
Carter's Small-flowered Flax	*Linum carteri*	E	Yes; 7 units in Miami-Dade County.	Pine rockland habitat on the Miami Rock Ridge outside of Everglades National Park in Miami-Dade County in south Florida.
Chapman Rhododendron	*Rhododendron chapmanii*	E	No	Sandy pine barrens, low pinelands, pine flatwoods and the edges of titi swamps; found in 4 counties in the Florida panhandle.
Cooley's Meadowrue	*Thalictrum cooleyi*	E	No	Wet pine savannas, grass-sedge bogs, and savanna-like areas with circumneutral soils; found in Walton County in the Florida panhandle.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
Cooley's Water-willow	*Justicia cooleyi*	E	No	Hardwood forests on uplands or hills; with some on low rises in wet hammocks or swamps; found in Hernando and Sumter Counties in central Florida.
Crenulate Lead-plant	*Amorpha crenulata*	E	No	Marl prairies and wet pine rocklands; in Miami-Dade County, Florida.
Deltoid Spurge	*Chamaesyce deltoidea* ssp. *Deltoidea*	E	No	Edges of sand pockets in sand and on limestone; in areas with an open shrub canopy providing high light levels, exposed limestone, and minimal organic litter accumulation; found in Miami-Dade County, Florida.
Etonia Rosemary	*Conradina etonia*	E	No	Deep white-sand scrub dominated by sand pine and shrubby oaks in areas near Florahome in Putnam County, northeast Florida.
Florida Bonamia	*Bonamia grandiflora*	T	No	Scrub areas of central and south Florida in Charlotte, Hardee, Highlands, Hillsborough, Lake, Manatee, Marion, Orange, Osceola, and Polk Counties.
Florida Brickell-bush	*Brickellia mosieri*	E	Yes; 7 units in pine rockland habitat of the Miami Rock Ridge, outside of Everglades National Park, in Miami-Dade County.	Pine rockland habitat on the Miami Rock Ridge outside of Everglades National Park in Miami-Dade County in south Florida.
Florida Bristle Fern	*Trichomanes punctatum* ssp. *Floridanum*	E	No	Rocky outcrops of rockland hammocks with high moisture and humidity under heavy canopy cover.
Florida Golden Aster	*Chrysopsis floridana*	E	No	Grows in open, sunny areas and inhabits sand pine-evergreen oak scrub vegetation on excessively drained fine white sand; found in Hardee, Hillsborough, Manatee and Pinellas Counties, west-central Florida.
Florida Perforate Cladonia	*Cladonia perforata*	E	No	High, well-drained sand dune ridges of central Florida's peninsula, in rosemary sand pine scrub.
Florida Semaphore Cactus	*Consolea corallicola*	E	Yes; 4 units in the Florida Keys.	Rockland hammocks, coastal berm, and buttonwood forests on sandy soils and limestone rockland soils; found in 2 counties in south Florida and the Florida Keys.
Florida Skullcap	*Scutellaria floridana*	T	No	Poorly drained coastal pinelands, specifically seepage bogs too wet for pines; found in Bay, Gulf, Franklin, and Liberty Counties in the Florida panhandle.
Florida Torreya	*Torreya taxifolia*	E	No	Bluffs, ravines, and steepheads; in 3 counties in the Florida panhandle.
Florida Ziziphus	*Ziziphus celata*	E	No	High pine areas or the transition zone between scrubby flatwoods and high pine;

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
				found in Polk and Highlands Counties, on the Lake Wales Ridge of central Florida.
Four-petal Pawpaw	*Asimina tetramera*	E	No	Coastal sand pine scrub areas in Martin and Palm Beach Counties in southeast Florida.
Fragrant Prickly Apple	*Cereus eriophorus* var. *fragrans*	E	No	Open understory, well-drained sand pine scrub habitat; found in Indian and St. Lucie Counties, east Florida.
Fringed Campion	*Silene polypetala*	E	No	Hardwood forests on fairly steep slopes of deep ravines or north-facing hillsides; found in 2 counties in the Florida panhandle.
Garber's Spurge	*Chamaesyce garberi*	T	No	Pine rocklands, coastal flats, coastal grasslands, and beach ridges in Miami-Dade and Monroe Counties, Florida.
Garrett's Mint	*Dicerandra christmanii*	E	No	Inhabits openings in oak scrub; found in Highlands County in central peninsular Florida.
Gentian Pinkroot	*Spigelia gentianoides*	E	No	Open space within well drained upland pinelands that are susceptible to periodic fires; found in Washington, Jackson, and Calhoun Counties in the Florida panhandle.
Godfrey's Butterwort	*Pinguicula ionantha*	T	No	Seepage bogs on gentle slopes, deep bogs, ditches, and depressions in grassy pine flatwoods and grassy plains; found in 6 counties in the Florida panhandle.
Harper's Beauty	*Harperocallis flava*	E	No	The side of roads in full sun, between the lowest part of the roadside ditch and the road. Also found in and next to open bogs, which are surrounded by sandy, occasionally burned longleaf pine woods; found in Bay, Franklin, and Liberty Counties in the Florida panhandle.
Highlands Scrub Hypericum	*Hypericum cumulicola*	E	No	Upland areas with well-drained, clean, white sands; almost exclusively in rosemary patches within the scrub; found in Polk and Highlands Counties on the Lake Wales Ridge in central Florida.
Johnson's Seagrass	*Halophila johnsonii*	T	Yes; Indian River, St. Lucie, Martin, Palm Beach, and Miami-Dade Counties.	Coastal lagoons deeper than other seagrasses. It also inhabits coarse sand and muddy bottoms and in areas of turbid waters and high tidal currents; found on the east coast of Florida from Sebastian Inlet to central Biscayne Bay.
Key Tree Cactus	*Pilosocereus robinii*	E	No	Tropical coastal hammock communities of the Florida Keys, Monroe County.
Lakela's Mint	*Dicerandra immaculata*	E	No	It grows in light shade or clearings in scrub, partly covered or bare sand; found in a limited area in Indian River, Martin, and St. Lucie Counties on the Atlantic coastal ridge in southeast Florida.
Lewton's Polygala	*Polygala lewtonii*	E	No	Oak scrub and high pine communities of Highlands, Polk, and Osceola Counties

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
				within the Lake Wales and Mount Dora ridges of central Florida.
Longspurred Mint	*Dicerandra cornutissima*	E	No	It inhabits the margins of scrub vegetation, surrounded by longleaf pine-turkey oak sandhill vegetation; found on the Sumter Upland in Marion County, central Florida.
Miccosukee Gooseberry	*Ribes echinellum*	T	No	Mixed hardwood or beech-magnolia forests on slopes and in bottomlands; found in Jefferson County, Florida panhandle.
Okeechobee Gourd	*Cucurbita okeechobeensis* ssp. *Okeechobeensis*	E	No	Swamp and marsh habitat in 6 counties, mainly along the St. Johns River in north Florida, and around the shoreline of Lake Okeechobee in south Florida.
Papery Whitlow-wort	*Paronychia chartacea*	T	No	It inhabits rosemary scrub on the Lake Wales Ridge in central Florida, and in coarse white sand along the shoreline of karst lakes in the Florida panhandle.
Pigeon Wings	*Clitoria fragrans*	T	No	It inhabits high pine and scrub communities, in white and yellow sand soils; found in Highlands and Polk Counties on the Lake Wales Ridge in central Florida.
Pygmy Fringe-tree	*Chionanthus pygmaeus*	E	No	It mainly inhabits scrub, but also grows in high pineland, dry hammocks, and transitional habitats; found in DeSoto, Osceola, and Sarasota Counties, and on Lake Wales Ridge in Polk and Highlands Counties in central Florida.
Rugel's Pawpaw	*Deeringothamnus rugelii*	E	No	It inhabits slash pine flatwoods with an understory of grasses and sedges; found near the Atlantic coast in Volusia County, east-central Florida.
Sandlace	*Polygonella myriophylla*	E	No	Moderately disturbed scrub in central Florida's upland ridge, in Highlands, Osceola, and Polk Counties.
Scrub Blazingstar	*Liatris ohlingerae*	E	No	Open, fire-maintained habitat on the Lake Wales Ridge in Highlands and Polk Counties.
Scrub Buckwheat	*Eriogonum longifolium* var. *gnaphalifolium*	T	No	It inhabits areas between scrub and high pine sandhills and in turkey oak barrens; found in Marion, Lake, Putnam, Pasco, Orange, Seminole, and Osceola counties, and on the Lake Wales Ridge in Polk and Highlands Counties.
Scrub Lupine	*Lupinus aridorum*	E	No	It inhabits well-drained white or yellow sandy soils with little organic matter that generally support sand pine scrub; found on the southern Mount Dora Ridge in western Orange County, and on the Winter Haven Ridge in north-central Polk County in south central Florida.
Scrub Mint	*Dicerandra frutescens*	E	No	It inhabits excessively drained, yellow sandy soils in disturbed areas of sand pine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Florida	Habitat Description
				scrub, oak scrub, and sandhill habitats; found on the Lake Wales Ridge in Highlands County, central Florida.
Scrub Plum	*Prunus geniculata*	E	No	Found in Lake, Orange, Osceola, Polk, and Highlands Counties, along the ridges of central Florida.
Short-leaved Rosemary	*Conradina brevifolia*	E	No	Found in white sand scrub on the Lake Wales Ridge in Polk and Highlands Counties in central Florida.
Small's Milkpea	*Galactia smallii*	E	No	Found in the Redland pine rocklands of southern Miami-Dade County, Florida.
Snakeroot	*Eryngium cuneifolium*	E	No	It inhabits sunny areas of bare sand; found on the Lake Wales Ridge, in Highlands County, central Florida.
Telephus Spurge	*Euphorbia telephioides*	T	No	It inhabits low land ridges near the coast among scrubby oaks; found in Bay, Gulf, and Franklin Counties in the Florida panhandle.
Tiny Polygala	*Polygala smallii*	E	No	It inhabits sand pockets of pine rocklands, open sand pine scrub, slash pine, high pine, and well-drained coastal spoil; near the Atlantic coast in southeast Florida.
White Birds-in-a-nest	*Macbridea alba*	T	No	It inhabits grassy pine flatwoods in poorly drained savannahs and road edges; found in Bay, Gulf, Franklin, and Liberty Counties, the Florida panhandle.
Wide-leaf Warea	*Warea amplexifolia*	E	No	It inhabits the high pine or sandhill community; found on the northern portion of the Lake Wales Ridge in Lake, Polk, and Osceola Counties, south Florida.
Wireweed	*Polygonella basiramia*	E	No	It inhabits rosemary scrub in central peninsular Florida on the Lake Wales, Winter Haven, and Bombing Range ridges.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015v) (USFWS, 2015h).

Aboriginal Prickly-apple. The aboriginal prickly-apple is a cactus with round ridged stems growing up to 20 feet from base to tip. The aboriginal prickly-apple was federally listed as endangered in 2013 (78 FR 63795 63821, October 24, 2013). It is known to occur in Charlotte, Lee, and Sarasota Counties in southwest Florida (USFWS, 2015du). This species can be found "in communities classified as coastal strand, coastal grasslands, coastal berms, maritime hammocks, and shell mounds" (USFWS, 2015). Critical habitat was designated in 2015 in 11 units along the southwest coast of Florida. Threats include habitat loss, competition from non-native species, wildfire, storm surge, "poaching, disease, predation, and climate change" (USFWS, 2015).

American Chaffseed. The American chaffseed is "a perennial member of the figwort family" that "grows 12 to 24 inches high," and has large purple and yellow tubular flowers that form a spike-like cluster (USFWS, 2014d). The American chaffseed was listed as endangered in 1992 (57 FR 44703 44708, September 29, 1992). The American chaffseed is a coastal plain species

and ranges throughout the Atlantic and Gulf coasts (USFWS, 2014d). In 2008, 53 known sites were recorded in this range. The species is known from two counties in Florida, and throughout the state (USFWS, 2008b) (USFWS, 2014d).

Suitable habitat for this species includes successional habitats such as pine flatwoods, fire-maintained savannas, and peaty wetlands. The American chaffseed prefers sandy, acidic, and seasonally moist to dry soils and species-rich plant communities where grasses, sedges, and savanna dicots are numerous. "American chaffseed is dependent on factors such as fire, mowing, and fluctuating water tables to maintain crucial open to partially-open conditions that it requires" (USFWS, 2014d). "Threats to the American chaffseed include collecting, excessive disturbance and loss of habitat due to development and natural vegetation succession" (USFWS, 2014d).

Apalachicola Rosemary. The Apalachicola rosemary is a minty-aromatic shrub with evergreen, opposite, and needle-like leaves that are hairless on the upper surface with dense hairs matted on the underside. The petals bend sharply downward to form a funnel-shaped throat. The many branches are spreading or upright, and the shrub can grow up to 6.5 feet (USFWS, 1994a). The Apalachicola rosemary was federally listed as endangered in 1993 (58 FR 37432 37443, July 12, 1993) (USFWS, 2015dw). The Apalachicola rosemary can be found in a portion of Liberty County, Florida near the Apalachicola River. This species was "originally restricted to a specialized habitat, the edges of steephead ravines,[105] and possibly to upland pine-wiregrass vegetation," but recently, it has been found in disturbed areas such as along roads (USFWS, 1994a). Threats to this species include habitat destruction and modification due to forestry practices and land conversion, and commercial and recreational harvest (USFWS, 1994a).

Avon Park Harebells. The Avon Park harebells are a spreading, perennial herb that looks likes bushy bunches of fuzzy grayish leaves hugging the ground. It has one to three hairy, flowering stems, round leaves that are covered in white or yellowish-white hairs, and a pea shaped flower with inflated long seed pods (USFWS, 1999l). The Avon Park harebells was federally listed as endangered in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS, 2015dz). The species can be found in two counties on central Florida's Lake Wales Ridge. Its habitat consists of "scrub communities found on the Lake Wales Ridge where it typically grows in full sun, on bare white sand, or in association with clumps of *Cladonia* lichens. However, it may also occur in the partial shade of other plants ... along trails, open edges, or on previously disturbed roadbeds" (USFWS, 1999l). Threats include loss of habitat due to the conversion of high pineland and scrub for agricultural purposes (principally citrus), and for commercial, residential, and recreational purposes (USFWS, 1999l).

Beach Jacquemontia. The beach jacquemontia is a member of the morning glory family, a perennial vine with white to light pink flowers. It is restricted to small, separated populations in Miami-Dade, Broward, and Palm Beach Counties on the southeastern coast of Florida (USFWS, 1999m). The beach jacquemontia was federally listed as endangered in 1993 (58 FR 62046 62050, November 24, 1993) (USFWS, 2015ab). "*Jacquemontia reclinata* requires open areas

[105] Steephead ravines: "circular spring head with nearly vertical bluffs, which form the upper ends of narrow, deeply incised, stream-eroded ravines" (Schmidt & Clark, 1980).

that are typically found on the crest and lee sides of stable dunes. *Jacquemontia reclinata* may also invade and restabilize maritime hammock or coastal strand communities that have been disturbed by tropical storms, hurricanes, and possibly fire" (USFWS, 1999m). The biggest threat to this species is habitat loss and modification due to much of its primary habitat being destroyed or altered for residential and commercial construction, and beach erosion (USFWS, 1999m).

Beautiful Pawpaw. The beautiful pawpaw is a low-growing shrub, rarely reaching more than 1.5 feet above the ground. It has rounded, green leaves and white flowers, with fleshy, smooth, yellow-green fruits when ripe, and dark brown seeds (USFWS, 1999n). The beautiful pawpaw was federally listed as endangered in 1986 (51 FR 34415 34420, September 26, 1986) (USFWS, 2015ac). It is found in dry, moist, and wet pine flatwoods in western Charlotte and Lee Counties in southwest Florida, and eastern Orange County in central Florida. The beautiful pawpaw depends on frequent ground fires to limit competition with larger grasses and shrubs; taking advantage of fire-created clearings by flowering and dropping its seeds during the first growing season after a fire. The biggest threat to this species is habitat loss due to agricultural, residential, and commercial conversion of land. Another threat is habitat degradation due to the exclusion of fire throughout much of its range. (USFWS, 1999n)

Britton's Beargrass. The Britton's beargrass is a clump-forming perennial in the agave family. The leaves are 3 to 6.5 feet long, with the young leaves standing up straight, while the old leaves lay almost flat on the ground. In April, the flowering stem is covered with small white flowers that grow at least 6 feet above the base of the plant (USFWS, 2015). The Britton's beargrass was federally listed as endangered in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS 2015by). This species can be found in six counties in Florida, from the south end of Lake Wales Ridge in Highlands County north to Marion County and northern Lake County (USFWS, 2016n). It inhabits scrub, high pine, and sometimes hammock and sandhill environments. The main threat to Britton's beargrass is loss of habitat due to agricultural (mostly citrus groves) and residential development (USFWS, 2015).

Brooksville Bellflower. The Brooksville bellflower is an annual herb, with slender stems growing up to 6 inches tall. Its leaves are largest at the base of the plant, with narrower and shorter leaves closer to the top of the plant. Many of the flowers are closed and self-pollinating; however, when open, it has solitary deep purple, bell-shaped flowers that cross-pollinate (USFWS, 2015). The Brooksville bellflower was federally listed as endangered in 1989 (54 FR 31190 31196, July 27, 1989) (USFWS, 2015ae). This species is native to the Brooksville Ridge, in north central Hernando County, and can also be found in Hillsborough County, Florida. Its habitat is a "wet prairie and along the edges of ponds near pastureland" (USFWS, 2015). The main threat to the Brooksville bellflower is habitat loss from residential and agricultural development. Runoff, as a byproduct of development, increases pond water levels and may be contaminated by petroleum, fertilizers, and herbicides, which decrease the numbers of the Brooksville bellflower. Other threats include collecting and vandalism. (USFWS, 2015)

Cape Sable Thoroughwort. The Cape Sable thoroughwort is a perennial herbaceous plant, reaching about 6 to 10 inches in height with upright stems. It has blue to lavender flowers that grow in clusters of two to six (USFWS, 2014g). The Cape Sable Thoroughwort was federally

listed as endangered in 2013 (78 FR 63795 63821, October 24, 2013) (USFWS, 2015ag)(USFWS 2015ca). This species is known from the southern tip of Florida and the Florida Keys. Critical habitat was designated in 2014 in nine separate units in Miami-Dade and Monroe Counties, south Florida. It inhabits "open canopy habitats in coastal berms and coastal rock barrens, and in semi-open to closed canopy habitats, including buttonwood forests, coastal hardwood hammocks, and rockland hammocks" (USFWS, 2014g). The threats to the Cape Sable thoroughwort include habitat loss and modification, recreation impacts, and competition from nonnative plant species (USFWS, 2014g).

Carter's Mustard. The Carter's mustard is "a fire-dependent annual herb," reaching up to 5 feet tall with upright green stems (USFWS, 1999o). It has many slender branches that grow upwards to form an open, rounded crown. The leaves grow alternately on the stem, and lower leaves fall off when the plant flowers. "Leaf size and shape varies with their age and position on the plant" (USFWS, 1999o). The leaves are rounded at the tip, with smaller and narrower leaves towards the tips of stems, and larger leaves closer to the bases of stems. It has a pod which carries a number of oblong shaped seeds (USFWS, 1999o). The Carter's mustard was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015ah). This species can be found in dry, shrub-dominated habitats on the Lake Wales Ridge of central Florida in Highlands, Polk, and Lake Counties. The primary threats to the Carter's mustard are habitat loss due to citrus groves and residential developments, and long-term fire suppression. (USFWS, 1999o)

Carter's Small-flowered Flax. The Carter's small-flowered flax is an annual herb reaching 4 to 24 inches tall with smooth stems; long, narrow, alternate leaves with a pair of small red glands at the base; yellow-orange flowers; and rounded fruit that open into five segments (FNAI, 2000a). The Carter's small-flowered flax was federally listed as endangered in 2014 (79 FR 52567 52575, September 4, 2014) (USFWS, 2015as). Critical habitat was designated in 2015 in seven separate units in Miami-Dade County. This species can only be found within pine rockland habitat on the Miami Rock Ridge outside of Everglades National Park in Miami-Dade County in south Florida. These pine rocklands are maintained by fire and characterized by an open canopy and undergrowth and by an often exposed limestone substrate. The Carter's small-flowered flax needs pine rocklands that have undergone some sort of substrate disturbance such as occurs from fire. Threats to this species include habitat loss and fragmentation, fire suppression, competition with nonnative, invasive plants, and sea level rise (USFWS, 2015as) (USFWS, 2015k).

Chapman Rhododendron. The Chapman rhododendron is a small, evergreen shrub with stiff branches growing upwards with alternating leaves. It has light pink flowers that grow in clusters, and fruit capsules that are clustered and stay on the plant for several years (USFWS, 1983a). The Chapman rhododendron was federally listed as endangered in 1979 (44 FR 24248 24250, April 24, 1979) (USFWS, 2015ai). This species is known to occur in four counties in the Florida panhandle and in northeast Florida. It inhabits "sandy pine barrens, low pinelands, pine

flatwoods,[106] and borders of titi swamps"[107] (USFWS, 1983a). It can always be found near a titi bog, and in scrubby flatwoods. It is adapted to and sustained by periodic fires. Threats to the Chapman rhododendron include habitat destruction and alteration due to development and logging, the suppression of fire, drainage of habitats, and the taking of plants for ornamental use. (USFWS, 1983a)

Cooley's Meadowrue. The endangered "Cooley's meadowrue is a tall herb (3 feet or more in flower), with the slender stems erect in" sunny locations to lax or sprawling in shade, leaves alternately divided (lower leaves usually subdivided) (USFWS, 1994b). Leaflets are about 0.8 inches long, mostly narrow (four or more times as long as wide), with entire (untoothed) margins or rarely with two to three lobes near the tip. All parts of the plant are glabrous (smooth) and have virtually no hairs or glands. Male and female flowers are on separate plants, in loose few-flowered clusters, appearing at the top of the plants in late June to early July" (USFWS, 1994b). Cooley's meadowrue was listed as endangered in 1989 (54 FR 5935 5938, February 7, 1989). The species is known from occurrences in northwest Florida and in coastal North Carolina; in Florida, the species is known in Walton County (USFWS, 2015ak). Suitable habitat for this species includes wet pine savannas, grass-sedge bogs, and savanna-like areas with circumneutral[108] soils, in habitat kept open by frequent fire or other disturbance ("clearings, the edges of frequently burned savannas, power line right-of-ways which are maintained either by fire or mowing, and roadside edges") (USFWS, 1994b). Threats include habitat loss due to drainage, conversion to forestry, agriculture or development road building, and succession through fire suppression (USFWS, 1994b).

Cooley's Water-willow. The Cooley's water willow is a short (less than 16 inches tall), perennial herb with upright stems and leaves up to two inches long. Bright lavender-rose and white colored flowers appear on forked branches that are a little longer than the leaves (USFWS, 2015). The Cooley's water willow was federally listed as endangered in 1989 (54 FR 31190 31196, July 27, 1989) (USFWS, 2015al). This species is native to the Brooksville Ridge, in north central Hernando County, and can also be found in "Withlacoochee State Forest near Richloam and on two sites in Sumter County, [Florida]" (USFWS, 2015). It inhabits hardwood forests on uplands or hills; with some on low rises in wet hammocks or swamps. The main threat to the Cooley's water willow is habitat loss from residential and agricultural development, as well as limestone mining (USFWS, 2015).

Crenulate Lead-plant. Also known as the Miami lead-plant, the crenulate lead-plant is a perennial, deciduous shrub reaching up to 5 feet with red/purple branches with green/gray leaflets and loose clusters of white flowers (USFWS, 1999p). The crenulate lead-plant was federally listed as endangered in 1985 (50 FR 29345 29349, July 18, 1985) (USFWS, 2015am).

[106] Scrubby flatwoods: "have an open canopy of widely spaced pine trees and a low, shrubby understory dominated by scrub oaks and saw palmetto, often interspersed with areas of barren white sand" (FNAI, 2010d).
[107] Titi swamp: a freshwater swamp forest dominated by titi (*Cliftonia monophylla* and/or *Crrilla racemiflora*) that "occurs on the Atlantic and Gulf coastal plains from eastern Texas eastward to Florida, and north to Virginia and Maryland" (Coladonato, 1992).
[108] Circumneutral: "pH between 5.5 and 7.4" (USGS, 2013a).

The range of the crenulate lead-plant is a 20 square mile area from Coral Gables to Kendall, Miami-Dade County, Florida. This species inhabits marl prairies[109] and wet pine rocklands, which are maintained by periodic fires. The species needs sun to partial shade. Threats to the crenulate lead-plant are large habitat loss due to development, fire suppression, drainage, and exotic pest plant invasions (USFWS, 1999p).

Deltoid Spurge. The deltoid spurge is a perennial herb with brown stems, brown to reddish brown smooth leaves, and ridged yellowish-white seeds that grows in low mats over exposed limestone (USFWS, 1999q). The deltoid spurge was federally listed as endangered in 1985 (50 FR 29345 29349, July 18, 1985) (USFWS, 2015an). The deltoid spurge is only known from south Miami to the Homestead area in Miami-Dade County, Florida. It is usually found growing at the edges of sand pockets in sand and on limestone; in areas with an open shrub canopy providing high light levels, exposed limestone, and minimal organic litter accumulation. Periodic fires are necessary in order to keep the shrub canopy open and burn up the organic litter. Threats to the deltoid spurge include habitat loss due to urban expansion, fire suppression, and exotic plant invasions. (USFWS, 1999q)

Etonia Rosemary. The Etonia rosemary is a shrub in the Mint family that grows up to 5 feet with curving branches. The upper side of the leaf is dull green and covered with short, soft hairs. The lower side is paler and curves in with dense tiny hairs. There are clusters of three to seven lavender-blue to lavender-rose flowers. The pollen sacs are dark purple with white hairs, and four brown, egg-shaped seeds are produced (USFWS, 2005b). The Etonia rosemary was federally listed as endangered in 1993 (58 FR 37432 37443, July 12, 1993) (USFWS, 2015ap). This species can only be found in areas near Florahome in Putnam County, Florida. It inhabits "deep white-sand scrub dominated by sand pine and shrubby oaks" (USFWS, 2005b). Etonia rosemary thrives in natural openings or artificial clearings rather than in the overstory. They flourish in areas of disturbance, usually from fire. Threats to the Etonia rosemary are habitat loss and fire suppression (USFWS, 2005b).

Florida Bonamia. The Florida bonamia is a perennial vine in the morning glory family with long stems more than 3.4 feet in length. It has leathery leaves and solitary, large, deep blue or bluish-purple flowers with white throats. "The flowers open in the morning and wilt by early afternoon" (USFWS, 1999r). Each fruit contains four smooth, pale brown or greenish-brown seeds (USFWS, 1999r). The Florida bonamia was federally listed as threatened in 1987 (52 FR 42068 42071, November 2, 1987) (USFWS, 2015dl). This species is found on scrub areas of central and south Florida in Charlotte, Hardee, Highlands, Hillsborough, Lake, Manatee, Marion, Orange, Osceola, and Polk Counties. It grows within or near scrub or on the edge of scrub habitat in the white sands/dunes of the central ridge system. It is associated with sand pine scrub vegetation, and "prefers an open canopy in full sunlight in order to avoid competition" (USFWS, 1999r). The main threat to the Florida bonamia is habitat destruction due to residential housing and agricultural expansion, fungus, and fire suppression (USFWS, 1999r).

[109] Marl Prairie: "These relatively short-hydroperiod marshes are typified by a diverse assemblage of low-growing vegetation" (NPS, 2016c).

Florida Brickell-bush. The Florida Brickell-bush is a branching perennial herb between 1 to 3.5 feet tall with long, alternate leaves "usually spreading or curved downward" (USFWS, 2013b). "The flower heads ae in loose, open clusters at the ends of the branches" (USFWS, 2013b). The Florida brickell-bush was federally listed as endangered in 2014 (79 FR 52567 52575, September 4, 2014) (USFWS, 2015as). The plant's critical habitat designations include land in pine rockland habitat on the Miami Rock Ridge, outside of Everglades National Park, in Miami-Dade County, Florida. Areas within the designations include occupied and unoccupied habitat within the plant's historical range. This species can now only be found in pine rockland habitat on the Miami Rock Ridge outside of Everglades National Park in Miami-Dade County in south Florida. These pine rocklands are maintained by fire and characterized by an open canopy and undergrowth and by an often exposed limestone substrate. The brickell-bush usually occurs on exposed limestone in areas with only a little substrate disturbance. Threats to this species include habitat loss and fragmentation, and fire suppression. (USFWS, 2015dp)

Florida bristle fern. The Florida bristle fern is a fern found on "rocky outcrops of rockland hammocks,[110] in oolitic[111] limestone solution holes,[112] and occasionally on tree roots in limestone- surrounded areas" (USFWS, 2015m). This species was listed as endangered in 2015 (50 FR 60440 60465, October 6, 2015). The Florida bristle fern is very small and resembles a moss. It is mat-forming with root-like structures, and at the tips of some fronds bristle-like growths extending from cup-like tubes that contain the enclosures where the fern's spores are formed. These thin, filmy fronds are 0.12 to 0.79 inches long and 0.08 to 0.43 inches wide, and are "fan-shaped, round, and entire or irregularly lobed" (USFWS, 2015m). The Florida bristle fern is unique in that it does not have cuticles or has highly reduced cuticles covering the epidermis. Reproduction occurs using spores and by division of rhizomes. (USFWS, 2015m)

Suitable habitat for this species consists of sheltered rockland hammocks with continuous high moisture and humidity. Populations of the Florida bristle fern occur in locations with heavy canopy cover and shady conditions. This species may grow directly on rocks or non-parasitically on other plants. Rockland habitats used by the Florida bristle fern are primarily marine limestone of the Miami Rock Ridge. (USFWS, 2015m)

Currently, the Florida bristle fern occurs in Sumter County in central Florida and Miami-Dade County in south Florida. Habitat reduction of the rockland hammocks is the biggest threat to the Florida bristle fern. Rockland hammocks are imperiled and have undergone significant reduction of habitat type due to urbanization, land clearance for residential development and agriculture, and susceptibility of fire, frost, canopy disruption, and groundwater reduction. (USFWS, 2015m)

Florida Golden Aster. The Florida golden aster is a perennial herb. Young plants form rosettes with leaves covered in dense, white hairs. Stems grow upright from the rosettes up to 1.5 feet

[110] Rockland hammock: Also known as tropical hardwood hammock, rockland hammocks are "closed canopy forests, dominated by a diverse assemblage of evergreen and semi-deciduous tree and shrub species" (USFWS, 2016a).
[111] Oolitic: comprised of minute rounded masses resembling fish eggs (USFWS, 2015m).
[112] Solution hole: A hole frequently found in hardwood hammocks and formed gradually with the erosion or dissolving of limestone. "When the wet season arrives, these holes fill with water and help give the hammocks added protection from possible files (like a moat protecting a castle)" (NPS, 2016).

tall, with closely spaced, hairy leaves. The yellow flowers are clustered flatly on top, and are a little over 1 inch wide. "This plant is short lived, and reproduces by seeds" that are primarily dispersed by the wind (USFWS, 2009c). The Florida golden aster was federally listed as endangered in 1986 (51 FR 17974 17977, May 16, 1986) (USFWS, 2015at). This species can be found in Hardee, Hillsborough, Manatee and Pinellas Counties, Florida. It prefers open, sunny areas within "sand pine-evergreen oak scrub vegetation on excessively drained fine white sand" (USFWS, 2009c). The greatest threat to the Florida golden aster is the loss of habitat due to residential and commercial development. "Other threats are mowing, dumping, excessive grazing, and off-road vehicle use" (USFWS, 2009c).

Florida Perforate Cladonia. The Florida perforate cladonia is a member of the reindeer lichen family. It has holes below each branch point, and wide, smooth, yellowish gray-green hollow branches (USFWS, 1999s). The Florida perforate cladonia was federally listed as endangered in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS, 2015ax).This species is known to occur in approximately 27 sites within eight counties in Florida. Most of the sites are on Lake Wales Ridge in central Florida. The Florida perforate cladonia inhabits the high, well-drained sand dune ridges of Florida's peninsula, in rosemary sand pine scrub. The main threat to this species is the significant loss of scrub habitat due to land conversion to citrus and residential development. Other threats include "trampling, off-road vehicles, hurricane washover, and improper land management" (USFWS, 1999s).

Florida Semaphore Cactus. The Florida semaphore cactus is a tree-like cactus, growing up to 6 feet tall with an oval shaped main trunk covered in spines. It has bright red flowers and yellow, one to two inch egg-shaped fruits (USFWS, 2013a). The Florida semaphore cactus was federally listed as endangered in 2013 (78 FR 63795 63821, October 24, 2013) (USFWS, 2015ba).This species can be found in "rockland hammocks, coastal berm, and buttonwood forests … on sandy soils and limestone rockland soils"(USFWS, 2015). It likes areas with some canopy cover and sun exposure. It is known to occur in two counties in south Florida and the Florida Keys. Critical habitat was designated in 2014 in four units located in Monroe and Miami-Dade Counties. Threats include habitat loss, storm surge, poaching, disease, predation, and climate change (USFWS, 2015).

Florida Skullcap. The Florida skullcap is a member of the mint family. It is a perennial herb with a minimum number branched stems, opposite leaves with a blunt, purplish tip, and solitary bell-shaped lavender-blue flowers (USFWS, 1994c). The Florida skullcap was federally listed as threatened in 1992 (57 FR 19813 19819, May 8, 1992) (USFWS, 2015bb). This species can be found in Gulf, Franklin, and Liberty Counties in the northwest portion of Florida. It inhabits poorly drained coastal pinelands, specifically seepage bogs too wet for pines, with frequent fires. Threats to the Florida skullcap include habitat modification for forestry purposes, and fire suppression, titi (*Cyrilla reacemiflora*) encroachment, and drainage alternations (USFWS, 1994c).

Florida Torreya. The Florida torreya is a small, conical tree of the yew family with whorled branches. The evergreen, needle-like leaves are 1-1.5 inches long, stiff, sharply pointed at the tip, and are arranged on both sides of the twigs in a single plane. The leaves and twigs have a

distinct pungent, resinous odor. Pollen cones and ovules are borne on separate trees (USFWS, 1986b). Florida torreya was listed as endangered in 1984 (49 FR 2783 2786, January 23, 1984). The species is native to several counties along the Apalachicola River and Lake Seminole in northwest Florida and adjoining Georgia; in Florida, the species is known from three counties in the northwest portion of the state (USFWS, 1986b) (USFWS, 2015bc). Suitable habitat for this species includes bluffs, ravines, and steepheads. Threats include habitat alterations (logging, conversion of habitat to pine plantations), and fungal stem and needle blight (USFWS, 1986b).

Florida Ziziphus. The Florida ziziphus is a spiny deciduous shrub that can grow to over 6.5 feet. The shrub is made up of groups of stems with bent, joined branches that give rise to short, straight, spiny branchlets. The oblong leaves are alternate and deciduous, with a dark glossy green upper leaf surface, and dull light green underside. The small, greenish-yellow and white flowers grow bunched together on short shoots (USFWS, 1999t). The Florida ziziphus was federally listed as endangered in 1989 (54 FR 31190 31196, July 27, 1989) (USFWS, 2015bd). This species can be found in Polk and Highlands Counties, on the Lake Wales Ridge of central Florida. It inhabits high pine areas or the transition zone between scrubby flatwoods and high pine. Threats to the Florida ziziphus include habitat loss, potential reproductive and genetic limitations, exotic species invasion, and the potential for over collection and vandalism. (USFWS, 1999t)

Four-petal Pawpaw. The four-petal pawpaw is a tall aromatic shrub in the custard apple family, and can reach up to almost 10 feet in height. Leaves are oblong, alternate, and yellow-green to deep green in color. The maroon flowers occur singly, but if the plant is burned or damaged, two or three flowers may grow together. The fruit is oblong and greenish-yellow, and gives off a banana-like smell when ripe. The flat seeds are dark brown and shiny (USFWS, 1999u). The four-petal pawpaw was federally listed as endangered in 1986 (51 FR 34415 34420, September 26, 1986) (USFWS, 2015be). This species is found in coastal sand pine scrub areas in Martin and Palm Beach Counties in southeast Florida. It only inhabits sand pine scrub vegetation on old, coastal dunes. The biggest threat to the Four-petal Pawpaw is the destruction of its sand pine habitat due to residential housing development and commercial activities (USFWS, 1999u).

Fragrant Prickly-apple. The fragrant prickly-apple is a solitary, slender, tree cactus that has from one to eight spiny, cane-like, succulent ridged stems. The spine-bearing regions are aligned along the ridges with 9 to 13 spines that are mostly grayish and yellowish at the tip. The flower buds are white and hairy, with fragrant, showy flowers that only open at night. The fruit is dull red and has long tufts of white hairs and contains approximately 1,500 small black seeds (USFWS, 1999v). The fragrant prickly-apple was federally listed as endangered in 1985 (50 FR 45618 45621, November 1, 1985) (USFWS, 2015bf). This species can only be found in St. Lucie County in eastern peninsular Florida (FNAI, 2000c). It prefers open understory, well-drained sand pine scrub habitat. The water capacity, fertility, and organic matter content of this habitat are all very low. The main threat to the fragrant prickly-apple is habitat loss and fragmentation (USFWS, 1999v).

Fringed Campion. The fringed campion is a perennial herb that forms mats by spreading vegetatively, with long, slender stolon-like rhizomes and leafy offshoots, both of which

terminate in overwintering clusters of leaves (rosettes). Leaves of the rosette and stem are opposite, widest toward the tip, mostly 1 to 4 inches long. Each rosette produces one to several erect flowering shoots, each of which is unbranched or sparingly branched, up to 16 inches tall. The flowers are arranged in groups of 3-5 at the top of the flowering shoot. The wide apex of each petal is divided into slender segments, giving the flower a fringed appearance. The petals are pink or white (USFWS, 1996b). Fringed campion was listed as endangered in 1991 (56 FR 1932 1936, January 18, 1991). The species is known from central and southwestern Georgia and northwestern Florida, with most populations occurring in the Apalachicola and Flint River watersheds; in Florida, the species can be found in Gadsden and Jackson Counties (USFWS, 1996b) (USFWS, 2015bg). Suitable habitat for this species includes hardwood forests on fairly steep slopes of deep ravines or north-facing hillsides, sometimes on nearly level ground with circumneutral soils. Threats include clearing and degradation of land for urban/suburban, agricultural, and pine plantation purposes, impoundments, and grazing by deer (USFWS, 1996b).

Garber's Spurge. The Garber's spurge is a short-lived perennial[113] herb with juvenile stems and oval shaped leaves. The fruit is a small capsule with either smooth or ridged seeds (USFWS, 1999w). The Garber's spurge was federally listed as threatened in 1985 (50 FR 29345 29349, July 18, 1985) (USFWS, 2015bi). This species can be found in the pine rocklands, coastal flats, coastal grasslands, and beach ridges in Miami-Dade and Monroe Counties, Florida. It grows at low elevations either on thin sandy soils or on limestone. It needs open sunny areas and periodic fires to maintain a relatively open overstory. Threats to the Garber's spurge include habitat loss from increased residential and commercial development, fire suppression, and exotic plant invasion (USFWS, 1999w).

Garrett's Mint. The Garrett's mint is a small, fragrant shrub with stiff shoots coming up from a branching, woody base. The leaves are oval shaped and the flowers start off yellow when they're budding, but turn a pale cream at maturity with vivid purple-red markings spotted on the petals (USFWS, 1999x). Garrett's mint was federally listed as endangered in 1985 (50 FR 45621 45624, November 1, 1985) (USFWS, 2015bj). This species can be found in Highlands County in central peninsular Florida. It is a "gap" species, meaning it inhabits openings in oak scrub and does not grow well when shaded. It grows in well drained yellow sands. Threats to Garrett's mint include loss of habitat due to residential and agricultural development (especially citrus groves), and fire suppression (USFWS, 1999x).

Gentian Pinkroot. The gentian pinkroot is a small, perennial herb with a single straight stem with opposite, paired leaves. The pale to dark pink flower makes a star shape when closed, and opens up into five pointed petals. It produces fruit capsules that forcefully eject the seeds when mature (USFWS, 2012b). The gentian pinkroot was federally listed as endangered in 1990 (55 FR 49046 49050, November 26, 1990). This species can be found in Alabama and Florida. It can be found in Washington, Jackson, and Calhoun Counties in northwest Florida (USFWS, 2015bk). It grows as a solitary individual or in small clumps in somewhat dry soil, but rich organic material, and in areas with a lot of visible limestone formations and chalky soils. The gentian pinkroot usually inhabits open space within well drained upland pinelands that are

[113] Short-lived perennial: Perennial usually lasting only 10 years (Iowa State University, 2016).

susceptible to periodic fires. The primary threats to gentian pinkroot are fire suppression, and habitat loss and alteration due to clearcutting, conversion of land to pine plantations, and development (USFWS, 2012b).

Godfrey's Butterwort. The Godfrey's butterwort is a member of a small family of carnivorous plants. It has a rosette about 6 inches across of fleshy, bright green leaves that are rounded at the tips, with the edges rolled up. The upper sides of the leaves are covered with short hairs that capture insects. The 1 inch wide flowers are pale violet to white with a deeper violet throat streaked with dark violet veins. They are on leafless stalks up to 6 inches tall (USFWS, 1994d). The Godfrey's butterwort was federally listed as threatened in 1993 (58 FR 37432 37443, July 12, 1993) (USFWS, 2015bl). This species can be found near the Gulf coast in Bay, Franklin, Gulf, and Liberty Counties, northwest Florida. It "inhabits seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and grassy savannahs" (USFWS, 1994d). Threats to the Godfrey's butterwort include habitat modification, fire suppression, titi (*Cyrilla racemiflora*) encroachment, and drainage alternations (USFWS, 1994d).

Harper's Beauty. Harper's beauty is a perennial herb in the lily family with short stems where the leafy base expands into a sheath[114] that clasps the stem. A single yellow flower with six petals grows on a stalk much longer than the leaves (USFWS, 1983b). Harper's beauty was federally listed as endangered in 1979 (44 FR 56862 56863, October 2, 1979) (USFWS, 2015bp). The five year review conducted in 2015 indicated this species was observed in Bay, Franklin and Liberty Counties in the Apalachicola region of the Florida panhandle. It mostly inhabits the side of roads in full sun, between the lowest part of the roadside ditch and the road. It is also found in and next to open bogs, which are surrounded by sandy, occasionally burned longleaf pine woods. Threats to Harper's beauty include prescribed burns occurring during the growing season, drought, collection, and vehicles (crushing the species) (USFWS, 1983b) (USFWS, 2015bp) (USFWS, 2015r).

Highlands Scrub Hypericum. The Highlands scrub hypericum is "a small, short-lived perennial herb" that branches from the base with 3 to 17 stems with opposite, needle-like leaves (USFWS, 1999y). All of the stems bear small, bright yellow, propeller-shaped flowers with 27 anthers, and small fruits that are red when immature and dark purple when mature with small, dark brown seeds (USFWS, 1999y). The Highlands scrub hypericum was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015br). This species can be found in Polk and Highlands Counties on the Lake Wales Ridge in central Florida. It inhabits upland areas with well-drained, clean, white sands; almost exclusively in rosemary patches within the scrub. Threats to the Highlands scrub hypericum include habitat loss due to development and agriculture, fire suppression, and isolation of existing populations (USFWS, 1999y).

Johnson's Seagrass. Johnson's seagrass is the only marine plant species to be listed under the Endangered Species Act. It has green leaves growing in pairs with flowers attached to the horizontal underground stem. It reproduces only asexually, which may contribute to its limited distribution. It is a food source for the endangered West Indian manatees and threatened green

[114] Sheath: "The tubular proton of the leaf which wraps around or encloses the stem. Edges of the sheath may join, overlap or be closed" (Georgia, University of, 2016).

sea turtles. Johnson's seagrass was federally listed as threatened in 1998 (63 FR 49035 49041, September 14, 1998) (NOAA, 2013).

This species is found on the east coast of Florida from Sebastian Inlet to central Biscayne Bay. The designated critical habitat for Johnson's seagrass is located in Indian River, St. Lucie, Martin, Palm Beach, and Miami-Dade Counties (NMFS, 2000). It prefers to grow in coastal lagoons deeper than other seagrasses. It also inhabits "coarse sand and muddy substrates and in areas of turbid waters and high tidal currents" (NOAA, 2013). Threats to Johnson's seagrass include "boating activities such as propeller damage, anchoring, and mooring; dredging; storms; and degraded water quality" (NOAA, 2013).

Key Tree- Cactus. The Key tree- cactus is a large, tree-like cactus with straight, green, succulent stems that reaches up to 33 feet in height. The stems are ridged and produce spines, large white flowers and a red fruit. The inside of the fruit is a soft, white pulp with small, hard, shiny black seeds (USFWS, 1999z). The Key tree- cactus was federally listed as endangered in 1984 (49 FR 29234 29237, July 19, 1984) (USFWS, 2015bw). This species is found in the tropical coastal hammock communities of the Florida Keys, Monroe County. It is also found in Cuba. The hardwood hammocks and cactus hammocks which the Key tree- cactus inhabits are all on a base of coral rock. It grows well on well-drained upland areas with little or no soil; and grows in small, isolated patches or clumps. Threats to the Key tree- cactus include habitat loss due to commercial and residential development, the restrictive habitat it requires, and catastrophic weather events. (USFWS, 1999z)

Lakela's Mint. Lakela's mint is a small, fragrant shrub with a spotless, lavender-rose colored flower. "It forms small mats or domes of spreading or sprawling branches" with horizontal or pointing upward main leaves, and downward pointing leaves in the flower cluster (USFWS, 1999aa). Lakela's mint was federally listed as endangered in 1985 (50 FR 20212 20215, May 15, 1985) (USFWS, 2015by). This species inhabits a limited area in Indian River, Martin, and St. Lucie Counties on the Atlantic coastal ridge in South Florida. It grows in light shade or clearings in scrub, partly covered or bare sand. The acidic soil is deep, level to sloping, and occurs on high, dune-like ridges. Threats to Lakela's mint include habitat destruction due to development and highway construction, and its fragmented populations. (USFWS, 1999aa)

Lewton's Polygala. Lewton's polygala is "a relatively short-lived (5 to 10 year) perennial herb" that produces one to several spreading, upward-curving, branched stems with small, overlapping leaves (USFWS, 1999ab). The flowers are bright pink or purplish-red, and have five petals (USFWS, 1999ab). Lewton's polygala was federally listed as endangered in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS, 2015ca). This species can be found in oak scrub and high pine communities of Highlands, Polk, Osceola, Orange, Lake, and Marion Counties within the Lake Wales and Mount Dora ridges of central Florida. It inhabits high pine and turkey oak scrub habitats, as well as the transitional area between them. It is found in sunny openings and depends on periodic fires to maintain this open habitat. Threats to Lewton's polygala include habitat destruction due to agriculture and residential housing construction, off-road vehicles, and mistaken harvesting (due to the species resemblance to the rusty lyonia (*Lyonia ferruginea*). (USFWS, 1999ab)

Longspurred Mint. The longspurred mint has purple-rose colored flowers and a strong minty smell (USFWS, 1987c). Longspurred mint was federally listed as endangered in 1985 (50 FR 45621 45624, November 1, 1985) (USFWS, 2015cc). In 1987 this species was found on the Sumter and Marion Counties. It inhabits "the margins of scrub vegetation … surrounded by longleaf pine-turkey oak sandhill vegetation" (USFWS, 1987c). It grows in sunny areas with bare sand. The threats to longspurred mint include sand pine scrub and sandhill habitat destruction or degradation due to development (USFWS, 1987c) (USFWS, 2016o).

Miccosukee Gooseberry. The Miccosukee gooseberry is a shrub that grows in large patches reaching around 3 feet in height. "The plant has spiny stems and three-lobed leaves that measure up to 1 inch in length. The flowers are greenish white and small. The fruits are spiny and measure up to 1 inch in diameter" (USFWS, 1985b). Miccosukee gooseberry was federally listed as threatened in 1985 (50 FR 29338 29341, July 18, 1985). This species is known only from populations in Jefferson County, Florida, and Edgefield and McCormick Counties, South Carolina (USFWS, 2015cf). Preferred habitat for Miccosukee gooseberry includes mixed hardwood or beech-magnolia forests on slopes and in bottomlands. Threats to the species include logging, changes to hydrology, and competition from invasive species such as Chinese privet (*Ligustrum* spp.) and Japanese climbing fern (*Lygodium japonicum*) (FNAI, 2000b) (USFWS, 2008c).

Okeechobee Gourd. The Okeechobee gourd is a high-climbing vine with tendrils and heart-shaped leaves. The large, cream-colored flowers are bell shaped. The gourd is light green and slightly oblong, with 10 stripes, a hard shell, and bitter flesh (USFWS, 1999at). The Okeechobee gourd was federally listed as endangered in 1993 (58 FR 37432 37443, July 12, 1993) (USFWS, 2015ch). This species exists in three counties, mainly along the St. Johns River in north Florida, and around the shoreline of Lake Okeechobee in south Florida. It climbs up any plant that will provide a trellis; when there were more of them, it used the natural trellises of pond apple branches. Around Lake Okeechobee and the St. Johns River, the gourd is often found near alligator nests. Threats to the Okeechobee gourd include habitat loss due to the conversion of swamp and marsh habitat for agriculture and water-level regulation in Lake Okeechobee and the spread of exotic vegetation in the lake (USFWS, 1999at).

Papery Whitlow-wort. The papery whitlow-wort is a short-lived perennial herb (often "described as an annual"), that forms small mats of many bright yellowish-green branches reaching flatly across the ground. The stems are long and wiry with numerous small cream-colored to greenish flowers and oval leaves (USFWS, 1999ad). The Papery whitlow-wort was federally listed as threatened in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015ci). This species can be found in seven counties; some on the Lake Wales Ridge in central Florida, and some in the karst region of the Florida panhandle. It inhabits rosemary scrub on the Lake Wales Ridge in central Florida, and in coarse white sand along the shoreline of karst lakes in the Florida panhandle. The greatest threat to the papery whitlow-wort is the loss of habitat due to agricultural, commercial, residential, and recreational purposes (USFWS, 1999ad).

Pigeon Wings. The pigeon wings is a long-lived perennial[115] herb belonging to the pea family. One to several purplish, very straight stems grow up from the thick, horizontally running root. The leaves are "somewhat leathery and consist of three leaflets" (USFWS, 1999ae). The name of this species comes from the petals of its pale purple colored flowers, which resemble wings (USFWS, 1999ae). The pigeon wings was federally listed as threatened in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS, 2015ck). This species can be found in Highlands, Orange, and Polk Counties on the Lake Wales Ridge in central Florida. It inhabits high pine and scrub communities, in white and yellow sand soils. The greatest threat to the pigeon wings is loss of habitat due to agriculture and residential development. "Other threats include off-road vehicle use, trash dumping, and trampling" (USFWS, 1999ae).

Pygmy Fringe-tree. The pygmy fringe-tree is a large shrub or small tree that is usually less than 3 feet tall, but can grow up to 13 feet. The twigs are opposite and stiff, with leathery, oval, dark yellow-green leaves. The fragrant, white, four-petal flowers grow in clusters of three to six flowers, with a green fruit turning purplish-brown when ripe (USFWS, 1999af). The pygmy fringe-tree was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015cn). This species can be found Lake and Osceola Counties, and on Lake Wales Ridge in Polk and Highlands Counties in central Florida. It mainly inhabits scrub, but also grows in high pineland, dry hammocks, and transitional habitats. It prefers excessively drained sandy soils that have low levels of nutrients. It does well in areas of bare sand and full sun, but can also occur in deep shade and pine canopy areas. The greatest threat to the pygmy fringe-tree is habitat loss due to citrus production and residential development (USFWS, 1999af).

Rugel's Pawpaw. The Rugel's pawpaw is a low-growing shrub in the custard apple family. It has canary yellow flowers, with fleshy berries and brown, bean-shaped seeds (USFWS, 2016p). Rugel's pawpaw was federally listed as endangered in 1986 (51 FR 34415 34420, September 26, 1986) (USFWS, 2015cr). This species can be found near the Atlantic coast in Volusia County, east-central Florida. It inhabits slash pine flatwoods with an understory of grasses and sedges. It grows on ridges of poorly drained flatwood soils bordered by swamps. It is adapted to periodic fires, which limit the growth of the larger shrubs, and release nutrients necessary for reproduction. The main threat to the Rugel's pawpaw is the loss of flatwoods habitat due to urban development and pine plantations, and lack of fire/mowing to control growth of understory plants (USFWS, 2007c) (USFWS, 2016p).

Sandlace. The sandlace is a sprawling shrub with many zigzagging branches along the ground, forming low mats. It has needle-like leaves and small, white or cream colored flowers (USFWS, 1999ag). The sandlace was federally listed as endangered in 1993 (58 FR 25746 25755, April 23, 1993) (USFWS, 2015ct). This species can be found in moderately disturbed scrub in central Florida's upland ridge, in Highlands, Osceola, and Polk Counties. It grows best in disturbed areas of bare white or yellow sand, and probably needs regular fires to maintain this habitat. Threats to the sandlace include habitat loss and modification due to residential and commercial development, agriculture, and recreation (USFWS, 1999ag).

[115] Long-lived perennial: "perennials that often persist for 20 or more years" (Iowa State University, 2016).

Scrub Blazingstar. The scrub blazingstar is a long-lived perennial herb with straight, unbranched stems, and can reach a height of a little over 3 feet. It has fleshy, narrow leaves, and bright purplish-pink flowers (USFWS, 1999ah). The scrub blazingstar was federally listed as endangered in 1989 (54 FR 31190 31196, July 27, 1989) (USFWS, 2015cv). This species can be found in open, fire-maintained habitat on the Lake Wales Ridge in Highlands and Polk Counties. It inhabits rosemary balds and on white or yellow sands in the transitional areas between these balds and surrounding scrub habitats, and in the scrub. It grows well in lightly shaded areas. The main threat to the scrub blazingstar is habitat loss due to commercial and residential development, agriculture, and recreation. (USFWS, 1999ah)

Scrub Buckwheat. The scrub buckwheat is a perennial herb with a single stem, leaves that are green or bronze-green above and white/wooly underneath, and silvery flowers growing 15 to 20 a cluster (USFWS, 2016q). The scrub buckwheat was federally listed as threatened in 1993 (58 FR 25746 25755, April 27, 1993) (USFWS, 2015cw). This species can be found in Marion, Lake, Putnam, Pasco, Orange, Seminole, and Osceola Counties, and on the Lake Wales Ridge in Polk and Highlands Counties. It inhabits areas between scrub and high pine sandhills and in turkey oak barrens. The main threat to the scrub buckwheat is habitat loss due to agricultural and residential development (USFWS, 2009).

Scrub Lupine. "The scrub Lupine is a woody, perennial herb, with sprawling stems reaching up to 3 feet long" (USFWS, 1999ai). The leaves have rounded bases with a sharp point at the end. The pale flesh-colored pink flowers have 5 to 14 flowers arranged around a flower stalk. It has long, woody fruits with a pointed end (USFWS, 1999ai). The scrub Lupine was federally listed as endangered in 1987 (52 FR 11172 11175, April 7, 1987) (USFWS, 2015cx).

This species can be found on the southern Mount Dora Ridge in western Orange County, and on the Winter Haven Ridge in north-central Polk County in south Florida. It inhabits well-drained white or yellow sandy soils with little organic matter that generally support sand pine scrub. The main threat to the scrub Lupine is habitat loss due to urban and agricultural expansion and development (USFWS, 1999ai).

Scrub Mint. The scrub mint is a small, dense, low-growing, fragrant shrub with spreading branches. It has two kinds of shoots; one leafy and the other flowering. The flower is white or yellowish white with a pattern of lines and dots of deep purple. The scrub mint was federally listed as endangered in 1985 (50 FR 45621 45624, November 1, 1985). This species can be found on the Lake Wales Ridge in Highlands County, central Florida. It inhabits excessively drained, yellow sandy soils in disturbed areas of sand pine scrub, oak scrub, and sandhill habitats. Threats to the scrub mint include habitat loss due to development or agriculture, and fire suppression. (USFWS, 1999aj)

Scrub Plum. The scrub plum is a small, heavily branched shrub that can reach up to 6.5 feet. "It grows from gnarled, half-buried trunks and spreading shoots" with zigzagging twigs and short, stubby branches (USFWS, 1999ak). Old bark is thin, gray and encrusted with lichen, while the new bark is shiny reddish-brown or purplish and smooth. It has small, fragrant, white flowers and dull reddish fruit with a thin, bitter flesh and flattened seed. The scrub plum was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987). This species can be found in

Lake, Orange, Osceola, Polk, and Highland Counties, along the ridges of central Florida. It inhabits dry, sunny, nutrient-poor soils that are acidic, dry rapidly, and have little silt, clay, or organic matter. It grows in the high pine and oak scrub communities, which both have periodic fires to maintain their habitats and prevent the scrub plum from being shaded out. Threats to the scrub plum include habitat loss due to residential development and conversion to agriculture (mainly citrus), as well as collection by plant collectors. (USFWS, 1999ak)

Short-leaved Rosemary. "The short-leaved rosemary is a short-lived, woody, perennial shrub that reaches about 3 feet in height" (USFWS, 1999al). The short-leaved rosemary was federally listed as endangered in 1993 (58 FR 37432 37443, July 12, 1993). This species is found on the Lake Wales Ridge in Polk and Highlands Counties in central Florida. It "inhabits white sand scrub with a scattered overstory of sand pine (*Pinus clausa*) and evergreen scrub oaks (*Quercus* spp.)" that need periodic fires to maintain their habitat (USFWS, 1999al). It grows well in clearings with other small shrubs and herbs. Threats to the short-leaved rosemary include habitat destruction due to residential and agricultural expansion, and fire suppression (USFWS, 1999al).

Small's Milkpea. The Small's milkpea is a small, perennial legume with small, purple flowers. It has grayish, hair covered stems that grow up to 6.5 feet long (USFWS, 1999am). The Small's milkpea was federally listed as endangered in 1985 (50 FR 29345 29349, July 18, 1985) (USFWS, 2015cz). This species can be found in the Redland pine rocklands of southern Miami-Dade County, Florida. "It prefers higher elevations and lower shrub cover than the more common Galactia species" and "doesn't occur in areas with a lot of exotic plant cover" (USFWS, 1999am). Threats to the Small's milkpea include habitat loss due to residential housing, commercial construction, and agriculture; fire suppression, and invasion of exotic plant species (USFWS, 1999am).

Snakeroot. The snakeroot is an aromatic perennial herb with a dark green rosette with leaves clustered at the base, and several branching, flowering stems. It can reach up to 3 feet in height, and has small, white petals and powdery blue anthers (USFWS, 1999an). The snakeroot was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015da). This species can be found on the Lake Wales Ridge, in Highlands County, central Florida. It inhabits sunny areas of bare sand, usually created by fire or some other disturbance. It often occurs in rosemary scrub, and survives in dry soil with low levels of nutrients. Threats to the snakeroot include habitat loss due to residential development and agriculture (citrus groves), and fire suppression (USFWS, 1999an).

Telephus Spurge. The telephus spurge is a perennial herb with lots of short stems with smooth, fleshy leaves 1 to 2 inches long, containing milky sap. This bushy looking plant can grow up to 1 foot tall (USFWS, 1994e). The telephus spurge was federally listed as threatened in 1992 (57 FR 19813 19819, May 8, 1992) (USFWS, 2015de). This species can be found in Bay, Gulf, and Franklin Counties in the Florida panhandle. It inhabits low land ridges near the coast among scrubby oaks. Threats to the telephus spurge include habitat modification production and development, drainage management, and titi (*Cyrilla racemiflora*) encroachment (USFWS, 1994e).

Tiny Polygala. The tiny polygala, also called Small's milkwort, is a short-lived herb in the milkworts family. It forms a rosette of leaves at its base and grows to a height of 3 inches. It has one to four short stems and a greenish-yellow flower with a thin-walled fruit that splits in two (USFWS, 1999ao). The tiny polygala was federally listed as endangered in 1985 (50 FR 29345 29349, July 18, 1985) (USFWS, 2015df). This species occurs "on the Atlantic Coastal Ridge of southeast Florida, from the Perrine area of Miami-Dade County north to southeast St. Lucie County" (USFWS, 1999ao). It inhabits sand pockets of pine rocklands, open sand pine scrub, slash pine, high pine, and well-drained coastal spoil. All of these habitats are extremely dry and prone to periodic fires. It grows best in high light levels and open sand with little to no organic matter accumulation. The main threat to the tiny polygala is habitat loss due to urban development, fire suppression, and exotic plant invasion. (USFWS, 1999ao)

White Birds-in-a-nest. The white birds-in-a-nest is an odorless perennial herb in the mint family. It usually has one stem with opposite leaves and bright white flowers that form in a cluster at the top of the plant (USFWS, 1994f). The white birds-in-a-nest was federally listed as threatened in 1992 (57 FR 19813 19819, May 8, 1992) (USFWS, 2015dh). This species can be found in Bay, Gulf, Franklin, and Liberty Counties, Florida. It inhabits grassy pine flatwoods, which are subject to periodic fires. It grows in the understory of coastal pinelands in poorly drained savannahs and road edges. Threats to the white birds-in-a-nest include habitat modification, fire suppression, titi (*Cyrilla racemiflora*) encroachment, and drainage alternations. (USFWS, 1994f)

Wide-leaf Warea. The wide-leaf warea, or clasping warea, is an annual herb in the mustard family. The stalk branches halfway up the stem with alternate heart-shaped, clasping leaves. It has pale lavender colored flowers that vary from almost white to almost purple, and grow in clusters at the ends of branches. As the stalk turns brown and the leaves wither, clusters of narrow down-curving seed pods split open to reveal small black seeds (USFWS, 1999ap). The (USFWS, 2015di) wide-leaf warea was federally listed as endangered in 1987 (52 FR 15501 15505, April 29, 1987) (USFWS, 2015di). This species can be found on the northern portion of the Lake Wales Ridge in Lake, Polk, and Osceola Counties, south Florida. It inhabits the high pine or sandhill community maintained by periodic summer fires. It grows in sunny openings in these woodlands on well-drained, clean, yellowish sands. Threats to the wide-leaf warea include habitat loss due to citrus groves, residential and commercial development, sand mining, and fire suppression (USFWS, 1999ap).

Wireweed. The wireweed is a short-lived, perennial herb. It can consist entirely of compressed stems with narrow, alternate leaves, ranging in color from green to dark red. As these stems grow longer, the plants develop slender, flowering, spike-like clusters of small, white to slightly pink flowers (USFWS, 1999aq). The wireweed was federally listed as endangered in 1987 (52 FR 2227 2234, January 21, 1987) (USFWS, 2015dj). This species can be found in central peninsular Florida on the Lake Wales, Winter Haven, and Bombing Range ridges. It inhabits rosemary scrub, which is interspersed with open sandy areas that contain a cover of herbs and lichens, and needs periodic fire to maintain its habitat. Threats to the wireweed include the destruction of its scrub habitat and fire suppression (USFWS, 1999aq).

5.1.7. Land Use, Recreation, and Airspace

5.1.7.1. Definition of the Resource

The following summarizes major land uses, recreational venues, and airspace considerations in Florida, characterizing existing, baseline conditions for use in evaluating the potential environmental consequences resulting from implementing the Proposed Action or Alternatives.

Land Use and Recreation

A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (USGS, 2012b).

Recreational uses are activities in which residents and visitors participate. They include outdoor activities, such as hiking, fishing, boating, athletic events (e.g., golf), and other attractions (e.g., historic monuments and cultural sites) or indoor activities, such as museums and historic sites. Recreational resources can include trails, lakes, forests, beaches, recreational facilities, museums, historic sites, and other areas/facilities.

Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion, highlighting the following areas: Northwest, North Central, Northeast, Central West, Central, Central East, Southwest, and Southeast regions.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015a). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The FAA is charged with the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. "The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the U.S. and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (FAA, 2014a). The ATO is composed of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft

Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015c). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

5.1.7.2. Specific Regulatory Considerations

Most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The *Community Planning* document (Florida Department of Economic Opportunity, 2015) is the current state-level guidance for land use planning in Florida.

Because the Nation's airspace is governed by federal laws, there are no specific Florida state laws that would alter the existing conditions relating to airspace for this PEIS.

5.1.7.3. Land Use and Ownership

For the purposes of this analysis, land use in Florida has been classified into primary land use groups based on coverage type as forest and woodlands, shrub/grassland, agricultural, and developed land. Land ownership within Florida has been classified into four main categories: private, federal, state, and tribal.

Land Use

Table 5.1.7-1 identifies the major surface land uses by coverage type in Florida. Forest and woodlands compose the largest portion of land use with 38.7 percent of Florida's total land occupied by this category Table 5.1.7-1 and Figure 5.1.7-1). Developed land is the second largest area of land use with 18.8 percent of the total land area. Agricultural land accounts for approximately 15 percent of the total land area. Shrub and grassland account for 10.5 percent. The remaining percentage of land includes public land and other land covers, shown in Figure 5.1.7-1, that are not associated with specific land uses (USGS, 2012d).

Table 5.1.7-1: Major Land Uses in Florida by Coverage Type

Land Use	Square Miles	Percent of Land
Forest and Woodland	25,396	38.7%
Shrub and Grassland	6,904	10.5%
Agricultural Land	9,926	15.1%
Developed Land	12,326	18.8%
Public Land, Surface Water, and other Land Covers	11,026	16.8%

Source: (USGS 2011)

Forest and Woodland

Forest and woodland areas can be found throughout most of Florida; however, forest and woodland areas are concentrated in northwest and northeast Florida. The state's three National Forests are located in these two regions. Most forest and woodland areas throughout Florida are privately owned (approximately 63 percent) (USFS, 2007). Section 5.1.6.3, Terrestrial Vegetation presents additional information about terrestrial vegetation.

State Forests

The Florida Forest Service manages 1,669 square miles of state land across 37 State Forests. Most of the State Forests are located in northwest and northwest Florida. The Florida Forest Service manages the State Forests for multiple public uses such as timber harvest and forest products, recreation, and wildlife habitat. The mission of the Florida Forest Service is "to protect and maintain the biological diversity of the many ecosystems found in and around the state forests while integrating public use of the resources" (State of Florida, 2015).

Private Forest and Woodland

Families, individuals, and non-industrial private forest owners collectively own approximately 63 percent of Florida's total forest and woodland. About 406,000 families or individuals own approximately 31 percent of Florida's forests and woodlands. Most private owners hold less than 50 acres of forest and woodland. The primary objectives for owning forest are aesthetics, protection of nature and biologic diversity, land investment, and privacy (USFS, 2007). For additional information regarding forest and woodland areas, see Section 5.1.6.3, Terrestrial Vegetation and Section 5.1.8, Visual Resources.

Shrub and Grassland

Approximately 10.5 percent of Florida's surface area is classified as shrub and grassland. These areas are in southcentral Florida, especially in the areas north and west of Lake Okeechobee. Portions of these grasslands are within the Kissimmee Prairie Preserve State Park, Paynes Prairie Preserve State Park, Myakka River State Park, and the Three Lakes Wildlife Management Area. Grasslands have transitioned to other vegetation types due to development and fire management. For additional information on shrub and grassland, see Section 5.1.6.3, Terrestrial Vegetation.

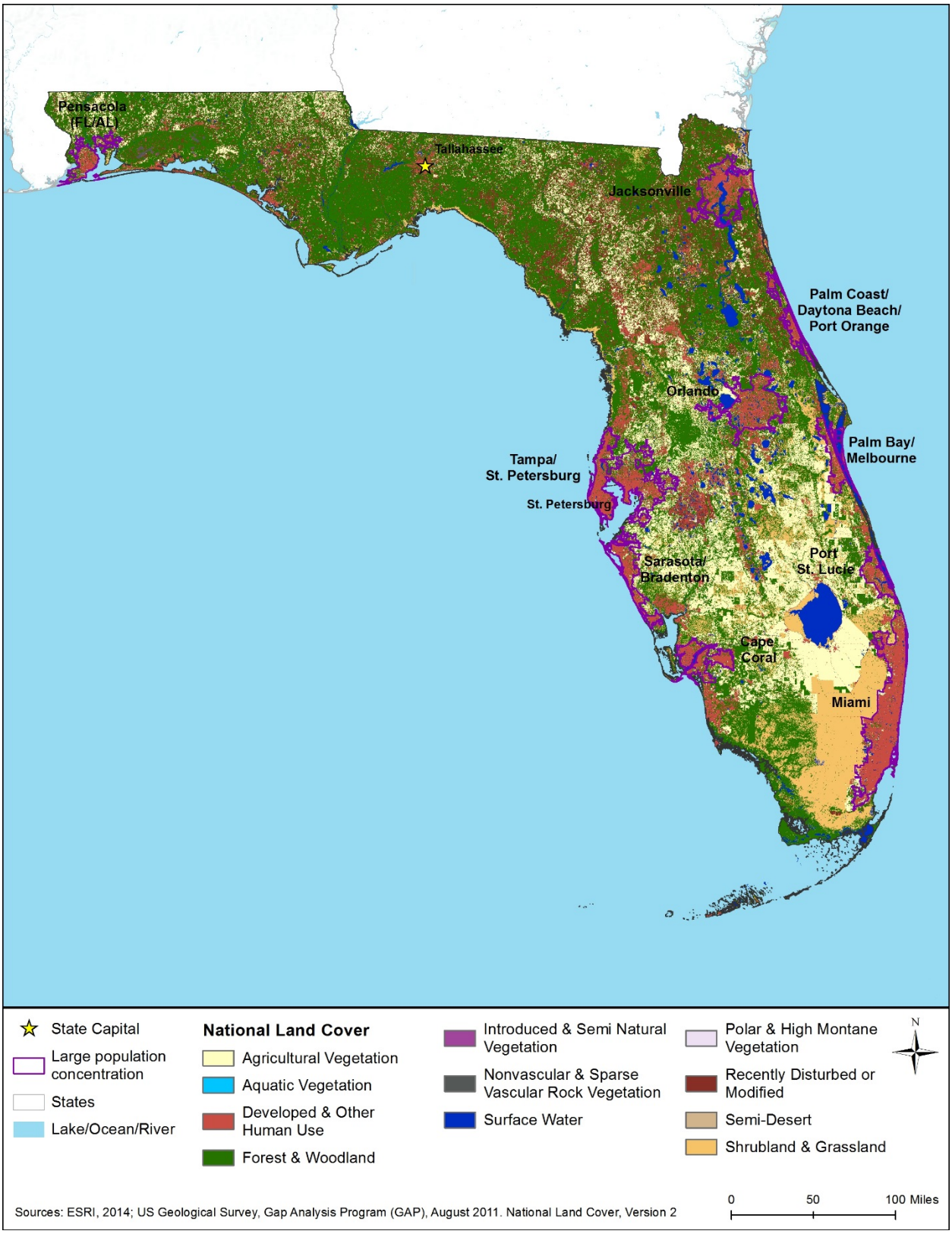


Figure 5.1.7-1: Major Land Use Distribution by Coverage Type

Agricultural Land

Agricultural land occurs throughout the state, with the largest concentrations in central and southern Florida (Figure 5.1.7-1). Approximately 15 percent of Florida's total land area is classified as agricultural land (approximately 9,926 square miles). In 2012, there were 47,740 farms in Florida and 80 percent were owned and operated by families or individuals, with the average farm size of 200 acres (USDA, 2012). Some of the state's largest agricultural uses include oranges, strawberries, peppers, grapefruit, peanuts, hay, potatoes, and corn. Additional products include sugarcane, fresh snap peas, watermelons, cucumbers, tomatoes, and beef (USDA, 2014). For more information by county, access the USDA Census of Agriculture website: (http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Florida/).

Developed Land

Developed land in Florida tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 5.1.7-1). Approximately 19 percent of Florida land is developed. These areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 5.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 5.1.7-1 shows where these areas are located within the developed land use category.

Table 5.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Miami-Fort Lauderdale-West Palm Beach, FL Metro Area	5,929,819
Tampa-St. Petersburg-Clearwater, FL Metro Area	2,915,582
Orlando-Kissimmee-Sanford, FL Metro Area	2,321,418
Jacksonville, FL Metro Area	1,419,127
North Port-Sarasota-Bradenton, FL Metro Area	748,708
Total Population of Metropolitan Areas	**13,334,654**
Total State Population	**19,893,297**

Source: (U.S. Census Bureau, 2015d)

Land Ownership

Land ownership within Florida has been classified into four main categories: private, federal, state, and tribal (Figure 5.1.7-2).[116] Table 5.1.7-3 lists the square miles and percentages for these categories.

[116] Land ownership data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried to show Owner and used USGS' PAD-US ownership symbolization for consistency. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

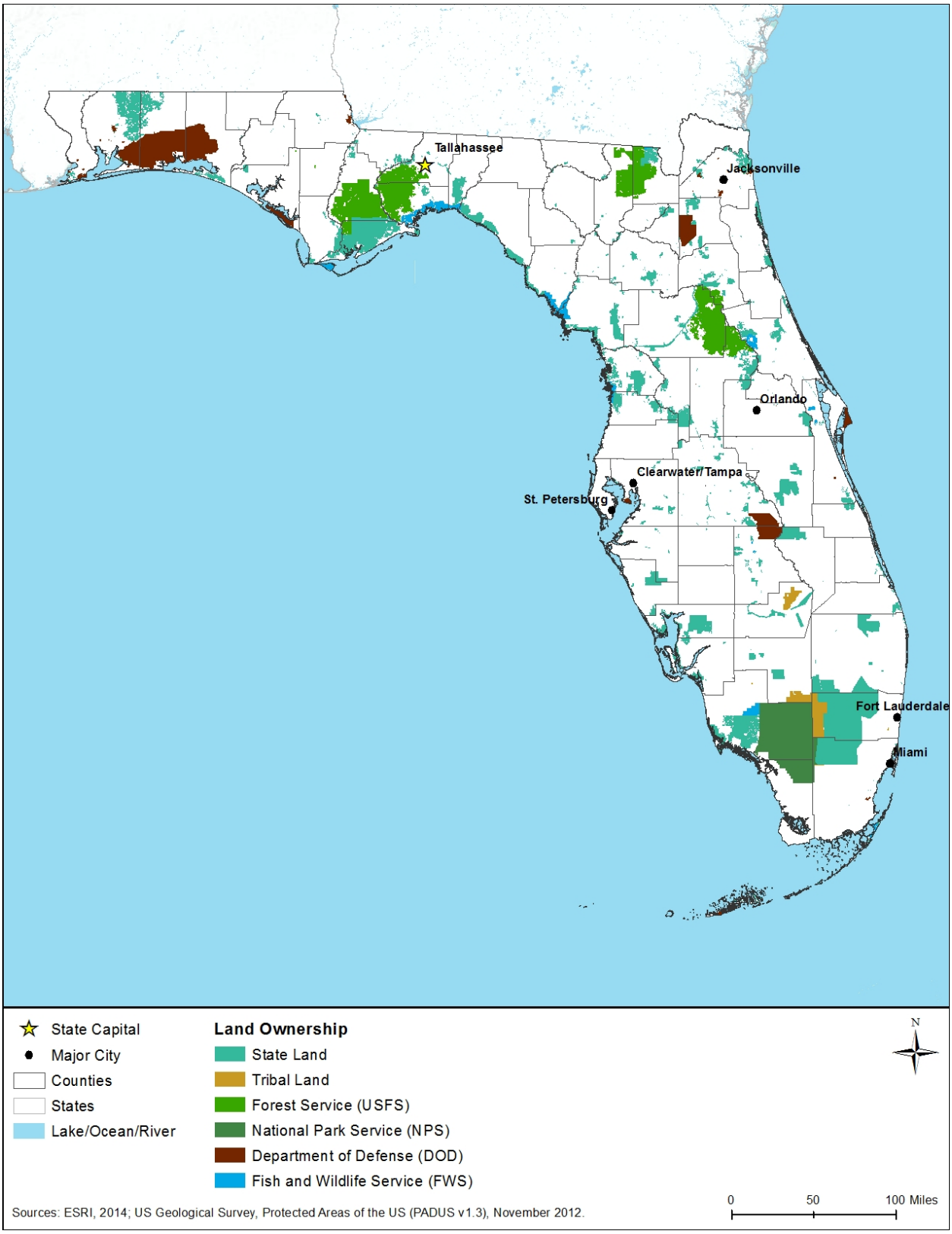


Figure 5.1.7-2: Land Ownership Distribution

Private Land

The majority of land in Florida is privately owned, with most of this land falling under the land use categories of forest, woodland, agricultural, and developed land (Figure 5.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas. Private land exists in all regions of the state.[117]

Federal Land

The federal government manages 4,526 square miles (8.4 percent) of Florida land with a variety of land types and uses, including military bases, ranges, and testing areas; national wildlife refuges, forests, and wilderness areas; and national parks, preserves, seashores, memorials, and monuments (Figure 5.1.7-2) (USGS, 2012c) (USGS, 2014f). Table 5.1.7-3 identifies the federal agencies managing the majority of federal lands throughout the state. There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.[118]

Table 5.1.7-3: Federal Land in Florida

Agency	Square Miles	Representative Type
Department of Defense (DoD)	1,175	Military Bases, Ranges, Testing Areas
USFWS	352	NWRs
USFS	1,862	National Forest and Wilderness Areas
National Park Service (NPS)[119]	1,137	National Preserves, National Parks, National Seashores, National Memorials, National Monuments
Total	**4,526**	

Sources: (USGS, 2012c) (USGS, 2014f)

- The DoD owns and manages 1,175 square miles used for military bases, ranges, and testing areas (DoD, 2014);
- The USFWS owns and manages 352 square miles consisting of 29 NWRs in Florida, with 17 located within four NWR Complexes (USFWS, 2014e) (USFWS, 2012c);
- The USFS owns and manages 1,862 square miles set aside as the Apalachicola, Osceola, and Ocala National Forests (USFS, 2015a); and
- The NPS manages 1,137 square miles consisting of National Preserves, National Parks, National Seashores, National Memorials, and National Monuments (NPS, 2014a).

State Land[120]

The Florida state government owns approximately 8,796 square miles of land. This land is composed of state parks, wildlife management areas, conservation lands, land for water management and flood protection, and National Guard training areas (Table 5.1.7-4).

[117] Total acreage of private land could not be obtained for the state.

[118] Not all Federal agency land is depicted in Figure 5.1.7-2 given the small size of some of the land acreage.

[119] Additional trails and corridors pass through Florida that are a part of the National Park System.

[120] State land use data for tables and narrative text were derived from specific state sources and may not correspond directly with USGS data that was used for developing maps and figures.

Table 5.1.7-4: State Land in Florida

Agency	Square Miles[a]	Representative Type
Florida Department of Environmental Protection (DEP)	5,627	State Parks, Wildlife Management Areas, Conservation Lands
Water Management Districts	2,836	Lands for Water Management and Flood Protection
Fish and Wildlife Conservation Commission (FWC)	218[b]	Conservation Lands
Department of Military Affairs	115	National Guard Training Areas

[a] Acres are not additive due to overlapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management Areas
[b] The Florida FWC manages and additional 5.8 million acres of land in 148 Wildlife Management Areas (WMA) and Wildlife Environmental Areas (WEAs) "to sustain the widest possible range of native wildlife in their natural habitats" (FWC, 2015a). FWC is the primary manager of 1.4 million acres and works cooperatively with other governmental agencies and private owners to manage the remaining 4.4 million acres (FWC, 2015a).
Source: (DEP, 2015u)

- The DEP manages 5,627 square miles consisting of 174 State Parks, 47 Wildlife Management Areas, and conservation lands;
- The Water Management Districts manage 2,836 square miles consisting of lands for water management purposes and flood protection;
- The Fish and Wildlife Conservation Commission manages 218 square miles consisting of lands for conservation of fish and wildlife species and their habitat; and
- The Department of Military Affairs manages 115 square miles consisting of National Guard training areas.

Tribal Land

The Bureau of Indian Affairs, along with individual tribes currently located in the state, manages 271 square miles, or 0.5 percent of the total land within Florida.[121] These lands are composed of seven Indian Reservations located throughout the state (Figure 5.1.7-2 and Table 5.1.7-5). However, according to the Bureau of Indian Affairs and the National Conference of State Legislators, there are only two federally recognized tribes in Florida: the Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida (National Conference of State Legislators, 2015; GPO, 2015). For additional information regarding tribal land, see Section 5.1.11, Cultural Resources.

[121] Although the Bureau of Indian Affairs "manages" American Indian lands, the Bureau of Indian Affairs is different than other land management agencies as the lands are held in trust and are sovereign nations.

Table 5.1.7-5: Indian Reservations of Florida

Reservation Name	Square Miles
Miccosukee Indian Reservation	128.5
Big Cypress Reservation	82.5
Tampa Reservation	0.1
Hollywood Reservation	0.8
Brighton Reservation	58.0
Immokalee Reservation	1.0
Fort Pierce Reservation	0.1
Total	**271.0**

Sources: (USGS, 2012c) (USGS, 2014f)

5.1.7.4. Recreation

Tourism is the top industry in Florida, bringing 93.7 million visitors in 2013 and employing 1.1 million people, and many of the recreational areas in Florida cater to visitors (Visit Florida, 2015). Florida is known for its beaches, fishing, wildlife, and amusement parks. Florida maintains several state-wide recreational trails as the Florida Greenways and Trails System, including: the Florida National Scenic Trail, a hiking trail that winds through over 1,000 miles of the state and each recreational region, has its trailhead on the seashore near Pensacola; the Florida Circumnavigational Saltwater Paddling Trail, a 1,515-mile kayaking route; and the Great Florida Birding and Wildlife Trail, a 2,000-mile highway trail that connects 515 Florida birding and wildlife viewing locations throughout the state (DEP, 2015v). On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, indoor and outdoor pools, and dog runs. Availability of community-level facilities is typically commensurate to the population's needs.

This section discusses recreational opportunities available at various locations throughout Florida. For information on visual resources, see Section 5.1.8, Visual Resources, and for information on the historical significance of locations, see Section 5.1.11, Cultural Resources.

Northwest Region

The Northwest Region consists of the western edge of Florida's panhandle (Figure 5.1.7-3).[122] It borders the Gulf of Mexico to the south, with beach cities lining the Gulf known as the Emerald Coast and the Forgotten Coast. This region is known for attracting tourists to its beaches and salt- and fresh-water fishing.

The Gulf Islands National Seashore (see Figure 5.1.7-3) stretches from Mississippi through Pensacola to Fort Walton Beach; and has areas for swimming, snorkeling, fishing, boating,

[122] Recreational area data was retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried to show the Primary Designation Type of area. To show these in the map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for recreational resources. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

camping, and hiking (NPS, 2015e). Included in the seashore several state parks, including the Perdido Key State Park, located on a barrier island with white sand beaches notable for swimming, seashells, swimming, surfing, and licensed surf fishing (Florida State Parks, 2015a). The Florida National Scenic Trail, a hiking trail that winds through over 1,000 miles of the state and each recreational region, has its trailhead on the seashore near Pensacola (USFS, 2015b), as does the Florida Circumnavigational Saltwater Paddling Trail, a 1,515-mile kayaking route (DEP, 2015w).

Pensacola is the largest metropolitan area in the Northwest Region. The coast is part of the Gulf Islands National Seashore, and the area caters to beach and water sports with sportfishing, scuba diving, and canoeing or kayaking the "Canoe Capital of Florida." The city is also home to the Blue Angels, the U.S. Navy Flight Demonstration Squadron, whose summertime weekly shows draw thousands of visitors (Visit Pensacola, 2015)

North Central Region

The North Central Region consists of the eastern part of the Panhandle and the northwestern tip of the peninsula (Figure 5.1.7-3). This region is known for the Apalachicola National Forest and American Indian history.

The Apalachicola National Forest (see Figure 5.1.7-3) is the easternmost edge of the region, and is the largest forest in Florida. The forest contains highlighted areas such as the Apalachee Savannahs Scenic Byway, the Leon Sinks Geological Area, and Fort Gadson with historic trails and an interpretive center. Recreational opportunities within the forest include multi-use trails, camping, licensed lake and stream fishing, licensed and seasonal small game hunting, boating, and swimming. (USFS, 2015c)

The Letchworth-Love Mounds Archaeological State Park contains the tallest American Indian ceremonial mound: the site contains an interpretive trail beginning at the base of the ceremonial mound and continues past several smaller mounds (Florida State Parks, 2015b). The Lake Jackson Mounds Archeological State Park has four earthen temple mounds, two of which are open to the public. Activities at Lake Jackson Mounds include two interpretive trails and picnic sites. (Florida State Parks, 2015c)

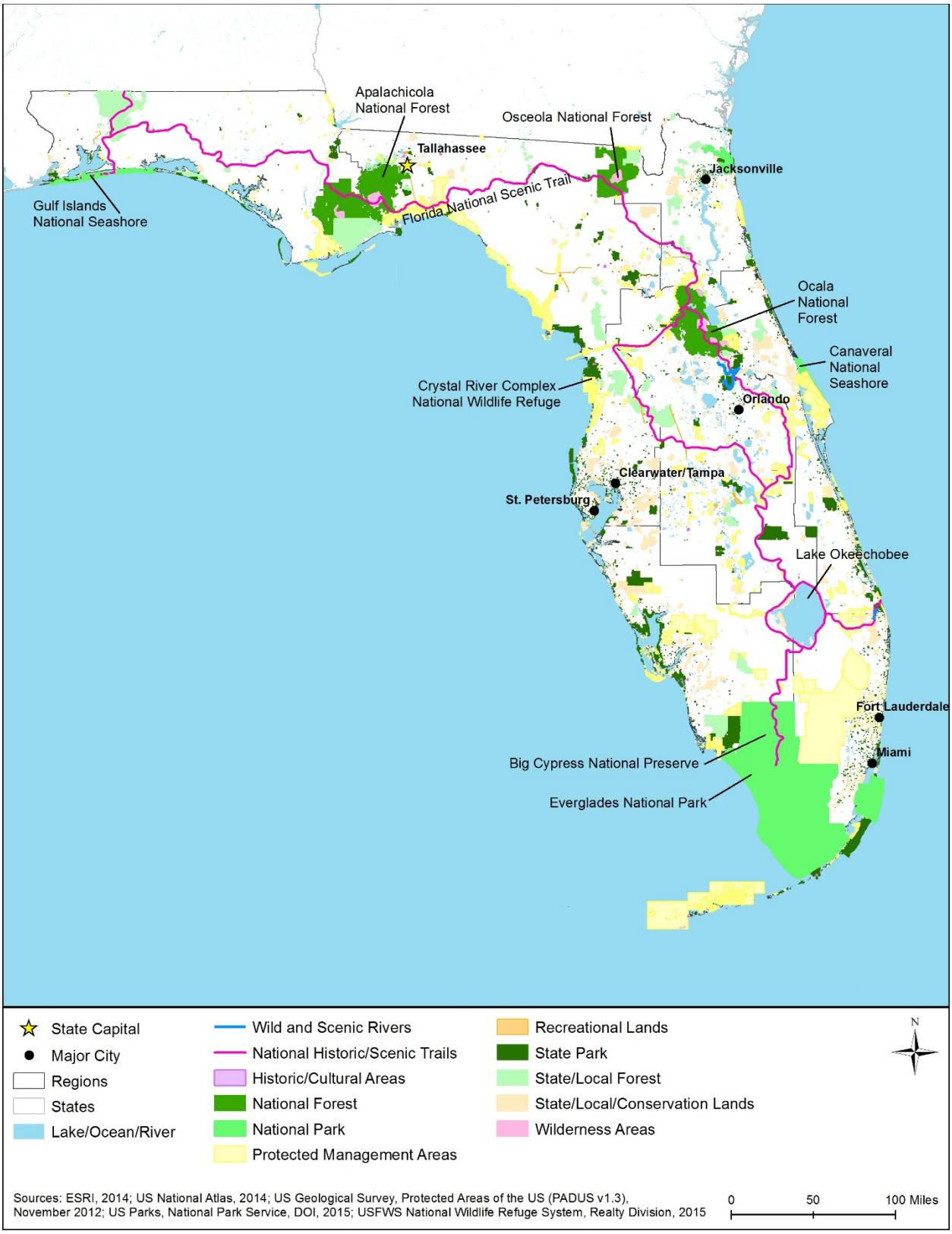


Figure 5.1.7-3: Florida Recreation Resources

Northeast Region

Florida's Northeast Region is located in the upper eastern corner of the state, from the Osceola National Forest west to the sand dunes and beaches lining the Atlantic Ocean (Figure 5.1.7-3).

The Osceola National Forest (see Figure 5.1.7-3) is located on the western boundary of the Northeast Region, and is known for lake fishing, swimming, camping, and hiking trails. Recreational areas and facilities are clustered together, mainly around Ocean Pond, as the forest contains dense wilderness and swamps. (USFS, 2015d)

Along the Atlantic Ocean, state parks including the Anastasia State Park and the seven parks comprising Talbot Islands State Parks preserve the undeveloped beaches and dunes. These beaches are popular for ocean recreation: swimming, fishing, kayaking, canoeing, paddle boating, and shell collecting. The parks are part of the Great Florida Birding and Wildlife Trail, a 2,000-mile trail that connects birding and wildlife viewing sites throughout Florida, and is the final segment of the Florida Circumnavigational Saltwater Paddling Trail. (Florida State Parks, 2015d) (Florida State Parks, 2015e)

The Jacksonville area hosts several professional sports venues: the Player's Championship is one of the Professional Golf Association's most attended tournaments, and the Jacksonville Jaguars host the annual collegiate-level TaxSlayer Bowl (formerly the Gator Bowl) (Visit Jacksonville, 2015).

Central West

The Central West Region is located on the Gulf side of the Florida peninsula (Figure 5.1.7-3). It contains the northern gulf keys and Tampa Bay and continues east into swampy terrain.

Part of the Florida Greenways and Trails System, the General James A. Van Fleet State Trail is the state's most rural paved trail. The trail allows bicycling and rollerblades, and has a parallel horse trail. (Florida State Parks, 2015f) It winds through the Green Swamp wildlife management area and Withlacoochee State Forest, and passes near the Withlacoochee, Hillsborough, and Peace Rivers. The Green Swamp Wilderness Preserve and Withlacoochee State Forest have activities including bird watching, hiking, bicycling, horseback riding, boating, canoeing, licensed fishing, seasonal hunting, and camping (SWFMD, 2015) (Florida Department of Agriculture and Consumer Service, 2013). The Withlacoochee, Hillsboro, and Peace Rivers are popular locations for canoeing, kayaking, and boating (Florida State Parks, 2015f).

The Crystal River Complex National Wildlife Refuge (see Figure 5.1.7-3) is composed of Chassahowitzka, Crystal River, Egmont Key, Passage Key, and Pinellas Refuges. The refuges are prime locations for wildlife viewing, specifically the West Indian Manatee, and are also part of the Great Florida Birding Trail and the Citrus County Birding Trail. Recreation available within portions of the refuges include wildlife viewing, licensed fishing, seasonal licensed duck hunting, boating and airboating, swimming, snorkeling, and scuba diving. Chassahowitzka and Egmont Refuges are accessible by boat only, and the Passage Key and Pinellas Refuges are closed to the public. (USFWS, 2015f) (USFWS, 2015i) (USFWS, 2015l)

Central

Florida's Central Region is the only region without a coast (Figure 5.1.7-3). The geography is mostly flatland prairies and wetlands, with many lakes and ponds.

The Ocala National Forest (see Figure 5.1.7-3) contains three first-magnitude springs popular for swimming, snorkeling, scuba diving, and diving. The forest contains two recreation areas created by dams in addition to over 600 lakes and streams with swimming, beaches, boating, and licensed fishing. Other activities within the park include multi-use trails, camping, and licensed, seasonal small game hunting. (USFS, 2015e)

The Orlando metropolitan area is the most visited tourist destination in the United States, receiving over 59 million visitors in 2013. Amusement parks are the most popular destinations in Orlando; the area is home to the Walt Disney World Resort, Universal Orlando Resort, and LEGOLAND Florida Resort. (Visit Orlando, 2015)

Central East

The Central East Region stretches along the Atlantic Ocean coastline south to Lake Okeechobee (see Figure 5.1.7-3). It includes beaches popular for surfing and other ocean sports.

The Washington Oaks Gardens, North Peninsula, Avalon, Fort Pierce, and St. Lucie Inlet Preserve State Parks have beaches known for swimming, shelling, fishing, and surfing. The state parks are also abundant in wildlife, with birdwatching, snorkeling, and scuba diving popular recreational activities. (Florida State Parks, 2015g) (Florida State Parks, 2015h) (Florida State Parks, 2015i) (Florida State Parks, 2015j)

Daytona Beach, with 23 miles of beaches, is a popular destination city (Daytona Beach Area CVB, 2015). The 480-acre Daytona International Speedway complex hosts the annual Daytona 500 NASCAR race, attended by over 100,000 spectators (Daytona International Speedway, 2015). The boardwalk at Daytona Beach includes piers, rides, arcades, and a historic bandshell. (Daytona Beach Area CVB, 2015)

The Canaveral National Seashore is a barrier island with undeveloped beaches. Activities available on the seashore include surfing, swimming, and boating. Short hiking trails are maintained, and seasonal, licensed waterfowl hunting is permitted. (NPS, 2015f)

The Kennedy Space Center in Cape Canaveral, Florida provides tours to the public to see shuttle launches, the Apollo/Saturn V Center, a simulated flight in the Shuttle Launch Experience, the launch countdown clock, Shuttle Landing Facility, and other exhibitions (Kennedy Space Center, 2015).

Southwest

Southwest Florida begins south of St. Petersburg and continues east to Lake Okeechobee and south into the fringes of the Everglades National Park. The Southwest Region's coast is on the Gulf of Mexico.

The Southwest Region is known for its gulf beaches located both on the mainland and on barrier islands. Lovers Key State Park consists of four barrier islands popular for swimming, shell hunting, boating, kayaking, and multi-use trails (Florida State Parks, 2015k). Delnor-Wiggins Pass State Park is a popular location for reef snorkeling and scuba diving, swimming, boating, canoeing and kayaking, fishing, and multi-use trails (Florida State Parks, 2015l).

The Big Cypress National Preserve (see Figure 5.1.7-3) is over 1,000 square miles of swamp adjacent to the Everglades National Park. Wildlife within the park includes the Florida panther; the preserve is popular for wildlife viewing and birdwatching. Other activities within the preserve include camping, canoeing, and kayaking. Hunting for white-tailed deer, turkey and hogs is allowed during archery, muzzle loading, and general gun seasons. The Tamiami Trail "Triathlon" is a trail where participants bike 15-miles, hike 3-miles, then canoe or kayak an additional 3.5-miles on a water route that ends in Everglades City. (NPS, 2015g)

Southeast

The Southeast Region of Florida begins to the west of Lake Okeechobee and continues south, encompassing the tip of the peninsula and the keys. Southeast Florida has coasts on both the Atlantic Ocean and the Gulf of Mexico (Figure 5.1.7-3).

The Everglades National Park (see Figure 5.1.7-3) is over 2,300 square miles of the southern tip of Florida, characterized as wet sawgrass prairie, pinelands, mangrove swamps, and estuaries. The park is famous for its wildlife: alligators, bird species, and turtles are a few of the wildlife species that attracts visitors to the unique park. Activities in the park include bicycling, slough slogging, and hiking trails; boating, canoeing, and kayaking; saltwater and freshwater sport fishing; and camping. (NPS, 2015h)

Miami Beach had 14.6 million tourists spending at least one night in the metropolitan area in 2014. The purpose for visiting Miami for the majority of people was for recreation and leisure vacations, visiting local attractions including the Art Deco District/South Beach, area beaches, shopping, and restaurants, bars, and nightclubs. (Greater Miami CVB, 2015).

The Florida Keys continues to be a popular destination, with ocean-related activities including sport fishing, dolphin encounters, scuba diving, boating, beaches, and swimming (The Monroe County Tourist Development Council, 2015).

5.1.7.5. Airspace

The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public.

Airspace Categories

There are two categories of airspace or airspace areas:

1) **Regulatory airspace** consists of controlled airspace (Class A, B, C, D, and E airspace areas in descending order of restrictive operating rules), and restricted and prohibited areas.
2) **Non-regulatory airspace** consists of MOAs, warning areas, alert areas, and controlled firing areas.

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 5.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[123] service is based on the airspace classification (FAA, 2008).

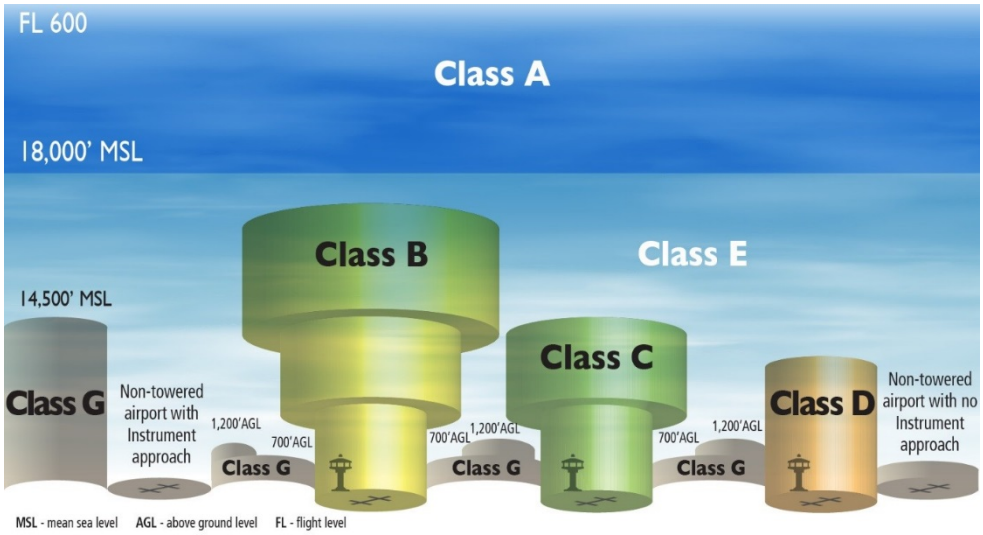


Figure 5.1.7-4: National Airspace Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[124]. Includes the airspace over waters off the United States coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[125]

[123] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operation (FAA, 2015h).
[124] MSL – The average level of for the surface of the ocean; "The height of the surface of the sea midway between the average high and low tides" (Merriam Webster Dictionary, 2015b).
[125] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015h).

- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

Class G: No specific definition. Refers generally to airspace not designated as Class A, B, C, D, or E. Class G airspace is from the surface to the base of Class E airspace.

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (Table 5.1.7-6).

Table 5.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the United States coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if

SUA Type	Definition
	IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Sources: (FAA, 2015d) (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 5.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 5.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the state of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.

Type	Definition
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and Irs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Sources: (FAA, 2015d) (FAA, 2008)

5.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/state/local governments, and other agencies. The FAA's Unmanned Aircraft Systems Integration Office integrates UAS into the NAS. The *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap of 2013* addresses the actions and considerations needed to integrate UAS into the NAS "without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies" (FAA, 2013).

UAS at airports is a complex operational challenge with the need to separate UAS flight operations from mainstream air traffic. Separation can be achieved with specific UAS launch windows, special airports, or off-airport locations that allow the UAS to easily launch and recover. Special aviation procedures are applied to UAS flights. There must be the capability of Sense and Avoid (SAA) and Control and Communication (C2) during UAS operations. An Unmanned Aircraft (UA) must be able to see (or sense) other aircraft in the area and avoid the aircraft through corrected flight path changes. General equipment and operational requirements can include aircraft anti-collision lights, an altitude encoding transponder, cameras, sensors, and collision avoidance maneuvers. The C2 of the UA occurs with the pilot/operator, the UAS control station, and ATC. Research efforts, a component of the FAA's UAS roadmap, continue to mature the technology for both SAA and C2 capabilities.

Balloons

Moored balloons and unmanned free balloons cannot be operated in a prohibited or restricted area unless approval is obtained from the controlling agency. Balloons also cannot be operated if they pose a hazard to people and their property.

5.1.7.7. Obstructions to Airspace Considerations

The Airports Division of the FAA is responsible for the evaluation and analysis of proposed construction or alterations on airports. The FAA Air Traffic Office is responsible for determining obstructions to air navigation as a result of construction that may affect the safe and efficient use of navigable airspace and the operation of planned or existing air navigation and

communication facilities. Such facilities include air navigation aids, communication equipment, airports, federal airways, instrument approach or departure procedures, and approved off-airway routes. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) is required when there is the potential for airport construction/alteration of a facility that may impinge upon the NAS. Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

- "Any construction or alteration exceeding 200 ft. aboveground level;
- Any construction or alteration:
  - within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft.
  - within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft.
  - within 5,000 ft. of a public use heliport which exceeds a 25:1 surface;
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards;
- When requested by the FAA; and
- Any construction or alteration located on a public use airport or heliport regardless of height or location" (FAA, 2015e).

Construction or alternative facilities (such as towers) that are subject to FCC licensing requirements are also required to have an OE/AAA performed by the FAA Airport Division.

5.1.7.8. Florida Airspace

The Florida Office of Aviation and Spaceports resides within the Office of Intermodal systems Development, FDOT. The Aviation and Spaceports Office is composed of three divisions: Development, Operations, and District Offices. The mission of the Aviation and Spaceports Office is "to provide a safe and secure air transportation system that ensure the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities" (FDOT, 2015e). The FDOT Aviation and Spaceports Office is responsible for protecting airspace via "airport compatible land use, airport protection zoning, federal obstruction evaluation and airport analysis, the Airspace Obstruction Permitting process, local government comprehensive plan amendment review, local government airport protection zoning ordinance technical review assistance, and local government airport protection zoning variance review" (FDOT, 2015f). There are three FAA FSDO for Florida located in Miramar (South Florida), Orlando, and Tampa (FAA, 2015c).

Florida airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key issues associated with their airports (National Association of State Aviation Officials [NASAO], 2015). Figure 5.1.7-5 presents the different aviation airports/facilities located in Florida, while Figure 5.1.7-6 and Figure 5.1.7-7 present the breakout by public and private airports, respectively. There are

approximately 858 airports (public and private) within Florida as presented in Table 5.1.7-8 (Department of Transportation, 2015b).

Table 5.1.7-8: Type and Number of Florida Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	124	380
Heliport	1	300
Seaplane	3	45
Ultralight	0	3
Balloonport	0	0
Gliderport	0	2
Total	**128**	**730**

Source: (FAA, 2015d) (FAA, 2008)

There are Class B, C, and D controlled airports for Florida as follows:

- Three Class B –
  - Miami International
  - Orlando International
  - Tampa International
- Twelve Class C –
  - Daytona Beach Regional
  - Fort Lauderdale-Hollywood International
  - Southwest Florida Regional
  - Jacksonville International
  - Milton Naval Air Station Whiting Field
  - Palm Beach International
  - Pensacola NAS Forrest Sherman Field
  - Pensacola Regional
  - Orlando Sanford International
  - Cedar Knoll Flying Ranch (Private Airport)
  - Sarasota-Bradenton
  - Tallahassee Regional

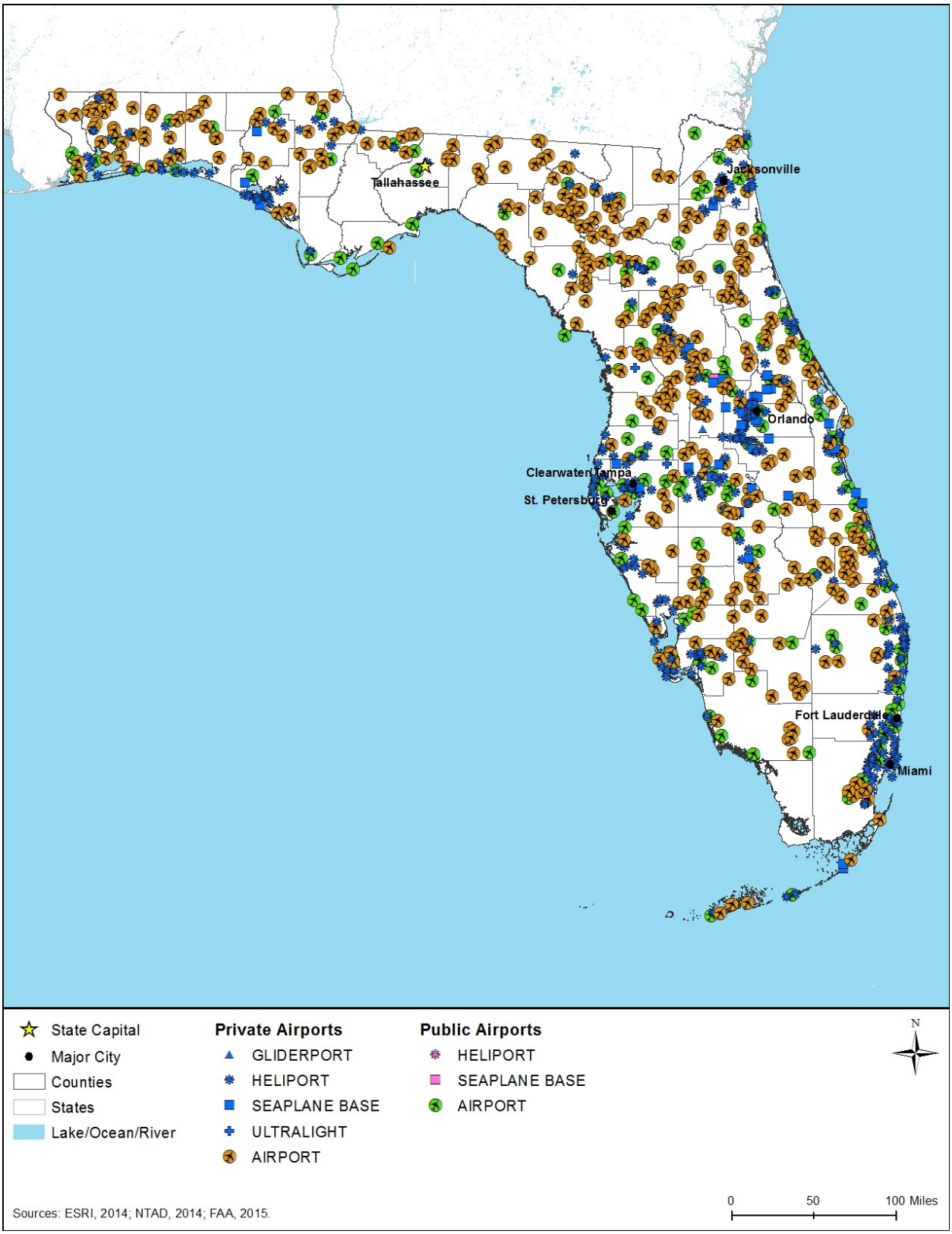


Figure 5.1.7-5: Composite of Florida Airports/Facilities

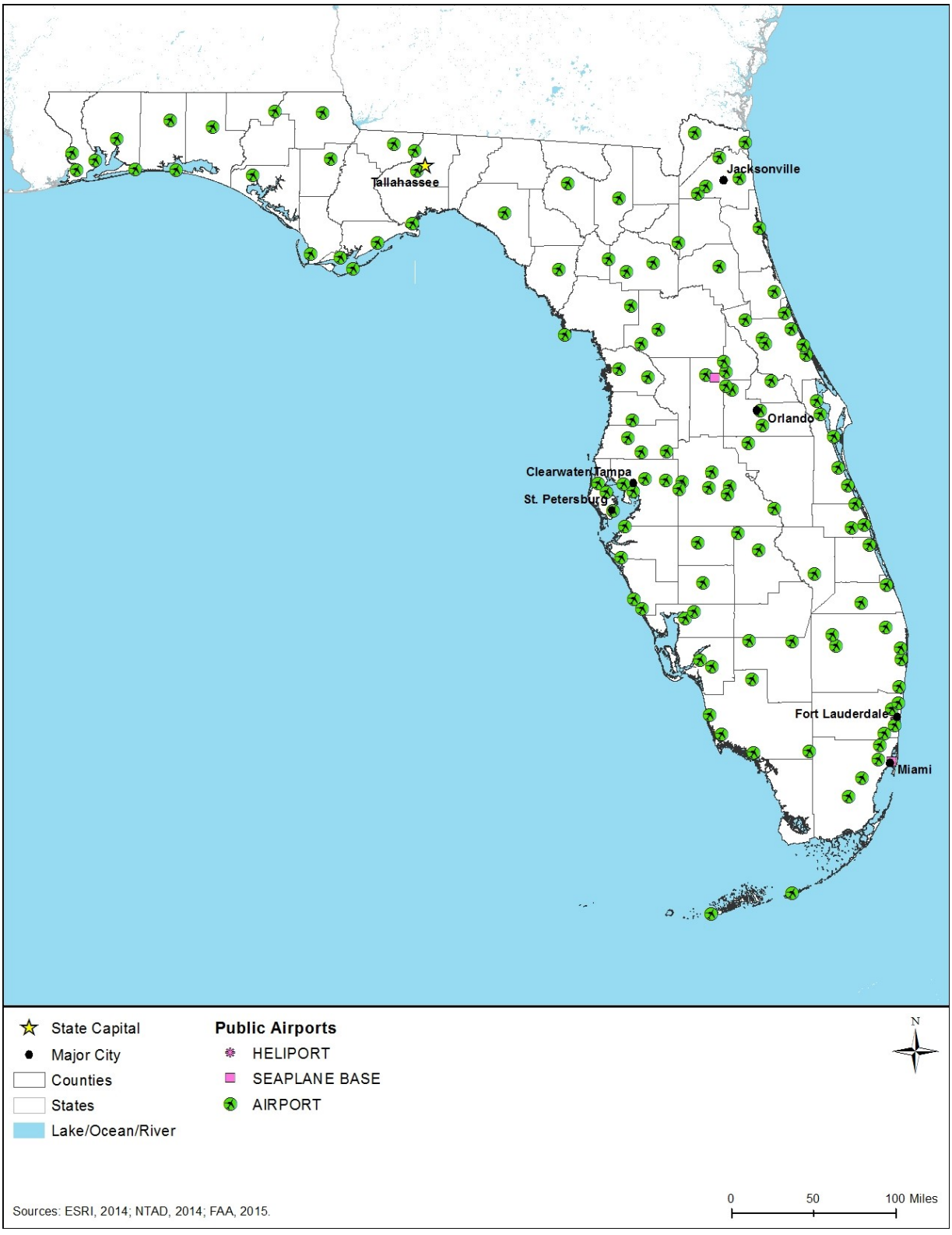


Figure 5.1.7-6: Public Florida Airports/Facilities

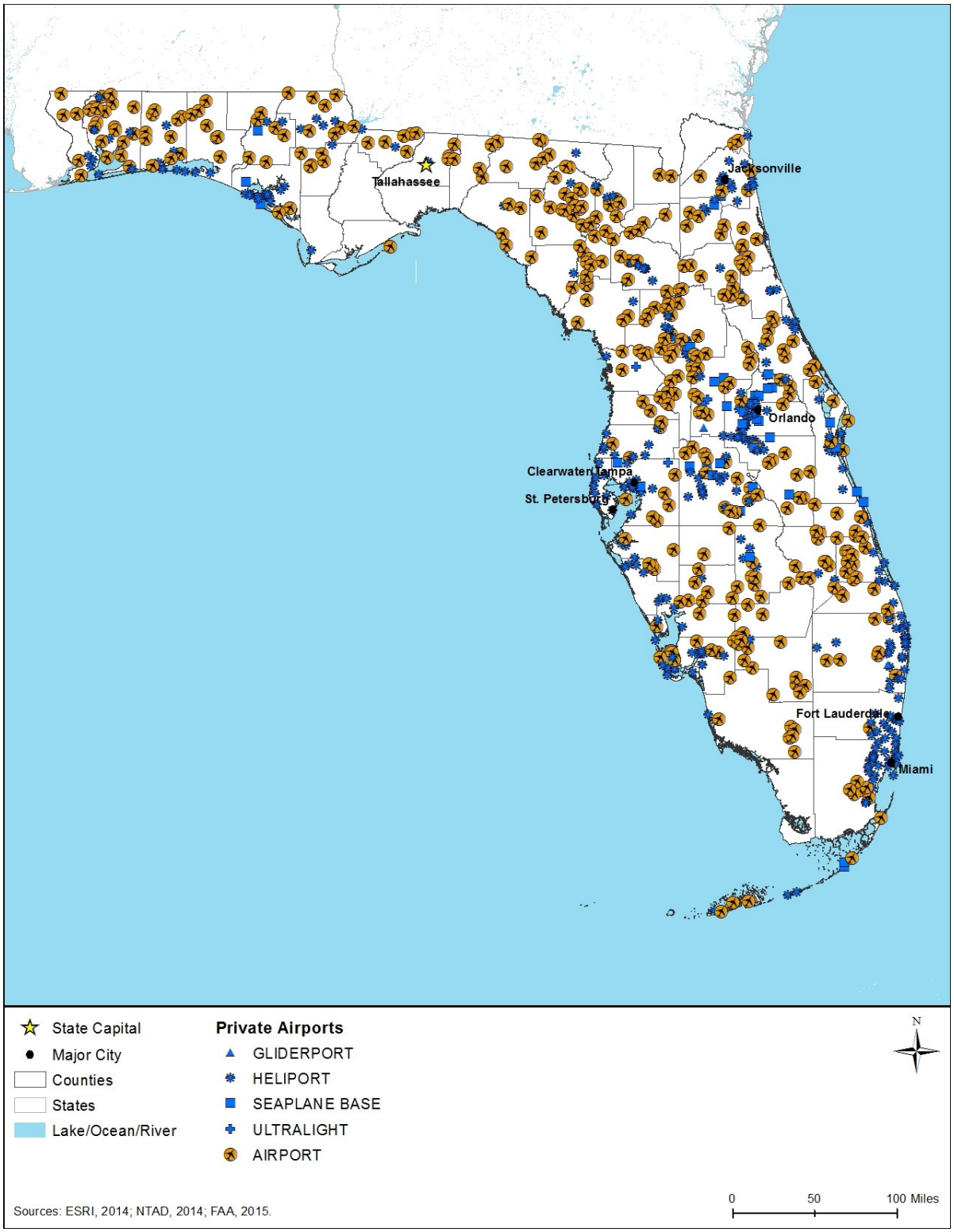


Figure 5.1.7-7: Private Florida Airports/Facilities

- Forty-Nine Class D –

Bartow Municipal	Boca Raton	Hernando County
Bunnell, Flagler County Airport	Cape Canaveral Skid Strip, Cocoa Beach	Cocoa, Patrick Air Force Base (AFB)
Eglin AFB	Eglin Axillary Field No. 3 Duke Field	Eglin, Hurlburt Field
Fort Lauderdale Executive	Fort Myers, Page Field	Fort Pierce, St. Lucie County International Airport
Gainesville Regional Airport, FL	Hollywood, North Perry Airport, FL	Homestead ARB
Cecil Field	Jacksonville NAS	Whitehouse Naval Outlying Field (NOLF)
Herlong Airport	Jacksonville, Craig Municipal	Whitehouse NOLF
Jupiter, William P. Gwinn	Key West International	Key West NAS
Kissimmee Municipal	Lakeland Linder Regional	Leesburg International
MacDill AFB	Mayport NAS	Melbourne International
Miami, Opa Locka Airport	Miami, Kendall-Tamiami Executive	Naples Municipal
New Smyrna Beach Municipal	Ocala International Airport–Jim Taylor Field, Ocala	Orlando Executive Airport, Choctaw NOLF
Ormond Beach Municipal	Northwest Florida-Panama City International	Pompano Beach, Airpark
Punta Gorda	St. Augustine	St. Petersburg-Clearwater International
St. Petersburg, Albert-Whitted	Witham Field	Spacecoast Regional
NASA Shuttle Landing Facility	Tyndall AFB	Vero Beach Municipal

Source: (FAA, 2014b)

SUAs (i.e., 45 restricted, 6 warning, 29 MOAs, 5 alerts, and 2 TFRs) located in Florida are as follows:

- Avon Park (Restricted)
  - R-2901A – Surface to, but not including, 14,000 feet MSL
  - R-2901B – 14,000 MSL to, but not including, FL 180
  - R-2901C – Surface to, but not including, 14,000 feet MSL
  - R-2901D – 500 feet MSL to, but not including, 4,000 feet MSL east of long
  - R-2901E – 1,000 feet to, but not including, 4,000 feet MSL
  - R-2901F – 4,000 feet MSL to, but not including, 5,000 feet MSL
  - R-2901G – Surface to, but not including, 5,000 feet MSL
  - R-2901H – 1,000 feet MSL to, but not including, 4,000 feet MSL
  - R-2901I – 1,500 feet MSL to, but not including, 4,000 feet MSL
  - R-2901J – FL to, but not including, FL 230
  - R-2901K – FL 230 to, but not including, FL 310

  - R-2901L – FL 310 to FL 400
  - R-2901M – 4,000 feet MSL to, but not including, 14,000 feet MSL
  - R-2901N – 5,000 feet MSL to, but not including, 14,000 feet MSL north of a line from lat. 27°24’46’’ N., long. 81°10’59’’ W.; to lat. 27°29’31’’ N., long. 81°05’27’’ W.; 4,000 feet MSL to, but not including, 14,000 feet MSL south of that line.
- Stevens Lake (Restricted)
  - R-2903A – Surface to, but not including, 23,000 feet MSL
  - R-2903B – 23,000 feet MSL to 32,000 feet MSL
  - R-2903C – Surface to 7,000 feet MSL
  - R-2903D – Surface to 5,000 feet MSL
- Starke (Restricted)
  - R-2904A – Surface to, but not including, 1,800 feet MSL
- Tyndall AFB (Restricted)
  - R-2905A – Surface to 10,000 feet MSL
  - R-2905B – Surface to 10,000 feet MSL
- Rodman (Restricted)
  - R-2906 – Surface to 14,000 feet MSL
- Lake George (Restricted)
  - R-2907A – Surface to FL 230
  - R-2907B – 2,000 feet MSL to FL 230
  - R-2907C – 500 feet MSL to, but not including, 2,000 feet MSL
- Pensacola (Restricted)
  - R-2908 – Surface to 12,000 feet MSL
- Pinecastle (Restricted)
  - R-2901A – Surface to FL 230
  - R-2901B – Surface to 6,000 feet MSL
  - R-2901C – Surface to 6,000 feet MSL
  - R-2901D – 2,000 feet MSL to FL 320
  - R-2901E – 500 feet MSL to, but not including, 2,000 feet MSL
- Valparaiso (Restricted)
  - R-2914A – Surface to unlimited, excluding that airspace within R-2917

  - R-2914B – 8,500 feet MSL to unlimited
  - R-2918 – Surface to unlimited
  - R-2919A – Surface to unlimited
  - R-2919B – 8,500 feet MSL to unlimited
- Eglin AFB (Restricted)
  - R-2915A – Surface to unlimited
  - R-2915B – Surface to unlimited
  - R-2915C – 8,500 feet MSL to unlimited
- Cudjoe Key (Restricted)
  - R-2916 – Surface to 14,000 feet MSL
- De Funiak Springs (Restricted)
  - R-2917 – Surface to 5,000 feet MSL
- Cape Canaveral (Restricted)
  - R-2932 – Surface to, but not including, 5,000 feet MSL
  - R-2933 – 5,000 feet MSL to unlimited
  - R-2934 – Surface to unlimited
  - R-2935 – 11,000 feet MSL to unlimited
- Mayport (Warning)
  - W-135 – Surface to 1,200 feet MSL
- Valparaiso (Warning)
  - W-151A – Surface to unlimited
  - W-151B – Surface to unlimited
- Pensacola (Warning)
  - W-155A – Surface to FL 600
- Patrick Air Force Base (Warning)
  - W-497A – Surface to unlimited
  - W-497B – Surface to unlimited (FAA, 2015f)

The 29 MOAs for Florida are as follows:

- Avon –
  - East – 500 feet Above Ground Level (AGL) to, but not including, 14,000 feet MSL
  - East High – 14,000 feet to, but not including FL 180

- Basinger – 500 feet AGL to 5,000 feet MSL, inclusive
- Eglin –
  - A East – 1,000 feet AGL to, but not including, FL 180; Occasional use to 200 feet AGL by NOTAM
  - A West – 1,000 feet AGL to but not including FL 180; Occasional use to 200 feet AGL by NOTAM
  - B – 1,000 feet AGL to, but not including FL 180; Occasional use to 200 feet AGL by NOTAM: Excluding Crestview, FL, Class E airspace area below 1,500 feet AGL
  - C – 1,000 feet AGL to, but not including FL 180; Occasional use to 200 feet AGL by NOTAM
  - D – 1,000 feet AGL to and including 3,000 feet MSL
  - E – Surface to, but not including, FL 180
  - F – Surface to, but not including FL 180
- Lake Placid –
  - North – 7,000 feet MSL to, but not including, FL 180
  - West – 7,000 feet MSL to, but not including, FL 180
  - East – 7,000 feet MSL to, but not including, FL 180
- Live Oak – 8,000 feet MSL to, but not including, FL 180
- Marian – 500 feet AGL to 5,000 feet MSL, inclusive
- Mayport –
  - High – 3,000 feet MSL to, but not including FL 180
  - Low – 500 feet MSL to, but not including, 3,000 feet MSL
- Palatka –
  - 1 – 3,000 feet MSL to, but not including, FL 180
  - 2 – 3,000 feet MSL to, but not including, FL180
- Pensacola –
  - North – 10,000 feet MSL to, but not including FL 180
  - South – 10,000 feet MSL to, but not including, FL 180
- Tortugas – 5,000 feet MSL to, but not including, FL 180
- Tyndall –
  - B – 9,000 feet MSL to, but not including FL 180
  - C – 300 feet AGL to 6,000 feet MSL

- D – 300 feet AGL to 6,000 feet MSL
- E – 300 feet AGL to, but not including, FL 180; Excluding the airspace 1,500 feet AGL and below within a 3 NM radius of the Apalachicola and Carrabelle-Thompson Airports
- F – 300 feet AGL to, but not including, FL 180; Excluding the airspace 1,500 feet AGL and below within a 3 NM radius of the Apalachicola and Costin Airports
- G – 1,000 feet AGL to, but not including, FL 180; Excluding the airspace 1,500 feet AGL and below within a 3 NM radius of the Carrabelle Thompson and St. George Island Airports; Times of use – Intermittent, sunrise to sunset, Monday-Friday; Other times by NOTAM
- H – 9,000 feet MSL to, but not including, FL 180 (FAA, 2015f)

MOAs of Georgia (Moody 1 and 2) extend into the north central/eastern portions of Florida, while the MOA of Alabama (Rose Hill) extends into the northwest part of the panhandle (FAA, 2015f)

There are five Alert Areas in Florida as follows:

- Miami –
  - A-291A – Surface to 2,500 feet MSL
  - A-291B – Surface to 3,900 feet MSL
  - A-291C – Surface to 2,500 feet MSL
  - A-291D – Surface to 3,900 feet MSL
- Pensacola –
  - A-292 – Surface to 3,000 feet MSL within federal airways; Otherwise, surface to FL 175

The Dothan Alert Area – A-211 (Surface to and including 5,000 feet MSL) – extends into the northwest portion of Florida (FAA, 2015f).

There are two TFRs [41929 – Jacksonville and 32122 – Orlando] for Florida. When active, the airspace restrictions associated with these TFRs may impact the airspace in the Jacksonville and Orlando area (Figure 5.1.7-8) (FAA, 2015f).

The SUAs for Florida are presented in Figure 5.1.7-8. MTRs in Florida, presented in Figure 5.1.7-9, consist of 24 Visual Routes, 23 Instrument Routes, and five Slow Routes.

UAS Considerations

The NPS signed a policy memorandum on June 20, 2014 that "directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service" (NPS, 2014b). Eleven NPS units within the state of Florida have to comply with this agency directive (NPS, 2015i).

Obstructions to Airspace Considerations

Chapter 333 of the Florida statutes protects the NAS over Florida by preventing airport hazards and incompatible land uses. The Aviation and Spaceports Office is responsible for determining if construction and operation of proposed tall structures will cause a temporary or permanent hazard to air navigation. An airport hazard, as defined by the statute, "endangers the lives and property of users of the airport and of occupants of land in its vicinity; and also, if of the obstruction type, in effect reduces the size of the area available for the taking off, maneuvering, or landing of aircraft, thus tending to destroy or impair the utility of the airport and the public investment therein" (The Florida State Senate, 2015). The Office is responsible for assessing and permitting construction within a 10 NM radius of military and public airports if the planned construction/modification exceeds the federal/FAA standards.

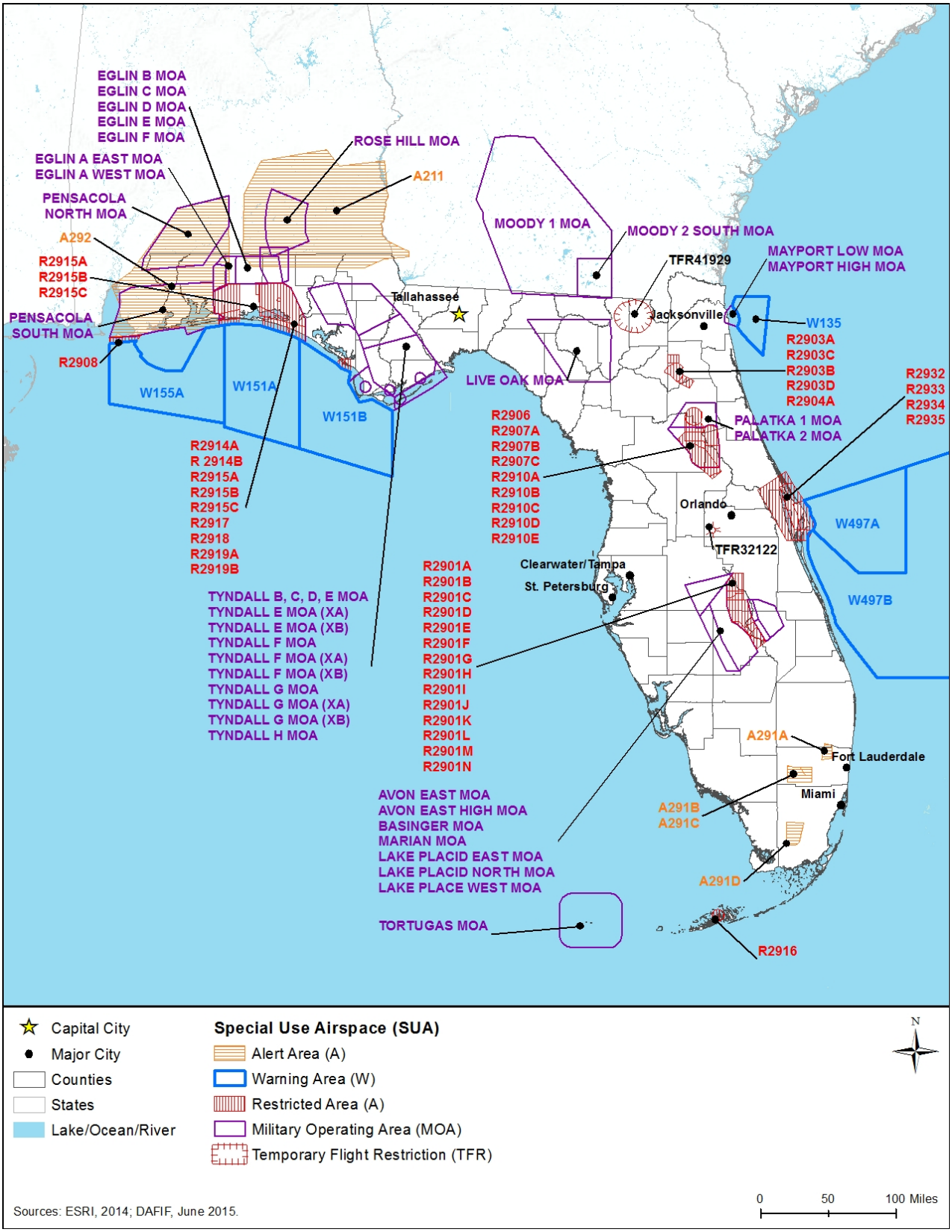


Figure 5.1.7-8: SUAs in Florida

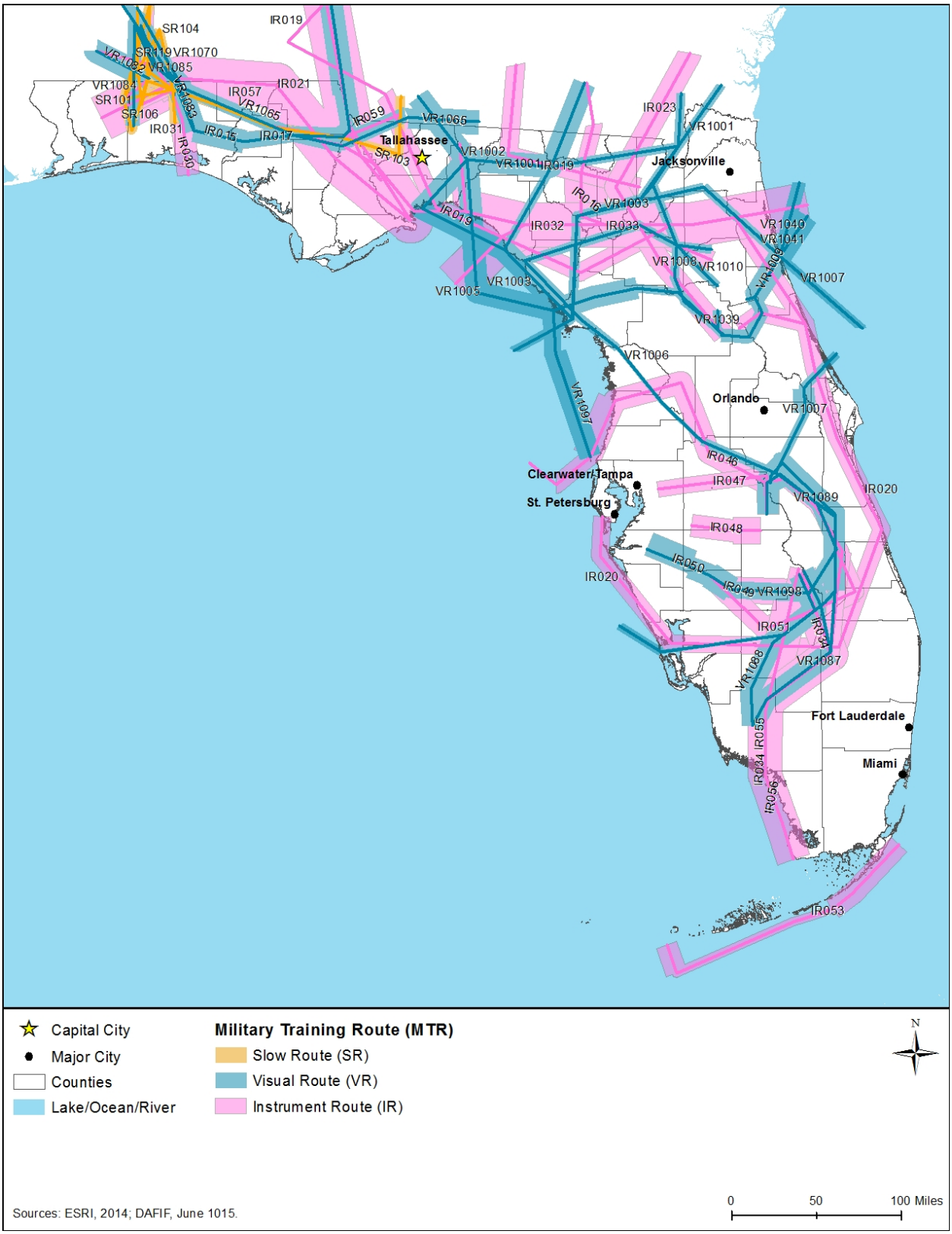


Figure 5.1.7-9: MTRs in Florida

5.1.8. Visual Resources

5.1.8.1. Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and NHPA compliance. The federal government does not have a single definition of what constitutes a visual resource; therefore, this PEIS will use the general definition of visual resources used by the Bureau of Land Management, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

5.1.8.2. Specific Regulatory Considerations

Table 5.1.8-1 presents state laws and regulations that relate to visual resources.

Table 5.1.8-1: Relevant Florida Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Florida Statutes, Chapter 267, Historical Resources	Division of Historical Resources (DHR)	Directs DHR to take actions to protect, preserve, and promote the protection of historic resources of Florida history and culture.
Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties	DHR	States that DHR must review any proposed projects concerning historic resources owned by the state of Florida.
Chapter 1A-46 Archaeological and Historical Report Standards and Guidelines	DHR	Specifies criteria by which DHR reviews reports of cultural resource activities on federal or state projects.
Performance Standards for Submerged Remote Sensing Surveys	DHR	Sets standards for remote sensing surveys conducted for the purposes of identifying submerged cultural resources.
Florida Statutes, Chapter 380, Land and Water Management	Local governments	Ensures the protection and restoration of natural areas is necessary to preserve cultural and heritage sites, provide recreational opportunities, and improve water quality.

In addition to the state laws and regulations, local zoning laws may apply related to visual resources. Viewsheds and scenic vistas are increasingly important to the state's towns, cities, and villages as they look at the future planning of their municipalities.

5.1.8.3. Character and Visual Quality of the Existing Landscape

Florida has a wide range of visual resources, both scenic and cultural. Florida is known for its sandy beaches and tropical wetlands known as the Everglades, but is also home to the oldest city in the U.S. – St. Augustine was established in 1565 by Spain. Most of Florida is located on a peninsula between the Gulf of Mexico and the Atlantic Ocean, with a small portion extending into a panhandle along the northern edge of the Gulf of Mexico. The state's highest point is Britton Hill in the Florida panhandle, which is only 345 feet above sea level.

Florida has several different types of land areas. The coastal plains generally consist of flat land, sandy beaches, coral reefs, and sandbars. The northern panhandle has gently rolling hills, while the Everglades is the largest tropical wilderness in the United States. The Florida Keys are a coral cay archipelago, extending from the southeastern tip of Florida to Key West, the westernmost of the inhabited islands, and on to the uninhabited Dry Tortugas.

One aspect of importance for visual resources is to maintain the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos would be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood is important to maintain if new development were to occur. Section 5.1.7.3, Land Use and Ownership, discusses land use and contains further descriptions of land cover within the state.

While the state and many municipalities have some regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have some measure of management, significance, or protection through state or federal policy, as well as being identified as a visually significant area.

5.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources (NASA, 2013). Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 5.1.8-2 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Florida, there are 1,702 NRHP listed sites, which include 1 World Heritage Site, 1 National Heritage Area, and 45 National Historic Landmarks. Other historic sites may also be included in the NRHP, whereas others are not designated at this time (NPS, 2014d).

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* addresses four aspects: preservation, rehabilitation, restoration, and reconstruction, whereas *The Guidelines for the Treatment of Cultural Landscapes*, both authored by the NPS, provides guidance for applying protections to all aspects of the historic and cultural landscape, such as forests, gardens, trails, structures, ponds, and farming areas, to meet the Standards (NPS, 1995). The

Standards ”require retention of the greatest amount of historic fabric, including the landscape’s historic form, features, and details as they have evolved over time,” which directly protects historic properties and the visual resources therein (NPS, 1995).

World Heritage Site

Everglades National Park is an international treasure – “a World Heritage Site, International Biosphere Reserve, a Wetland of International Importance, and a specially protected areas under the Cartagena Treaty” (NPS, 2015y).

Sites are designated as World Heritage sites if they reflect “the world’s cultural and natural diversity of outstanding universal value” (UNESCO, 2015a). To be included on the World Heritage List, sites must meet 1 of 10 criteria reflecting cultural, natural, or artistic significance (UNESCO, 2015b). World Heritage sites are diverse and range from archaeological remains, national parks, islands, buildings, city centers, and cities. The importance of World Heritage-designated properties can be attributed to cultural or natural qualities that may be considered visual resources or are visually sensitive at these sites. In Florida, there is one World Heritage site, Everglades National Park (see Figure 5.1.8-1 and Figure 5.1.8-4) (World Heritage Convention, 2015). Everglades National Park contains the largest sub-tropical wilderness reserve, largest mangrove ecosystem, and “largest continuous stand of sawgrass prairie” in North America (World Heritage Convention, 2015). The Park is home to more than 20 rare, endangered, and threatened species, and 400 species of birds for breeding, foraging, and migrating.



Figure 5.1.8-1: Great Egret and Cypress Trees at Everglades National Park

Source: (NPS, 2015j)

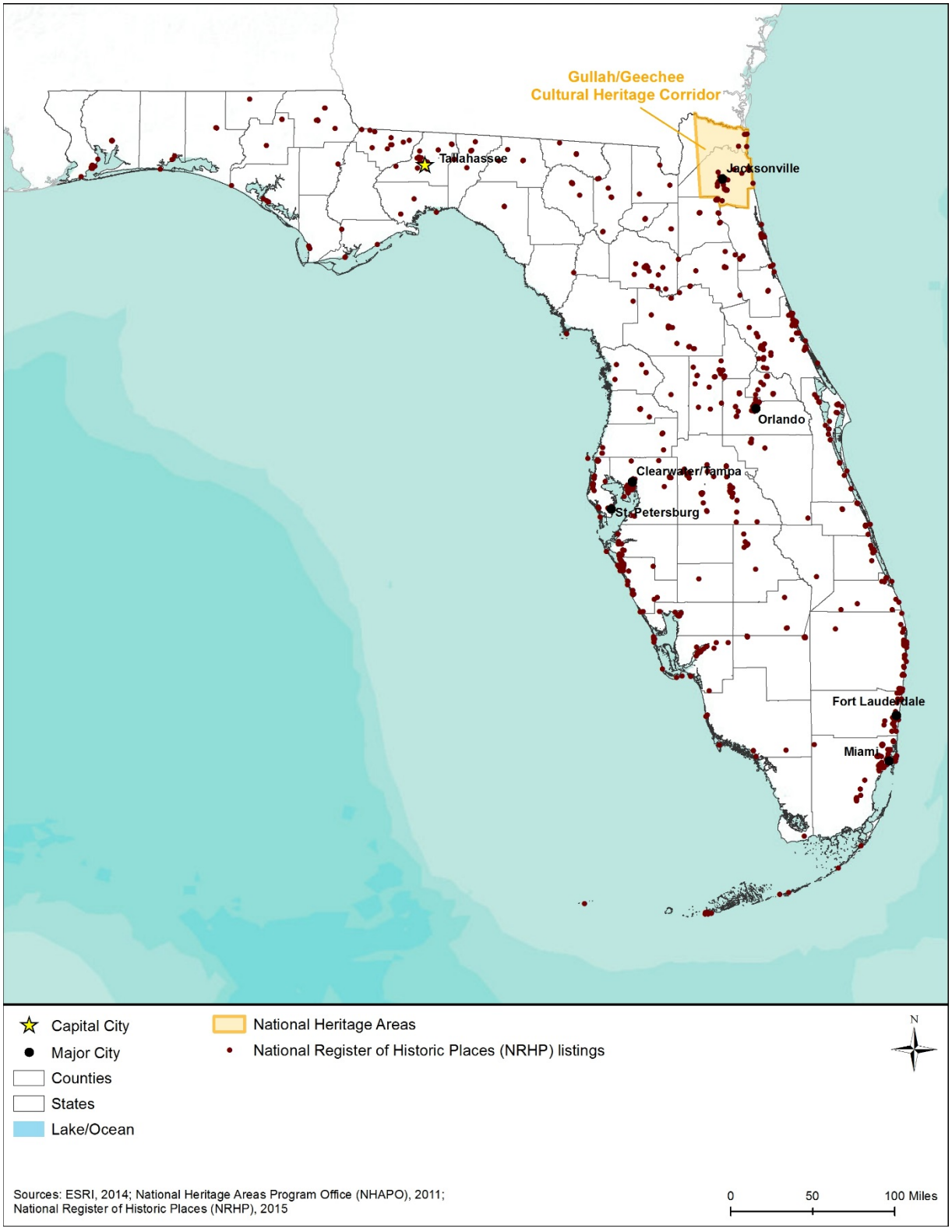


Figure 5.1.8-2: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive

National Heritage Areas

National Heritage Areas (NHA) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011). These areas help tell the history of the United States. Based on this criteria, NHAs in Florida may contain scenic or aesthetic areas considered visual resources or visually sensitive. There is only one NHA in Florida, the Gullah/Geechee Heritage Corridor (Figure 5.1.8-2). The Gullah/Geechee Cultural Heritage Corridor extends from Wilmington, North Carolina to St. Augustine, Florida. The Gullah/Geechee Heritage Corridor "recognizes the important contributions made to American culture and history by Africans and African Americans known as the Gullah and the Geechee who settled in the coastal counties of South Carolina, Georgia, the southeast coast of North Carolina, and the northeast coast of Florida" (NPS, 2015k).

National Historic Landmarks

National Historic Landmarks (NHL) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015l). NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016b). Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. In Florida, there are 45 NHLs, such as Cape Canaveral, Ernest Hemingway's House, and the historic district of St. Augustine (NPS, 2015m) shown in Table 5.1.8-2. By comparison, there are over 2,500 NHLs in the United States (NPS, 2015z). Figure 5.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

Table 5.1.8-2: Florida National Historic Landmarks

NHL Name	
Mary McLeod Bethune Home	Ingham (U.S. Coast Guard Cutter)
Bok Tower Gardens (Historic Bok Sanctuary)	Llambias House
British Fort	Maple Lead
Cape Canaveral Air Force Station	Mar-A-Lago
Cathedral of St. Augustine	Miami Biltmore Hotel & Country Club
Crystal River Site	The Miami Circle at Brickell Point Site
Dade Battlefield	Mud Lake Canal
Marjory Stoneman Douglas House	Okeechobee Battlefield
El Centro Espanol de Tampa	Pelican Island NWR
Ferdinand Magellan-United State Car No. 1	Pensacola Naval Air Station Historic District
Florida Southern College Historic District	Plaza Ferdinand VII
Fort King Site	Ponce de Leon Inlet Light Station
Fort Mose Site	Marjorie Kinnan Rawlings House and Farm Yard
Fort San Carlos de Barrancas	The Research Studio (Maitland Art Center)
Fort San Marcos de Apalache	Safety Harbor Site
Fort Walton Mound	St. Augustine Town Plan Historic District
Fort Zachary Taylor	San Luis De Talimali
Freedom Tower	Tampa Bay Hotel
Gonzalez-Alvarez House	Vizcaya
Governor Stone	White Hall (Henry M. Flager House)
Ernest Hemingway House	Windover Archeological Site
Hotel Ponce de Leon	Ybor City Historic District
Zora Neale Hurston House	

Source: (NPS, 2015n)

5.1.8.5. Parks and Recreation Areas

Park and recreation areas include National Parks, National Seashores, National Monuments, National Memorials, and National Preserves; as well as State Parks and Preserves, and State and National Trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. Figure 5.1.8-4 identifies resources that may be visually sensitive in Florida.[126] For additional information about park and recreation areas, including national and state parks, see Section 5.1.7, Land Use, Recreation, and Airspace.

National Park Service

National Parks are managed by the NPS and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Florida, there are 11 officially designated NPS units in addition to other NPS affiliated areas, such as National Heritage Areas. The officially designated NPS units in Florida are comprised of 3 National Parks, 2 National Seashores, 2 National Monuments, 2 National Memorials, 1

[126] The natural areas data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive dataset that contains large quantities of information relevant to the Proposed Action. The data was queried and further combined by the Primary Designation Type into classifications that fit the multiple types of land applicable for Natural Areas. For this map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for natural areas. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

National Preserve, and 1 Ecological and Historic Preserve. Table 5.1.8-3 identifies the NPS units and affiliated areas located in Florida (Figure 5.1.8-4). Dry Tortugas National Park (Figure 5.1.8-3) is a 100-square mile park 70 miles west of Key West that includes the 19th century Fort Jefferson, picturesque blue waters, coral reefs, marine life, and migratory birds. For additional information regarding parks and recreation areas, see Section 5.1.7, Land Use, Recreation, and Airspace.

Table 5.1.8-3: Florida National Parks and Affiliated Areas

Area Name	
Big Cypress National Preserve	Everglades National Park
Biscayne National Park	Fort Caroline National Memorial
Canaveral National Seashore	Fort Matanzas National Monument
Castillo De San Marcos National Monument	Gulf Islands National Seashore
DeSoto National Memorial	Timucuan Ecological & Historic Preserve
Dry Tortugas National Park	

Source: (NPS, 2015o), (USFS, 2015f)



Figure 5.1.8-3: Dry Tortugas National Park

Source: (NPS, 2015p)

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Florida residents and visitors. There are 174 state parks, trails and historic sites throughout Florida, most of which likely contain scenic or aesthetic areas considered to be visual resources or visually sensitive (Florida State Parks, 2015m). Table 5.1.8-4 contains a sampling of state parks and their associated visual attributes. For a complete list of state parks, access the Florida State Parks website (https://www.floridastateparks.org/) (Florida State Parks, 2015n).

Table 5.1.8-4: Examples of Florida State Parks and Associated Visual Attributes

State Park	Visual Attributes
Blue Spring State Park	Springs, St. John's River, wildlife (manatees), Historic Thursby House
Fakahatchee Strand Preserve State Park	Linear swamp forest, cypress trees, shallow river, lake vistas, prairies, tropical hardwood hammocks, pine rock lands, royal palms, wildlife, flora
Falling Waters State Park	Fern-covered sinkholes, Florida's highest waterfall, lake vistas, butterfly garden, sloping landscape
Little Talbot Island State Park	White sandy beaches, maritime forests, dunes, salt marshes, wildlife, tidal streams
St. Sebastian River Preserve State Park	Open grassy forests, longleaf pine stands, scrubby flatwoods, strand swamp, sand hills, cypress domes, wildlife

Source: (Florida State Parks, 2015o)

State and Federal Trails

Florida boasts numerous trails for nature walking, hiking, biking and other recreation in the state forests and parks. These are designated for parks and recreation use, and there is no separate designation as scenic or historical, although all have aesthetic value and some may have historical value as well. The Florida State Parks website (https://www.floridastateparks.org/) contains a list of trail information by activity on its website (Florida State Parks, 2015p). In addition, Florida has nine greenway and multi-use trails for "recreation, conservation, and alternative transportation use" and details can be found on the Florida State Parks website (Florida State Parks, 2015q).

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails (NSTs) are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2012b). The only National Scenic Trail in Florida is the Florida NST administered by the USFS (see Figure 5.1.8-4) (USFS, 2015b). The Florida NST is a 1,000-mile trail that travels across Florida from Big Cypress National Preserve to the Gulf Islands National Seashore and contains unique scenic, historic, cultural, and natural features (USFS, 2015b).

The National Trails System Act authorized the designation of National Recreational Trails near urban areas by either the Secretaries of the Interior or Agriculture, depending upon the ownership of the designated land (American Trails, 2015a). There are 10 National Recreation Trails covering over 230.6 miles in Florida, administered by a variety of federal, state, local, and private organizations. These trails include:

- Apalachicola River Blueway (106 miles);
- Chipola River Greenway – Hinson Conservation and Recreation Area Trail System (4 miles);
- Chipola River Greenway – Butler Trail (3.5 miles);
- Aucilla River (50 miles);
- Cross Seminole Trail (13.9 miles);

- Econfina River (16 miles);
- Flagler Trail (8.7 miles);
- Foster's Hammock Loop Trail (8 miles);
- North Bay Trail (6.5 miles); and
- Seminole Wekiva Trail (14 miles).

Source: (American Trails, 2015b)

U.S. Army Corps of Engineers Recreation Areas

There are two USACE recreation and flood risk management areas within the state: Lake Okeechobee and Lake Seminole (USACE, 2015). Lake Okeechobee has mossy oaks, sabal palms, and a variety of water plants and animals. Lake Seminole has 37,500 acres of water and over 18,000 acres of surrounding land used for navigation, hydro-power, and recreation. These lakes are specifically managed by the USACE for scenic and aesthetic qualities in their planning guidance in addition to managing risks for floods (USACE, 1997).

5.1.8.6. Natural Areas

Natural areas vary by state depending on the amount of public or state lands within each state. Although many areas may not be managed specifically for visual resources, these areas exist because of their natural resources, and the resulting management may also protect the scenic resources therein.

National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 to "establish a National Wilderness Preservation System for the permanent good of the whole people" to provide "clean air, water, and habitat critical for rare and endangered plants and animals" (Wilderness.net, 2015a). This Act defined wilderness as land untouched by man and primarily affected only by the "forces of nature" and as that which "may also contain ecological, geological, or other features of scientific, education, scenic, or historical value" (Wilderness.net, 2015b). A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. Over 106 million acres of federal public lands have been designated as wilderness areas. Twenty-five percent of these federal lands are in 47 national parks (44 million acres) and part of the National Park System. Other designated wilderness areas are managed by the USFS, BLM, and USFWS (NPS, 2015q). Florida is home to 17 federally managed Wilderness Areas, totaling 1,421,587 acres, some areas of which are included in the state's NWRs, National Forests, and one National Park (see Table 5.1.8-5) (Wilderness.net, 2015c).

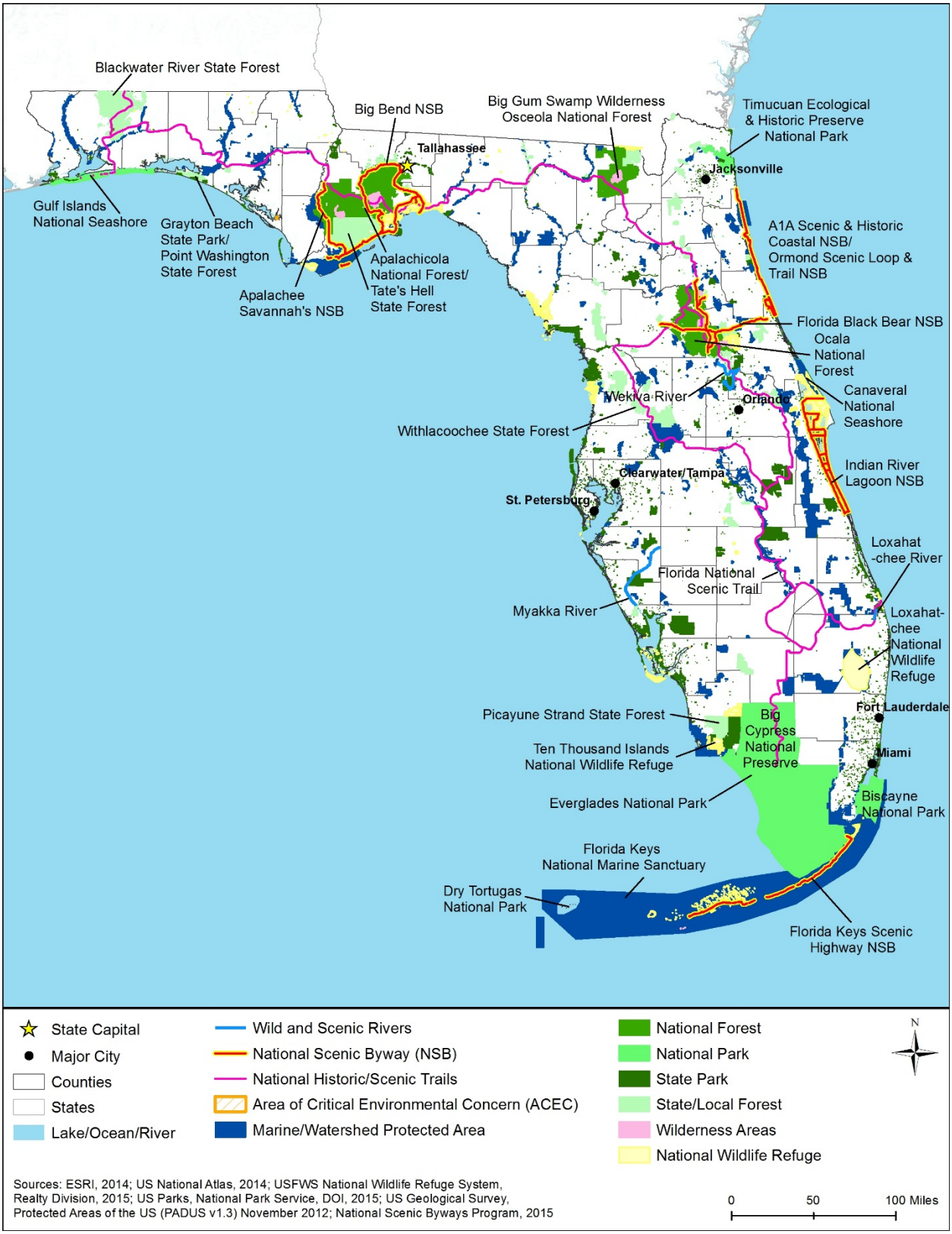


Figure 5.1.8-4: Natural Areas that May be Visually Sensitive

Table 5.1.8-5: Florida Wilderness Areas

Wilderness Area Name	
Alexander Springs Wilderness	Juniper Prairie Wilderness
Big Gum Swamp Wilderness	Lake Woodruff Wilderness
Billies Bay Wilderness	Little Lake George Wilderness
Bradwell Bay Wilderness	Marjory Stoneman Douglas Wilderness
Cedar Keys Wilderness	Mud Swamp/ New River Wilderness
Chassahowitzka Wilderness	Passage Key Wilderness
Florida Keys Wilderness	Pelican Island Wilderness
Island Bay Wilderness	St. Marks Wilderness
J.N. "Ding" Darling Wilderness	

Source: (Wilderness.net, 2015c)

Bureau of Land Management Outstanding Natural Area

The BLM manages the Jupiter Inlet Lighthouse Outstanding Natural Area (ONA) in Florida as part of its 27-million acre National Landscape Conservation System (see Figure 5.1.8-4). Jupiter Inlet Lighthouse ONA is 120 acres in Northern Palm Beach County, at the intersection of the Loxahatchee River and Indian River Lagoon, including native and restored coastal habitat and the Jupiter Inlet Lighthouse. This ONA is protected for its "unique scenic, scientific, educational, and recreation values" (BLM, 2015a). BLM lands are managed under a multiple use mandate (FLPMA) meaning that BLM must allow many uses of the lands, from recreation, to livestock grazing, forestry, wildlife habitat, and energy development (BLM, 2015b). The BLM uses their visual resources management system to "identify and evaluate scenic values to determine the appropriate levels of management" (BLM, 2012). Lands that are classified with high scenic values are assigned management that prevents or reduces impacts to the visual resources, protecting the scenic landscape (BLM, 2012). BLM lands with high scenic values are less likely to be developed or have the visual resources disturbed. Management varies among uses and resources, some areas, like lands adjacent to wild and scenic rivers, will be managed for high quality visual resources. Other areas, such as where energy development is occurring, may be managed for lower quality visual resources (BLM, 1984).

National Forests

National Forests are owned and managed by the U.S. Department of Agriculture (USDA) Forest Service and may contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Florida, there are three National Forests: Apalachicola National Forest, Ocala National Forest, and Osceola National Forest (see Figure 5.1.8-4).

State Forests

In addition to state parks, Florida also has 37 state forests. The Florida Forest Service manages these state forest lands "to protect and maintain the biological diversity of the many ecosystems found in and around the state forests while integrating public use of the resources" (Florida

Department of Agriculture and Consumer Services, 2015a). These lands may be contained within or are part of national and state parks and wildlife management areas and refuges. These forests provide all manner of visual resources such as flatwood scrubs, bottomland forests, pine ridges, strand swamp, and floodplain swamp. Picayune Strand State Forest is the heart of Florida's Big Cypress Basin and is mostly underwater during the wet season (Florida Department of Agriculture and Consumer Services, 2015a).

Table 5.1.8-6 lists Florida's 37 state forests.

Table 5.1.8-6: Florida State Forests

State Forest Name	
Belmore State Forest	Matanzas State Forest
Big Shoals State Forest	Myakka State Forest
Blackwater River State Forest	Newnans Lake State Forest
Carl Duval Moore State Forest	Okaloacoochee Slough State Forest
Cary State Forest	Peace River State Forest
Charles H. Bronson State Forest	Picayune Strand State Forest
Cottage Hill State Forest	Pine Log State Forest
Deep Creek State Forest	Point Washington State Forest
Etoniah Creek State Forest	Ralph E. Simmons State Forest
Four Creeks State Forest	Ross Prairie State Forest
Goethe State Forest	Seminole State Forest
Holopaw State Forest	Tate's Hell State Forest
Indian Lake State Forest	Tiger Bay State Forest
Jennings State Forest	Twin Rivers State Forest
John M. Bethea State Forest	Wakulla State Forest
Lake George State Forest	Watson Island State Forest
Lake Talquin State Forest	Welaka State Forest
Lake Wales Ridge State Forest	Withlacooche State Forest
Little-Big Econ State Forest	

Source: (Florida Department of Agriculture and Consumer Services, 2015a)



Figure 5.1.8-5: Picayune Strand State Forest

Source: (Florida Department of Agriculture and Consumer Services, 2015b)

State Forest Preserves and Conservation Areas

The DEP Division of State Lands is entrusted with environmental management and stewardship

of 12 million acres of public lands in order to provide "residents and visitors…with the opportunity to truly appreciate Florida's unique landscape" (DEP, 2015x). In addition to acquiring and managing state lands, the DEP also manages water resources in five Water Management Districts. These districts are responsible for acquiring and managing lands for water management purposes under the state's Save Our Rivers program. State lands with preserves and conservation areas are contained within or are part of the state's national and state parks, wildlife management areas, and refuges. State lands containing water resources are managed within the Water Management District in which they reside (DEP, 2014e). For specific information related to each of the preservation and conservation areas, see Florida's State Forests website (Florida Department of Agriculture and Consumer Services, 2015a). For information regarding Water Management Districts, see the DEP's Water Management Districts website (DEP, 2014e).

Rivers Designated as Wild, Scenic, or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. Florida has two designated National Wild and Scenic Rivers, the Loxahatchee River and Wekiva River as shown on Figure 5.1.4-1 (National Wild and Scenic Rivers System, 2015). The Loxahatchee River is composed of 260 square miles of watershed and includes 10 major freshwater and saltwater habitats and many endangered species, such as the manatee (Loxahatchee River District, 2015a). The Wekiva River is 42 miles of flowing river and 34 springs. It is the only river in the National Wild and Scenic River System whose entire length is designated as it is one of the few "near-pristine river systems in central Florida" and is home to a floodplain of hardwood forests and a variety of protected plant and animal species (Friends of the Wekiva River, Inc., 2011).

Additionally, the Florida State Myakka River Wild and Scenic Designation and Preservation Act of 1985 designates a 34-mile segment of the Myakka River as a State Wild and Scenic River because it "possesses outstandingly remarkable ecological, fish and wildlife, and recreational values which are unique in the state of Florida" (Myakka River Management Coordinating Council, 2015).



Figure 5.1.8-6: Loxahatchee River

Source: (Loxahatchee River District, 2015b)

NWRs and State Wildlife Management Areas

NWRs are a network of lands and waters managed by the USFWS. These lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015a). There are 29 NWRs in Florida including Pelican Island NWR, Everglades Headwaters NWR, and Florida Panther NWR (see Table 5.1.8-7) (USFWS, 2015y). Pelican Island NWR was the first NWR designated in the NWR System in 1903 and includes 95 million acres of habitat for the protection of nesting native birds and brown pelicans (USFWS, 2015z). Everglades Headwaters NWR consists of approximately 150,000 acres of the Kissimmee River Valley and is "one of the last remaining grassland and longleaf pine savanna landscapes in eastern North America" (USFWS, 2015n). Florida Panther NWR is composed of 26,400 acres to protect the Florida panther and its habitat (USFWS, 2013d).

Table 5.1.8-7: Florida NWRs

NWR Name	
Archie Carr NWR	Lake Wales Ridge NWR
Arthur R. Marshall-Loxahatchee NWR	Lake Woodruff NWR
Caloosahatchee	Lower Suwanee NWR
Cedar Keys NWR	Matlacha Pass NWR
Chassahowitzka NWR	Merritt Island NWR
Crocodile Lake NWR	National Key Deer NWR
Crystal River NWR	Passage Key
Egmont Key NWR	Pelican Island NWR
Everglades Headwaters NWR	Pine Island NWR
Florida Panther NWR	Pinellas NWR
Great White Heron NWR	St. Johns NWR
Hobe Sound NWR	St. Marks NWR
Island Bay NWR	St. Vincent NWR
J.N. "Ding" Darling NWR	Ten Thousand Islands NWR
Key West NWR	

Source: (USFWS, 2015y)

The Florida FWC manages 5.8 million acres of land in 148 Wildlife Management Areas (WMA) and Wildlife Environmental Areas (WEAs) "to sustain the widest possible range of native wildlife in their natural habitats" (FWC, 2015v). FWC is the primary manager of 1.4 million acres and works cooperatively with other governmental agencies and private owners to manage the remaining 4.4 million acres (FWC, 2015v). For additional information on wildlife refuges, management areas, and environmental areas, see Section 5.1.6.4, Terrestrial Wildlife.

Table 5.1.8-8: Examples of Florida WMAs and WEAs and Associated Visual Attributes

WMA/WEA Name	Associated Visual Attributes
Apalachee WMA	Chattahoochee River and Lake Seminole vistas, 8,000-acres of longleaf pine uplands, ponds, wetlands, and floodplain forest
Escribano Point WMA	Grassy Point Area, East Bay, wetlands along Blackwater Bay, Catfish Basin and creeks, Weaver River, black needlerush marsh, pine forest, basin swamp, maritime hammock, scrubby pine forest, and habitats for Gulf sturgeon, Florida black bear)
Florida Keys WEA	Tropical hardwood hammocks, rare and protected species (e.g., white-crowned pigeon, Schaus swallowtail butterfly, Liguus tree snail)
Fred C. Babcock-Cecil M. Webb WMA	65,758-acre of citrus groves, improved pasture, undeveloped expanses of hydric (wet) pine flatwoods, wildflowers, migratory birds, bobwhite quail
Hickey Creek WEA	Oaks, palms, ferns, Palmetto Pines Trail, pine flatwoods, marshes, cypress swamps, and oak-palm hammocks;, habitats for otters, alligators, largemouth bass, manatees, Florida scrub-jays, and Eastern indigo snakes

Source: (FWC, 2015w)

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014c). These landmarks may be considered visual resources or visually sensitive. In Florida there are 18 NNLs (see Table 5.1.8-9). Some of the visual resources located within these areas include the Florida Caverns Natural Area dry caves with stalactite and stalagmite formations; Rainbow Springs State Park, the fourth largest spring in the state; Corkscrew Swamp Sanctuary, a sawgrass prairie; and Wakulla Springs, one of the "largest and deepest freshwater springs" in the world (NPS, 2012c).



Figure 5.1.8-7: Florida Caverns State Park and Natural Area

Source: (Florida State Parks, 2015n)

Table 5.1.8-9: Florida National Natural Landmarks

NNL Name	
Archbold Biological Station	Osceola Research Natural Are
Big Cypress Bend	Paynes Prairie
Corkscrew Swamp Sanctuary	Rainbow Spring
Devil's Millhopper	Reed Wilderness Seashore Sanctuary
Emeralda Marsh	San Felasco Hammock
Florida Caverns Natural Area	Silver Spring
Ichetucknee Springs	Torreya State Park
Lignumvitae Key	Waccasassa Bay Preserve State Park
Manatee Springs	Wakulla Springs

Source: (NPS, 2012c)

5.1.8.7. Additional Areas

State and National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The FHWA manages the National Scenic Byways Program (FHWA, 2015d). Florida has six designated National Scenic Byways (Figure 5.1.8-4):

- A1A Scenic & Historic Coastal Byway, 72 miles;
- Big Bend Scenic Byway, 220 miles;
- Florida Black Bear Scenic Byway, 123 miles;
- Florida Keys Scenic Highway, 106.5 miles;
- Indian River Lagoon National Scenic Byway, 150 miles; and
- Ormond Scenic Loop & Trail, 36 miles.

The A1A Scenic & Historic Coastal Byway is also designated an historic road and passes St. Augustine, which is the oldest continually occupied European settlement in the states (FHWA, 2015e). The Florida Keys Scenic Highway is also designated an All-American Road, which are the most scenic byways with multiple inherent qualities (e.g., cultural, historic, scenic) (FHWA, 2012).

Similar to National Scenic Byways, Florida Scenic Highways are established by the Florida Scenic Highways Program "to heighten awareness of [the] State's historical and intrinsic resources (cultural, recreational, natural, archaeological, historical and scenic)" and include historical, scenic, and heritage highways (FDOT, 2015c). There are 19 State Scenic Highways, in addition to the six designated National Scenic Byways (see Table 5.1.8-10) (FDOT, 2015c).

Table 5.1.8-10: Florida Scenic Highways

Highway Name	
Bradenton Beach Scenic Highway	Old Florida Heritage Highway
Broward County A1A Scenic Highway	Ormond Scenic Loop & Trail
Courtney Campbell Scenic Highway	Palma Sola Scenic Highway
Florida Black Bear Scenic Byway	Pensacola Scenic Bluff
Green Mountain Scenic Byway	The Ridge Scenic Highway
Heritage Crossroads – Miles of History Heritage Highway	River of Lakes Heritage Corridor Scenic Highway
Indian River Lagoon Treasure Coast Scenic Highway	Scenic Highway 30A
J.C. Penney Memorial Scenic Highway	Suncoast Scenic Parkway
Lemon Bay/Myakka Trail Scenic Highway	William Bartram Scenic & Historic Highway
Martin Grade Scenic Highway	

Source: (Florida Scenic Highway, 2015)

5.1.9. Socioeconomics

5.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. § 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures (BLM, 2005). When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects, and in addition, FirstNet projects may affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however, this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8, Overview of Relevant Federal Laws and Executive Orders). This PEIS addresses

environmental justice in a separate section (Section 5.1.10, Environmental Justice). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 5.1.7, Land Use, Recreation, and Airspace), infrastructure (Section 5.1.1, Infrastructure), and aesthetic considerations (Section 5.1.8, Visual Resources).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau[127] (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level (U.S. Census Bureau, 2016).

The remainder of this section addresses the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

[127] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g., "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g., "United States – 010" or "State – 040" or ..... "County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g., "DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. In many cases, the FirstNet PEIS report tables contain data from multiple Census Bureau tables and sometimes incorporate other sources.

5.1.9.2. Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to socioeconomics for this PEIS.

5.1.9.3. Communities and Populations

This section discusses the population and major communities of Florida (FL) and includes the following topics:

- Recent and projected statewide population growth;
- Current distribution of the population across the state; and
- Identification of the largest population concentrations in the state.

5.1.9.4. Statewide Population and Population Growth

Table 5.1.9-1 presents the 2014 population and population density of Florida in comparison to the south region[128] and the nation. The estimated population of Florida in 2014 was 19,893,297. The population density was 350.6 persons per square mile (sq. mi.), which is higher than the population density of both the region (114 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Florida was the third largest state by population among the 50 states and the District of Columbia, 26th largest by land area, and had the ninth greatest population density (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f).

Table 5.1.9-1: Land Area, Population, and Population Density of Florida

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2010 (persons/sq. mi.)
Florida	53,927	19,893,297	350.6
South Region	914,471	104,109,977	114
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f)

Population growth is an important subject for this PEIS given FirstNet's mission. Table 5.1.9-2 presents the population growth trends of Florida from 2000 to 2014 in comparison to the south region and the nation. The state's annual growth rate decreased slightly in the 2010 to 2014 period compared to 2000 to 2010, from 1.64 percent to 1.42 percent. The growth rate of Florida in the latter period was higher than the growth rate of the region, at 1.14 percent, and the nation, at 0.81 percent.

[128] The South Region is composed of the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, New Mexico, Oklahoma, South Carolina, Tennessee, and Texas. Throughout the socioeconomics section, figures for the south region represent the sum of the values for all states in the region, or an average for the region based on summing the component parameters. For instance, the population density of the south region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

Table 5.1.9-2: Recent Population Growth of Florida

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
Florida	15,982,378	18,801,310	19,893,297	2,818,932	1,091,987	1.64%	1.42%
South Region	86,516,862	99,487,696	104,109,977	12,970,834	4,622,281	1.41%	1.14%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

[a] AARC = Average Annual Rate of Change (compound growth rate)
Sources: (U.S. Census Bureau, 2015e) (U.S. Census Bureau, 2015g)

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The U.S. Census Bureau does not prepare population projections for the states. Therefore, Table 5.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service (ProximityOne, 2015) (University of Virginia Weldon Cooper Center, 2015). The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates Florida's population will increase by approximately 3.6 million people, or 18.3 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 1.05 percent, which is somewhat lower than the historical growth rate from 2010 to 2014 of 1.42 percent. The projected growth rate of the state is similar to that of the region (0.97 percent) and greater than the projected growth rate of the nation (0.80 percent).

Table 5.1.9-3: Projected Population Growth of Florida

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC)[a] 2014 to 2030
Florida	19,893,297	25,020,477	22,392,839	23,527,715	3,634,418	18.3%	1.05%
South Region	104,109,977	122,323,551	120,794,020	121,558,786	17,448,809	16.8%	0.97%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

[a] AARC = Average Annual Rate of Change (compound growth rate)
Sources: (U.S. Census Bureau, 2015e; ProximityOne, 2015; University of Virginia Weldon Cooper Center, 2015)

Population Distribution and Communities

Figure 5.1.9-1 presents the distribution and relative density of the population of Florida. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015h).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2015g) (U.S. Census Bureau, 2012). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. The map shows that Florida has several densely settled areas besides those specifically identified as the top 10 population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. The very sparsely populated area in the southern portion of the state is the Everglades area, much of which is protected from development as part of the Everglades National Park. For more information about the Everglades, see Section 5.1.7, Land Use, Recreation, and Airspace.

Table 5.1.9-4 provides the populations of the 10 largest population concentrations in Florida, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[129] In 2010, the largest population concentration by far was the Miami area, which had approximately 5.5 million people. The state had three other population concentrations over 1 million, including the Jacksonville, Orlando, and Tampa/St. Petersburg areas. It had two areas with populations between 500,000 and 1 million, and four with

[129] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

populations between 300,000 and 500,000. The smallest of these 10 population concentrations was the Florida portion of the Pensacola area, with a 2010 population of 333,801. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Cape Coral area, with an annual growth rate of 4.87 percent. The only area with a growth rate less than 1.00 percent was the Florida portion of the Pensacola area (0.36 percent).

Table 5.1.9-4 also shows that the top 10 population concentrations in Florida accounted for 70.2 percent of the state's population in 2010. The population growth in the 10 areas from 2000 to 2010 amounted to 71.9 percent of the entire state's growth. These figures indicate that the population of the remainder of the state, as a whole, increased from 2000 to 2010 at a similar rate to the rate of increase in the largest 10 population concentrations.

Table 5.1.9-4: Population of the 10 Largest Population Concentrations in Florida

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)[a]
Cape Coral	329,757	530,290	541,570	6	200,533	4.87%
Jacksonville	882,295	1,065,219	1,079,377	4	182,924	1.90%
Miami	4,919,036	5,502,379	5,608,298	1	583,343	1.13%
Orlando	1,157,431	1,510,516	1,552,482	3	353,085	2.70%
Palm Bay/Melbourne	393,289	452,791	454,906	7	59,502	1.42%
Palm Coast/Daytona Beach/Port Orange[b]	283,494	349,064	351,738	9	65,570	2.10%
Pensacola (FL/AL) (FL Portion)	321,875	333,801	338,558	10	11,926	0.36%
Port St. Lucie	270,774	376,047	380,652	8	105,273	3.34%
Sarasota/Bradenton	559,229	643,260	652,022	5	84,031	1.41%
Tampa/St. Petersburg	2,062,339	2,441,770	2,474,857	2	379,431	1.70%
Total for Top 10 Population Concentrations	**11,179,519**	**13,205,137**	**13,434,460**	**NA**	**2,025,618**	**1.68%**
Florida (statewide)	**15,982,378**	**18,801,310**	**19,091,156**	**NA**	**2,818,932**	**1.64%**
Top 10 Total as Percentage of State	**69.9%**	**70.2%**	**70.4%**	**NA**	**71.9%**	**NA**

[a] AARC = Average Annual Rate of Change (compound growth rate)
[b] The 2000 population presented here is the sum of populations for the Palm Coast urban cluster and the Daytona Beach/Port Orange urbanized area.
Sources: (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015i) (U.S. Census Bureau, 2015j)

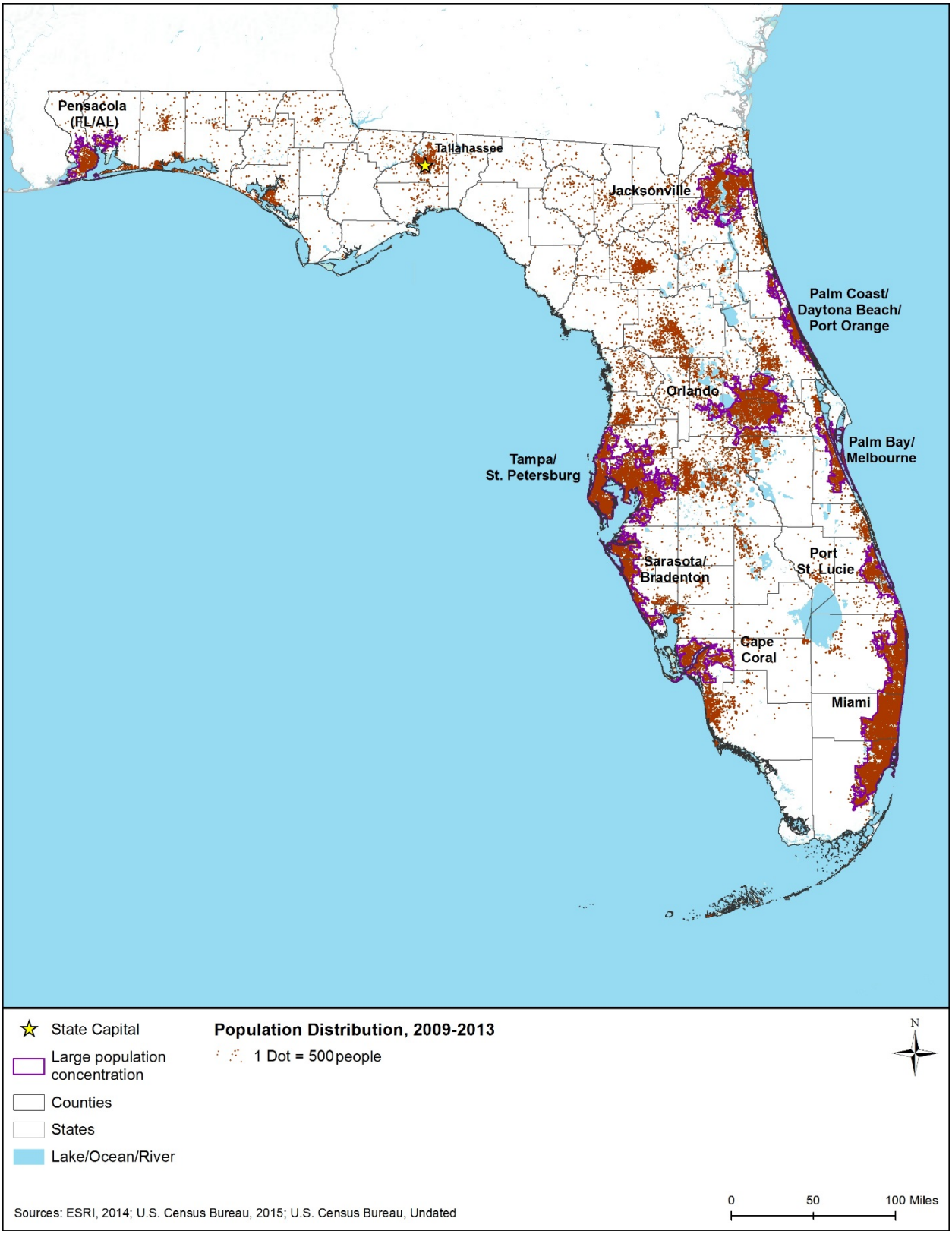


Figure 5.1.9-1: Population Distribution in Florida, 2009–2013

5.1.9.5. Economic Activity, Housing, Property Values, and Government Revenues

This section addresses other socioeconomic topics that are potentially relevant to FirstNet. These topics include:

- Economic activity;
- Housing;
- Property values; and
- Government revenues.

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 5.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 5.1.9-5 compares several economic indicators for Florida to the south region and the nation. The table presents two indicators of income[130] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 5.1.9-5, the per capita income in Florida in 2013 ($25,834) was $823 higher than that of the region ($25,011), and $2,350 lower than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 5.1.9-5 shows that in 2013, the MHI in Florida ($46,021) was $541 lower than that of the region ($46,562), and $6,229 lower than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the

[130] The Census Bureau defines income as follows: "'Total income' is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. Receipts from the following sources are not included as income: capital gains, money received from the sale of property (unless the recipient was engaged in the business of selling such property); the value of income "in kind" from food stamps, public housing subsidies, medical care, employer contributions for individuals, etc.; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances, insurance payments, and other types of lump-sum receipts" (U.S. Census Bureau, 2015i).

unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 5.1.9-5 compares the unemployment rate in Florida to the south region and the nation. In 2014, Florida's statewide unemployment rate of 6.3 percent was similar to the rate for the region (6.1 percent) and the nation (6.2 percent).[131]

Table 5.1.9-5: Selected Economic Indicators for Florida

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Florida	$25,834	$46,036	6.3%
South Region	$25,011	$46,562	6.1%
United States	$28,184	$52,250	6.2%

Sources: (U.S. Census Bureau, 2015k) (U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m) (BLS, 2015b)

Figure 5.1.9-2 and Figure 5.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015k) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 5.1.9-1 (U.S. Census Bureau, 2015g) (U.S. Census Bureau, 2012). Following these two maps, Table 5.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Florida.

Figure 5.1.9-2 shows that, at the county level, MHI in 2013 had a variable distribution across the state, with high and low MHI levels occurring throughout the state. Relatively few counties had MHI values above the national average. The counties classified as having the lowest MHI levels were all in sparsely populated areas, away from the top 10 population concentrations. Table 5.1.9-6 shows that MHI was above the state average in six of the 10 population concentrations, and was highest in the Jacksonville and Orlando areas. MHI was lowest in the Palm Coast/Daytona Beach/Port Orange and Pensacola (Florida portion) areas.

Figure 5.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. Similar to the figure for MHI, this figure shows a highly variable distribution of unemployment rates throughout the state. There is no clear relationship of high or low unemployment rates to population density. When comparing unemployment in the population concentrations to the state average (Table 5.1.9-6), four areas had a 2009–2013 unemployment rate that was higher than the state average. These areas were the Palm Bay/Melbourne and Pensacola (Florida portion) areas, which had unemployment rates that were only slightly higher than the state average, as well as the Cape Coral and Port St. Lucie areas, which had considerably higher unemployment rates.

[131] The timeframe for unemployment rates can change quarterly.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 5.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was somewhat higher in Florida than in the south region and the nation. The percentage of government workers was somewhat lower in the state than in the region and nation. Self-employed workers were a slightly smaller percentage in the state than in the region and nation.

By industry, Florida has a mixed economic base and some notable figures in the table are as follows. Florida in 2013 had a similar percentage (within two percentage points) of workers in most industries compared to the region and nation. It had a considerably lower percentage of persons working in "manufacturing" than did the region or the nation. It also had a notably lower percentage of workers in the "educational services, and health care and social assistance" industry compared to the nation. Florida had a notably higher percentage of workers in "retail trade" compared to the nation, in "professional, scientific, management, administrative, and waste management services" compared to the region, and in "arts, entertainment, and recreation, and accommodation and food services" compared to both the region and nation.

Table 5.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Florida, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Cape Coral	$45,864	14.0%
Jacksonville	$51,977	11.2%
Miami	$48,183	11.8%
Orlando	$50,535	11.3%
Palm Bay/Melbourne	$48,626	12.2%
Palm Coast/Daytona Beach/Port Orange	$41,361	11.4%
Pensacola (FL/AL) (FL Portion)	$44,935	12.1%
Port St. Lucie	$45,198	14.6%
Sarasota/Bradenton	$47,786	11.5%
Tampa/St. Petersburg	$47,180	10.9%
Florida (statewide)	$46,956	11.8%

Source: (U.S. Census Bureau, 2015n)

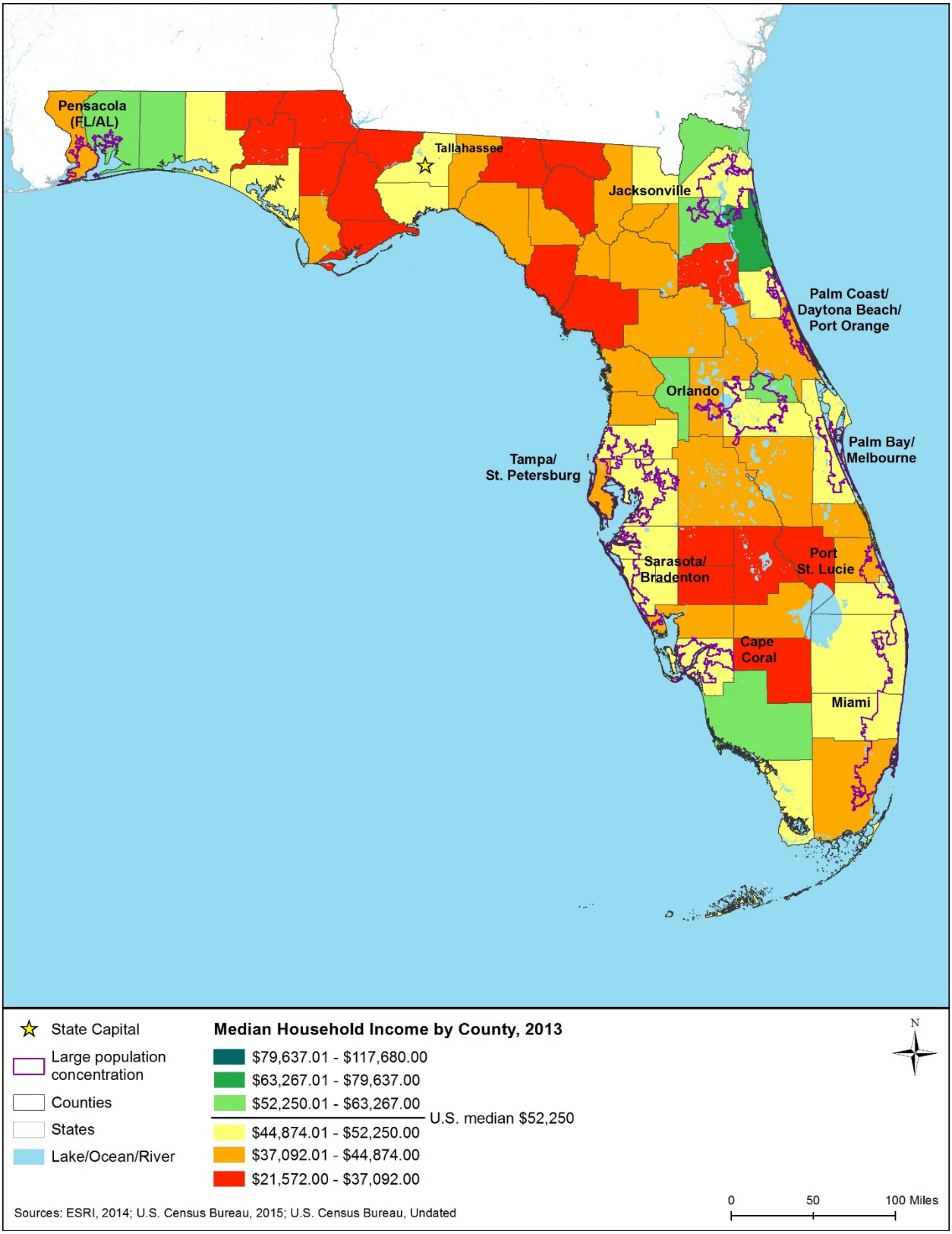


Figure 5.1.9-2: Median Household Income in Florida, by County, 2013

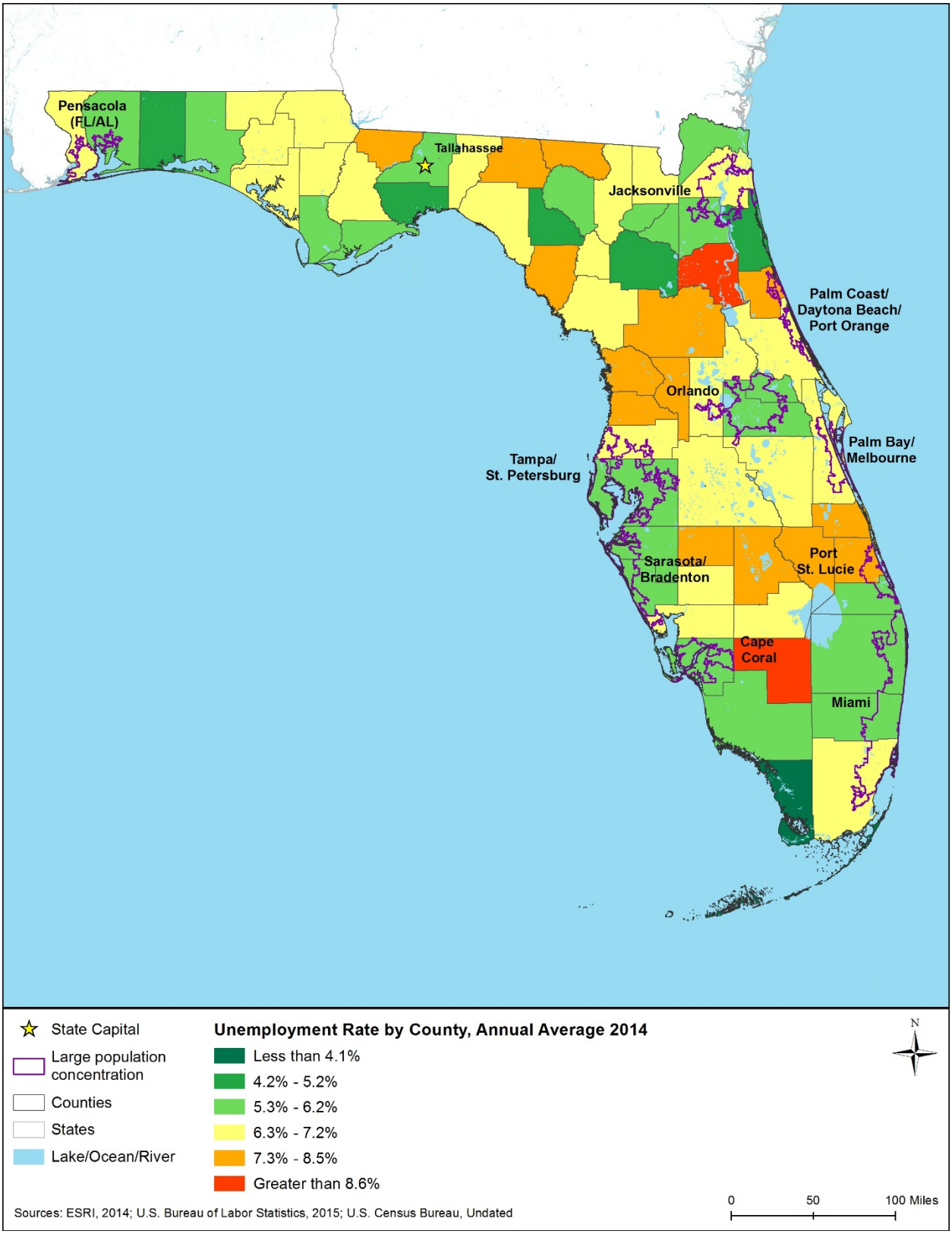


Figure 5.1.9-3: Unemployment Rates in Florida, by County, 2014

Table 5.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Florida	South Region	United States
Civilian Employed Population 16 Years and Over	8,459,990	45,145,155	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	81.9%	79.4%	79.7%
Government workers	12.3%	14.5%	14.1%
Self-employed in own not incorporated business workers	5.6%	5.9%	6.0%
Unpaid family workers	0.1%	0.2%	0.2%
Agriculture, forestry, fishing and hunting, and mining	1.0%	2.4%	2.0%
Construction	6.8%	6.9%	6.2%
Manufacturing	5.2%	9.9%	10.5%
Wholesale trade	2.9%	2.8%	2.7%
Retail trade	13.5%	12.1%	11.6%
Transportation and warehousing, and utilities	5.0%	5.2%	4.9%
Information	2.1%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	7.8%	6.3%	6.6%
Professional, scientific, management, administrative, and waste management services	12.5%	10.5%	11.1%
Educational services, and health care and social assistance	20.9%	22.0%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	12.3%	9.9%	9.7%
Other services, except public administration	5.5%	5.2%	5.0%
Public administration	4.5%	4.8%	4.7%

Source: (U.S. Census Bureau, 2015o)

Table 5.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 5.1.9-7 for 2013.

Table 5.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Florida, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Cape Coral	8.7%	4.6%	1.8%	11.9%
Jacksonville	5.7%	6.7%	1.9%	12.0%
Miami	6.5%	5.8%	2.2%	13.3%
Orlando	6.0%	4.6%	2.7%	14.1%
Palm Bay/Melbourne	5.9%	3.7%	1.6%	13.7%
Palm Coast/Daytona Beach/Port Orange	5.8%	3.8%	1.6%	10.6%

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Pensacola (FL/AL) (FL Portion)	6.6%	4.9%	1.7%	10.7%
Port St. Lucie	8.4%	4.8%	1.5%	10.7%
Sarasota/ Bradenton	7.0%	3.4%	1.7%	12.5%
Tampa/St. Petersburg	5.9%	4.2%	2.5%	13.3%
Florida (statewide)	6.6%	5.1%	2.0%	12.3%

Source: (U.S. Census Bureau, 2015n)

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 5.1.9-9 compares Florida to the south region and nation on several common housing indicators.

As shown in Table 5.1.9-9, in 2013, Florida had a lower percentage of housing units that were occupied (79.7 percent) than the region (85.2 percent) or nation (87.6 percent). Of the occupied units, Florida had a similar percentage of owner-occupied units (64.8 percent) to the region (64.6 percent) and a somewhat higher percentage than the nation (63.5 percent). Florida had a lower percentage of detached single-unit housing (also known as single-family homes) in 2013 (54.0 percent) compared to the region (63.8 percent) and nation (61.5 percent). The homeowner vacancy rate in Florida (2.5 percent) was similar to the rate for the region (2.2 percent) and was somewhat higher than the rate for the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015i). The vacancy rate among rental units was higher in Florida (9.2 percent) than in the region (8.5 percent) and nation (6.5 percent).

Table 5.1.9-9: Selected Housing Indicators for Florida, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Florida	9,047,973	79.7%	64.8%	2.5%	9.3%	54.0%
South Region	44,126,724	85.2%	64.8%	2.2%	8.5%	63.8%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

Source: (U.S. Census Bureau, 2015q)

Table 5.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly

comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period.

Table 5.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Florida, 2009–2013

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Cape Coral	306,771	66.6%	69.3%	4.6%	14.7%	53.6%
Jacksonville	470,202	85.9%	64.5%	3.0%	10.7%	63.3%
Miami	2,446,594	81.7%	63.1%	3.0%	9.1%	42.3%
Orlando	652,368	83.9%	61.3%	2.6%	10.9%	59.0%
Palm Bay/Melbourne	223,135	81.8%	72.7%	3.2%	12.7%	64.7%
Palm Coast/Daytona Beach/Port Orange	198,169	73.0%	70.7%	3.8%	8.9%	60.5%
Pensacola (FL/AL) (FL Portion)	148,720	84.5%	63.9%	2.1%	10.2%	68.8%
Port St. Lucie	190,215	77.9%	73.1%	2.9%	11.2%	62.0%
Sarasota/Bradenton	382,668	73.8%	72.7%	3.4%	12.9%	53.0%
Tampa/St. Petersburg	1,188,546	83.3%	64.6%	3.1%	9.9%	54.9%
Florida (statewide)	9,003,933	79.5%	67.1%	3.3%	10.7%	54.2%

Source: (U.S. Census Bureau, 2015p)

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 5.1.9-11 provides indicators of residential property values for Florida and compares these values to values for the south region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015i).

The table shows that the median value of owner-occupied units in Florida in 2013 ($153,300) was higher than the corresponding value for the south region ($137,752) and lower than that for the nation ($173,900).

Table 5.1.9-11: Residential Property Values in Florida, 2013

Geography	Median Value of Owner-Occupied Units
Florida	$153,300
South Region	$137,752
United States	$173,900

Source: (U.S. Census Bureau, 2015q)

Table 5.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Four of the 10 areas had median values higher than the state median value ($160,200), including the Jacksonville, Miami, Orlando, and Sarasota/Bradenton areas. All other population concentrations had property values below the state value. The areas with the lowest median values were the Cape Coral, Pensacola (Florida portion), and Port St. Lucie areas. These areas also had low median household incomes relative to the state average and most other population concentrations (Table 5.1.9-6).

Table 5.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Florida, 2009–2013

Area	Median Value of Owner-Occupied Units
Cape Coral	$132,500
Jacksonville	$160,800
Miami	$193,900
Orlando	$171,100
Palm Bay/Melbourne	$150,700
Palm Coast/Daytona Beach/Port Orange	$154,000
Pensacola (FL/AL) (FL Portion)	$131,600
Port St. Lucie	$143,400
Sarasota/Bradenton	$172,100
Tampa/St. Petersburg	$151,400
Florida (statewide)	$160,200

Source: (U.S. Census Bureau, 2015p)

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety

broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 5.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures were particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 5.1.9-13 shows that the state government in Florida received less total revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. In 2012, local governments in Florida received slightly more total revenue per capita than their regional counterparts and less revenue than their counterparts in the nation. The state government received less intergovernmental revenue[132] from the federal government than counterpart governments in the region and nation did, while such revenues to Florida local governments were higher than those for counterparts in the region and similar to those for counterparts in the nation. Florida local governments obtained more revenue per capita from property taxes than local governments in the region and less revenue per capita than local governments in the nation. For general sales taxes, the Florida state government received more revenue and Florida local governments received considerably less revenue per capita compared to their counterparts in the region and nation. Selective sales tax revenues per capita were similar for state governments in Florida, the region, and the nation, and considerably higher for Florida local governments than for local governments in the region and nation. Florida state and local governments received considerably more revenue per capita from public utilities taxes compared to their counterparts in the region and nation. The Florida state government obtained no revenues from property taxes or individual income taxes. Florida local governments received no revenue from individual or corporate income taxes. The state government in Florida obtained higher levels of corporate income tax revenues per capita than local governments in the region and lower levels compared to counterparts in the nation.

[132] Intergovernmental revenues are those revenues received by one level of government from another level of government, such as shared taxes, grants, or loans and advances (U.S. Census Bureau, 2006).

Table 5.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue	Florida		Region		United States	
	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue ($M)	$82,386	$91,081	$524,374	$449,683	$1,907,027	$1,615,194
Per capita	$4,265	$4,715	$5,148	$4,414	$6,075	$5,145
Intergovernmental from Federal ($M)	$22,851	$4,410	$160,706	$18,171	$514,139	$70,360
Per capita	$1,183	$228	$1,578	$178	$1,638	$224
Intergovernmental from State ($M)	$0	$17,672	$0	$115,088	$0	$469,147
Per capita	$0	$915	$0	$1,130	$0	$1,495
Intergovernmental from Local ($M)	$406	$0	$2,815	$0	$19,518	$0
Per capita	$21	$0	$28	$0	$62	$0
Property Taxes ($M)	$0	$24,598	$2,073	$109,687	$13,111	$432,989
Per capita	$0	$1,273	$20	$1,077	$42	$1,379
General Sales Taxes ($M)	$19,404	$1,828	$82,651	$25,836	$245,446	$69,350
Per capita	$1,004	$95	$811	$254	$782	$221
Selective Sales Taxes ($M)	$7,863	$3,631	$41,447	$9,394	$133,098	$28,553
Per capita	$407	$188	$407	$92	$424	$91
Public Utilities Taxes ($M)	$3,163	$2,039	$5,101	$4,745	$14,564	$14,105
Per capita	$164	$106	$50	$47	$46	$45
Individual Income Taxes ($M)	$0	$0	$38,637	$1,226	$280,693	$26,642
Per capita	$0	$0	$379	$12	$894	$85
Corporate Income Taxes ($M)	$2,003	$0	$8,099	$114	$41,821	$7,210
Per capita	$104	$0	$80	$1	$133	$23

Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

Sources: (U.S. Census Bureau, 2015r; U.S. Census Bureau, 2015s)

5.1.10. Environmental Justice

5.1.10.1. Definition of the Resource

EO 12898,[133] Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 1.8.12, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). The fundamental principle of environmental justice is, "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA, 2016b). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and

[133] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (USDOC, 2013).

In 1997, the Council on Environmental Quality (CEQ) issued *Environmental Justice: Guidance under the National Environmental Policy Act (NEPA)* to assist federal agencies in meeting the requirements of the EO (CEQ, 1997). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015q) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015r).

The CEQ guidance provides several important definitions and clarifications that this PEIS utilizes:

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the Census Bureau.
- Environmental effects include social and economic effects. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997)

5.1.10.2. Specific Regulatory Considerations

Florida enacted legislation in 1998 to establish the Center for Environmental Equity and Justice (CEEJ) at Florida Agricultural and Mechanical University and to create a Community Environmental Health Program (Florida Legislature, 2015a) (University of California, 2010). The purpose of the CEEJ is to "conduct and facilitate research, develop policies, and engage in education, training, and community outreach with respect to environmental equity and justice issues" (The Florida Legislature, 2015b) (University of California, 2010).[134] The Community Environmental Health Program operated during 1998 to 2011 to "ensure the availability of public health services to members of low-income communities that may be adversely affected by contaminated sites located in or near the community" (Florida Legislature, 2015a) (University of California, 2010). Florida discontinued this program in 2012. Federal laws relevant to environmental justice are summarized in Section 1.8, Overview of Relevant Federal Laws and Executive Orders.

5.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 5.1.10-1 presents 2013 data on the composition of Florida's population by race and by Hispanic origin. In comparison to both the south region and the nation, the state's population has

[134] More information about the CEEJ is available at (http://www.famu.edu/index.cfm?environmentalscience&CEEJ).

similar or somewhat lower percentages of individuals who identify as American Indian/Alaska Native (0.3 percent), Asian (2.6 percent), Native Hawaiian/Pacific Islander (0.0 percent), Some Other Race (2.5 percent), or Two or More Races (2.3 percent). The state's Black/African American population (16.1 percent) is smaller than that of the south region (18.4 percent), but larger than that of the nation (12.6 percent). The state's population of persons identifying as White (76.2 percent) is larger than that of the south region (72.3 percent) and the nation (73.7 percent).

The percentage of the population in Florida that identifies as Hispanic (23.6 percent) is considerably larger than in the south region (18.8 percent) and the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. Florida's All Minorities population percentage (43.8 percent) is higher than that of the south region (42.3 percent) and the nation (37.6 percent).

Table 5.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Florida (17.0 percent) is lower than that for the south region (18.2 percent) and higher than the figure for the nation (15.8 percent).

Table 5.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Florida	19,552,860	76.2%	16.1%	0.3%	2.6%	0.0%	2.5%	2.3%	23.6%	43.8%
South Region	102,853,019	72.3%	18.4%	0.9%	2.6%	0.1%	3.3%	2.4%	18.8%	42.3%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.
Source: (U.S. Census Bureau, 2015t)

Table 5.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Florida	17.0%
South Region	18.2%
United States	15.8%

Source: (U.S. Census Bureau, 2015u)

5.1.10.4. Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix D, Environmental Justice

Methodology, presents the methodology used in this PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices used for environmental justice analysis. It uses data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 5.1.10-1 visually portrays the results of the environmental justice population screening analysis for Florida. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x) (U.S. Census Bureau, 2015h) and Census Bureau urban classification data (U.S. Census Bureau, 2015g) (U.S. Census Bureau, 2012).

Figure 5.1.10-1 shows that a high proportion of Florida has high potential for environmental justice populations. This probably reflects the relatively high levels of minority populations in the state compared to the region and nation. The distribution of these high potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is also fairly even across the state.

It is important to understand how the data behind Figure 5.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 5.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to significance criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). Section 5.2, Environmental Consequences addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

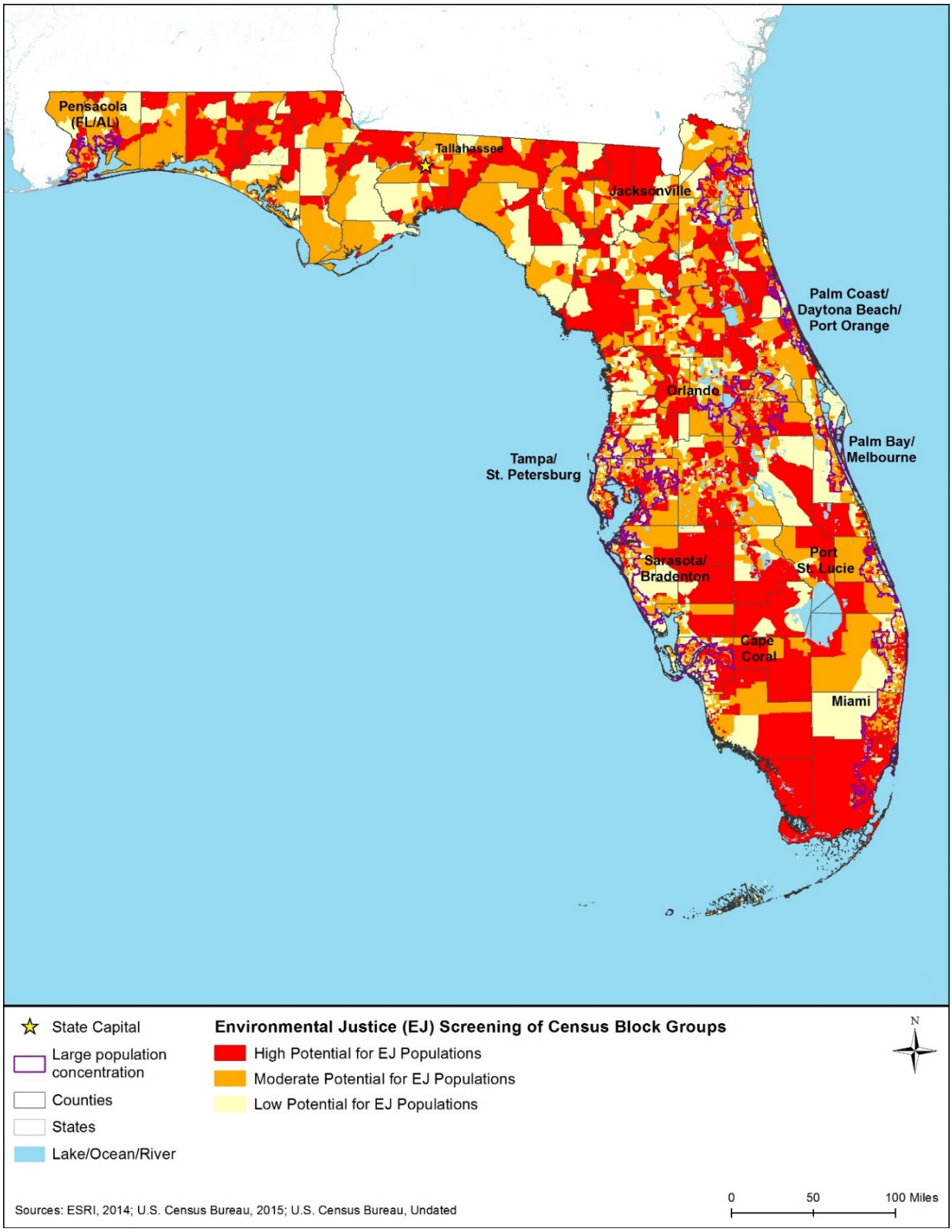


Figure 5.1.10-1: Potential for Environmental Justice Populations in Florida, 2009–2013

5.1.11. Cultural Resources

5.1.11.1. Definition of Resource

For the purposes of this PEIS, Cultural Resources are defined as:

> Natural or manmade structures, objects, features, locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance and any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the NRHP.

This definition is consistent with the how cultural resources are defined in the:

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470ccI and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2015r); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to American Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

5.1.11.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders), the American Indian Religious Freedom Act (AIRFA), ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

Florida has a state statute and associated regulations that parallel the NHPA (refer to Table 5.1.11-1). However, federal laws and regulations supersede state laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 5.1.11-1: Relevant Florida Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Florida Statutes, Chapter 267, Historical Resources (§ 267.061 Historic properties; state policy, responsibilities)	Florida Division of Historical Resources (SHPO)	This statute mirrors the NHPA for state government or state-assisted undertakings, requiring state agencies to consult with the State Historic Preservation Office (SHPO) to minimize the impact of their undertakings on NRHP-listed and eligible properties.

5.1.11.3. Cultural and Natural Setting

There is evidence of American Indian occupation of present day Florida for approximately 14,500 years (National Geographic, 2016). Following the Wisconsin Glacial Episode (the last "ice age"), sea levels rose substantially and the climate of Florida became less arid and more conducive to human habitation. Over a substantial period of time, the earliest people of the region took advantage of the increasingly diverse flora and fauna that flourished. For instance, with the formation of rivers, wetlands and lagoons across the peninsula, shellfish became an important source of protein, and by about A.D. 500, the area's inhabitants began to grow crops, such as corn, Florida's rich subtropical soils. Some research suggest that, "…maize was introduced into peninsular Florida, both inland and along the Gulf Coast, perhaps 1,000 years before the arrival of Europeans" (Kelly, Tykot, & Milanich, 2006).

Eventually, societies formed and created villages throughout the state, which were governed by sophisticated hierarchical structures. Chiefdoms of the Mississippian culture built large earthen mounds in the shape of pyramids, some as high as 40 feet. Communities were formed around the pyramids, with the Apalachee, Timucua, Tocabaga, Tequesta, and the Calusa being among the largest of these chiefdoms at the time of European contact. Mississippian societies occupied much of the state at the time European explorers arrived in the early 1500s. (Florida Division of Historical Resources, 2015a).

Archaeologists typically divide large areas into regions to concentrate their studies. As depicted in Figure 5.1.3-1, Florida is wholly within the Atlantic Plain Physiographic Region, and Coastal Plain Physiographic Province.

The following sections provide additional detail about Florida's prehistoric periods (approximately 12550 B.C. – A.D. 1513) and the post-contact, historic period since European exploration and colonization in the 1500s.

Sections 5.1.11.4 present an overviews of the initial human habitation in Florida and the cultural development that occurred before European contact. Section 5.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 5.1.11.6 provides a current list of significant archaeological sites in Florida and tools that the state has developed to ensure their preservation. Section 5.1.11.7 document the historic context of the state since European contact, and Section 15.1.11.8 summarizes the architectural context of the state during the historic period.

There are four distinct periods associated with the prehistoric human populations that inhabited present day Florida: the Paleoindian (12550 – 9400 B.C.), Archaic (9400 – 1200 B.C.), Woodland (1200 B.C. – A.D. 800), and Mississippian (A.D. 800 – 1513) (Florida Department of State, 2015b). Figure 5.1.11-1 shows a timeline representing these periods of early human habitation in Florida. It is important to note that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation has been discovered in every physiographic region of Florida (Florida Division of Historical Resources, 2015a).

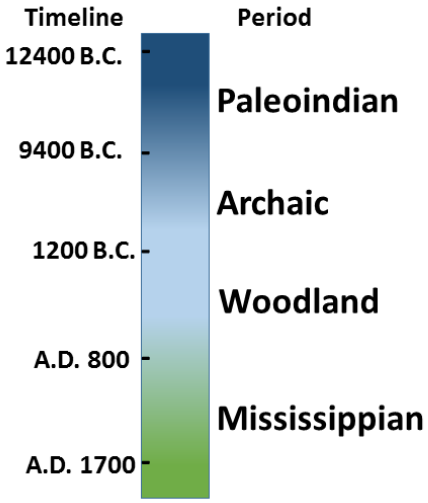


Figure 5.1.11-1: Timeline of Prehistoric Human Occupation in Florida

Sources: (Institute of Maritime History 2015, Pauketat 2012)

Paleoindian Period (12550 B.C. – 9400 B.C.)

The Paleoindian Period represents the earliest era of human habitation of the southeast United States. Because the sea level was much lower than modern day, much of the land in Florida that was accessible to early humans in this region is now submerged under water, and, as a result, many sites dating to the Paleoindian Period are not easily excavated (Milanich 1995).

Most evidence of early man in Florida is based on the discovery of fluted projectile points, commonly known as "arrowheads," which are found on the surface, in shallow deposits, deep alluvial deposits, along the coast, and under water. A recent study involving the radiocarbon dating of organic remains and artifacts from a site in the Aucilla River suggests that human habitation of Florida began approximately 14,550 years ago (Halligan et al., 2016). It is likely that the earliest people to occupy the state were small groups of nomadic hunters and gatherers that used a small inventory of chipped-stone tools known as "fluted javelin head" spear points or Clovis form spear point (fluted points). Archaeologists theorize that humans of the Paleoindian Period formed small bands, which ranged across the state as they followed migratory game. These peoples initially established seasonal camps, some of which likely became permanent settlements within the region. It is generally believed that they were descended from people who spread south and east into North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch). Technologies such as the Clovis fluted point were devised for hunting mammoth, mastodon, and other large game of that period (Florida Department of State, 2015b; Milanich, 1995; NPS, 2015s).

Archaic Period (9400 B.C. – 1200 B.C.)

During the early Archaic Period, American Indian peoples lived in small family based units throughout present day Florida. North America was experiencing end of the glacial retreat from the last ice age. The climate was becoming much like that of the present, and various flora and fauna now found in Florida began to be established (NPS, 2015s). The Archaic Period in Florida is divided into the Early, Middle, and Late periods.

Much like the Paleoindians that preceded them, early Archaic Period people were hunter-gatherers whose diet consisted of wild plants and animals. Technology was based on chipped stone tools, including drills, choppers, flake knives, scrapers, gouges, and hammerstones (Milanich, 1995) (NPS, 2015v). The people began to make permanent settlements around streams and rivers where potable water could be found. Populations were beginning to grow, based on the number of archaeological sites which represent this period (NPS, 2015s).

During the Middle Archaic Period, populations continued to increase and societies became more regionalized. Tools became more sophisticated with the development of grinding implements, which are also indicators of early horticulture (NPS, 2015s). The diet of Middle Archaic period people in Florida included wild plants and shellfish. Archaeological sites have revealed storage pits, house floors, and the burying of deceased members of society, all of which are indicators of primitive societies becoming less nomadic and more sedentary (NPS, 2015s).

During the Late Archaic period, inhabitants of Florida and throughout southeastern United States increasingly formed regionalized and more sedentary societies. The first fiber-tempered fired and decorated pottery was introduced to people in Florida, as evidenced in the archaeological record (NPS, 2015s).

Woodland Period (1200 B.C. – A.D. 800)

Similar to the Archaic Period, the Woodland Period is divided into three sequential stages: Early, Middle, and Late. During the course of the Woodland Period, there is an increasing shift from a semi-nomadic to a more sedentary lifestyle, and a continued expansion of horticulture (crop growing) practices (NPS, 2015s).

Hunting and fishing was the predominant form of subsistence during the Early Woodland Stage. Although more deliberate attempts at farming began to be established, the collection of shellfish and plants was also taking place. Pottery manufacturing and use became commonplace throughout Florida during this period. Funerary practices were more complex, with burials often being placed in large earthen mounds (NPS, 2015s).

Across the state, the practice of mound-building continued and burial practices became more elaborate throughout the Middle Woodland Period. The ceremonial earthen mounds often contained the graves of elite individuals. These graves of frequently were accompanied by exotic materials presumably believed to accompany the dead into the afterlife. Toward the end of the Early Woodland and into the Middle Woodland, there is a great deal of the material evidence of long-distance trade with other peoples. One example of trade is meteoritic iron that was used for making various type of jewelry, beads, earspools, buttons, and headdresses, which

have been found in northern Florida (Carr & Sears, 1985) (NPS, 2015s). The Miami Circle site in southern Florida includes galena from the Midwest and copper from the Great Lakes area. Additionally, one of the oldest archeological sites near Miami is the Cutler Fossil site (Carr, 2012).

The Late Woodland is characterized by continued development of cultural practices. In 2007, a group of amateur cavers discovered Late Woodland petroglyphs (stone carvings) in the eastern Florida Panhandle (Simek, Cresler, Blankenship, Mosler, & Kalch, 2009). In 1896, an extraordinary archaeological site from this period was excavated on Key Marco in southwest Florida, where over 1,000 wooden artifacts (including carvings and paintings on boards) were recovered by Frank Hamilton Cushing leading a Smithsonian expedition. This site is considered to contain the most wooden artifacts from any prehistoric archaeological site in the eastern United States; the Key Marco island contains shell mounds and other shell works (Gilliland, 1989) Also during this stage, the bow and arrow replaced the atlatl, which improved hunting efficiency. Maize, beans, and squash cultivation increased. The archaeological records shows that habitation sites were smaller in size than earlier stages, but more numerous. (NPS, 2015s).

Mississippian Period (A.D. 800 – A.D. 1513)

The Mississippian Period Chiefdoms were the most complex prehistoric cultures in the southeast United States, including Florida. Chiefdoms were hierarchically organized societies, which practiced "an ideological belief system called the Southwestern Ceremonial Complex." The period is distinguished by "…large platform mounds, which were often concentrated in civic-ceremonial centers at the political capital…" (Bense, 1996).

Maize cultivation was being practiced, but not in all of the Mississippian period societies. However, the storage of food for future use was becoming commonplace. Deer, fish, and nuts were being procured, and the intensification of hunting was escalated. The development of agricultural and exploitation of the coastal environment were the two main types of subsistence of this period. (Bense, 1996)

Florida was unique in that several complex, non-agricultural chiefdoms developed into regional polities during this period and were present at the arrival of the Spanish in the sixteenth century. The Calusa chiefdom on the southwest coast and the Tequesta chiefdom on the southeast coast of the Florida peninsula were fishing-dependent societies that were not reliant upon maize agriculture for the development of their culture. However, "Archeological investigation of Everglades tree island communities indicates that the Tequesta may have intentionally contributed to the formation of these islands" (Wheeler, 2004). Additionally, "Some sites of the Tequesta and their ancestors exhibit considerable engineering accomplishments related to the construction of long-distance canoe canals. This accomplishment is equivalent to irrigation canals built by prehistoric cultures in the American Southwest" (Wheeler, 2004).

5.1.11.4. Federally Recognized Tribes of Florida

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are two federally recognized tribes in Florida: the Miccosukee Tribe of Indians of Florida

and the Seminole Tribe of Florida (National Conference of State Legislators, 2015; GPO, 2015). Figure 5.1.11-2 shows the general historic location of other tribes known to exist in this region of the United States, but are not officially federally recognized.

5.1.11.5. Significant Archaeological Sites of Florida

There are 101 archaeological sites in Florida listed on the NRHP. Table 5.1.11-2 lists the names of the sites, the city they are closest to, and type of site. Both prehistoric and historic archaeological sites are listed. The number of archaeological sites increases as new sites are discovered. A complete listing of NRHP sites can be found on the NRHP website at (http://www.nps.gov/nr/) (NPS, 2015t).

Florida State Cultural Resources Database and Tools

Florida Museum of Natural History (FMNH)

The Florida Museum of Natural History, maintained by the University of Florida, houses information on and collections of Florida archaeology. The museum's collections contain artifacts and information on more than 1,500 archaeological sites in Florida, and are a source of primary information for researchers on the prehistory of the state. Researchers and the public may access the collections by appointment only; contact information for appointments can be found at (https://www.flmnh.ufl.edu/flarch/people/faculty-staff/).

Florida Master Site File (FMSF)

The Florida Master Site File, maintained by the Florida Division of Historical Resources' Bureau of Historic Preservation, is the state's official inventory of its identified historic and cultural resources. The Site File records include "information on more than 200,000 cultural resources and copies of over 21,000 manuscripts," covering archaeological sites, historical structures, historical cemeteries, historical bridges, and historic districts, landscapes and linear features." (Florida Division of Historical Resources, 2015b) Researchers and users of the Site File can obtain computer database information, GIS shape files, and scanned reports in addition to copies of Site File forms for recorded cultural resources. A guide for users on the availability of information and how to request access to the Site File's records can be found at (http://dos.myflorida.com/media/31349/informationforusers.pdf).

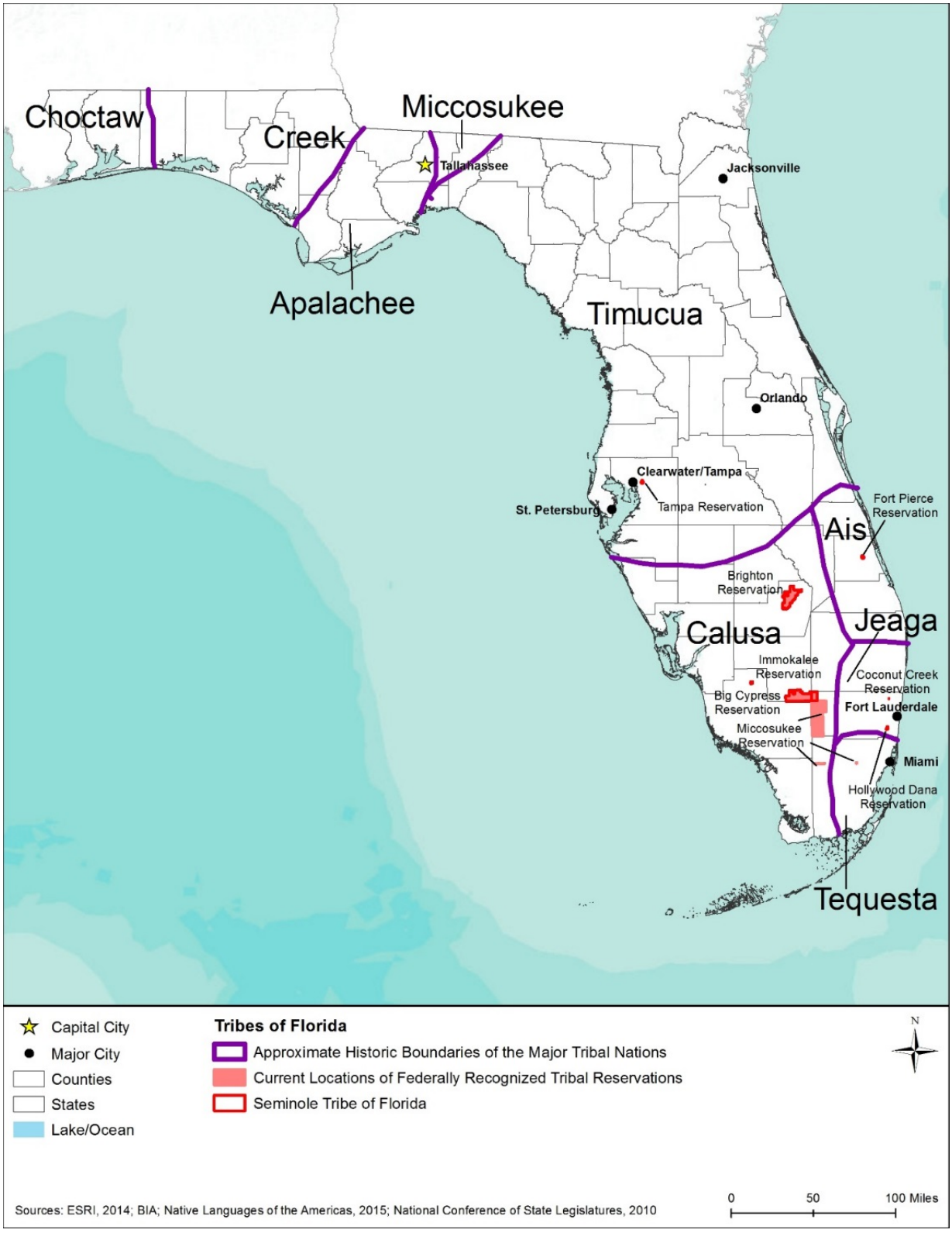


Figure 5.1.11-2: Federally Recognized Tribes in Florida and Historic Boundaries of Major Tribal Nations in Florida

Table 5.1.11-2: Archaeological Sites on the National Register of Historic Places in Florida

Closest City	Site Name	Type of Site
Flamingo, FL	Bear Lake Mounds Archeological District	Historic and Prehistoric
Milton, FL	Bethune Blackwater Schooner	Shipwreck
Wakulla Beach, FL	Bird Hammock	Prehistoric (Burial Sites)
Gulf Breeze, FL	Big Heart West	Prehistoric
Canal Point	Big Mound City	Prehistoric (Ceremonial Complex)
Placida, FL	Big Mound Key-Boggess Ridge Archaeological District	Prehistoric
New Smyrna, FL	Blanchette Archaeological Site	Historic (18th Century Smyrnea Settlement)
Astor, FL	Bowers Bluff Middens Archeological District	Prehistoric
Fleming Island, FL	Bubba Midden	Prehistoric (Shell Midden)
Burnell, FL	Bulow Plantation Ruins	Historic (Sugar Plantation)
Gulf Breeze, FL	Butcherpen Mound	Prehistoric
Blountstown, FL	Cayson Mound and Village Site	Prehistoric
Islamorada, FL	Chaves Shipwreck Site	Shipwreck
Layton, FL	El Gallo Indiano Shipwreck Site	Shipwreck
Plantation, FL	El Infante Shipwreck Site	Shipwreck
Tavernier	El Rubi Shipwreck Site	Shipwreck
Inverness, FL	Etna Turpentine Camp Archaeological Site	Historic
Okaloosa, FL	Fort Walton Mound	Prehistoric
New Smyrna Beach, FL	First Presbyterian Church Archaeological Site	Historic
St. Augustine, FL	Fish Island Site	Historic
St. James City, FL	Galt Island Archaeological District	Prehistoric (Shell Midden)
Horseshoe Beach, FL	Garden Patch Archaeological Site	Historic
Stuart, FL	Georges Valentine Shipwreck Site	Shipwreck
Jacksonville, FL	Grand Site	historic
Ponce, Inlet, FL	Green Mound	Prehistoric (Shell Midden)
Miami, FL	Half Moon	Shipwreck
Blountstown, FL	Hare, Otis Archaeological Site	Historic
Edgewater, FL	Hawks Archaeological Site	Historic
Islamorada, FL	Herrara Shipwreck Site	Shipwreck
Marco Island, FL	Horr's Island Archaeological Site	Prehistoric
Pensacola, FL	Hickory Ridge Cemetery Archaeological Site	Prehistoric
Sarasota, FL	Indian Fields	Prehistoric
Fort Myers, FL	Josslyn Archaeological Site	Prehistoric (Shell Midden)
St. Petersburg	Jungle Prada Site	Prehistoric and Historic
Jupiter, FL	Jupiter Inlet Historic and Archeological Site	Historic
Islamorada, FL	LaBranche Fishing Camp	Historic
Gainesville, FL	Lake Pithlachocco Canoe Site	Historic

Closest City	Site Name	Type of Site
Islamorada, FL	Lignumvitae Key Archeological and Historical District	Historic
Bradenton, FL	Madira Bickel Mound State Archaeological Site	Prehistoric
Mandarin, FL	Maple Leaf	Shipwreck
Palm Coast, FL	Mala Compra Plantation Archeological Site	Historical (Plantation)
Micanopy, FL	Micanopy Historic District	Historic (District)
Jacksonville, FL	Mission of San Juan del Puerto Archeological Site	Historical (Mission)
Palm Coast, FL	Mata Compra Plantation Archaeological Site	Historic (Plantation)
Fort Myers Beach, FL	Mound Key Site	Prehistoric
Welaka, FL	Mount Royal	Prehistoric
Crystal River, FL	Mullet Key Archaeological Site	Historic (Island)
Ormond Beach, FL	Nocoroco	Prehistoric
Homestead, FL	Offshore Reefs Archaeological District	Historic
New Smyrna Beach, FL	Old Fort Park Archeological Site	Historic (Fort Ruins)
New Smyrna Beach, FL	Old Stone Wharf Archeological Site	Historic
Eglin Air Force Base	Operation Crossbow Site	Historic (WW II)
Bokeelia, FL	Pardo, Mark Shellworks Site	Prehistoric
Bowling Green, FL	Payne's Creek Massacre – Fort Chokonikla Site	Historic
Rockledge, FL	Persimmon Mound	Historic
Apalachicola, FL	Pierce Site	Prehistoric
Pineland, FL	Pineland Archaeological District	Prehistoric
Arcadia, FL	Pine Level Archaeological District	Prehistoric
Miles City, FL	Platt Island	Prehistoric
Ochopee, FL	Plaza Site	Prehistoric
Pompano Beach, FL	Pompano Beach Mound	Prehistoric
Palmetto, FL	Portavant Mound	Prehistoric
Eastpoint, FL	Porter's Bar Site	Prehistoric
Green Cove Springs, FL	Princess Mound	Prehistoric
Tallahassee, FL	Roberts Farm Historic and Archeological District	Prehistoric and Historic
Key Largo, FL	Rock Mound Archaeological Site	Prehistoric
Everglades City, FL	Rookery Mound	Prehistoric
Oak Hill, FL	Ross Hammock Site	Historic
Safety Harbor, FL	Safety Harbor Site	Prehistoric
Islamorada, FL	San Felipe Shipwreck Site	Shipwreck
Layton, FL	San Francisco Shipwreck Site	Shipwreck
Plantation Key, FL	San Jose Shipwreck Site	Shipwreck
Lloyd, FL	San Joseph de Ocuya Site	Historic (17th Century Mission)
Wacissa, FL	San Juan De Aspalaga Site	Historic (17th Century Mission)
Lamont, FL	San Miguel de Asile Mission Site	Historic (17th Century Mission)
Islamorada, FL	San Pedro Shipwreck Site	Shipwreck

Closest City	Site Name	Type of Site
Miami, FL	Shark River Slough Archeological District	Historic
Tampa, FL	Shaw's Point Archaeological District	Historic
Ponte Verde Beach, FL	Shell Bluff Landing	Historic
New Smyrna Beach, FL	Sleepy Hollow Archeological Site	Historic
Layton, FL	Sueco de Arizon Shipwreck Site	Shipwreck
Ochopee, FL	Sugar Pot Site	Prehistoric
Port Orange, FL	Spruce Creek Mound Complex	Prehistoric and Early Historic
Everglades City, FL	Ten Thousand Islands Archeological District	Prehistoric
Gulf Breeze, FL	Third Gulf Breeze	Prehistoric
Chamukla, FL	Thomas Creek Archaeological District	Historic
Ilamorada	Tres Puentes Shipwreck Site	Shipwreck
New Smyrna Beach	Turnbull Colonists' House Archeological Site	Historic
New Smyrna Beach	Turnbull Colonists' House No. 2 Archeological Site	Historic
Chokoloskee, FL	Turner River Site	Prehistoric
New Smyrna Beach, FL	Turtle Mound	Prehistoric
Tampa, FL	Upper Tampa Bay Archeological District	Historic
Fort Pierce, FL	Urca De Lima	Shipwreck
Bokeelia, FL	Useppa Island Site	Historic
Cape Hatteras, FL	USS Alligator	Shipwreck (Civil War Era Submarine)
Marianna, FL	Waddells Mill Pond Site	Prehistoric
North Port, FL	Warm Mineral Spring	Prehistoric (Spring)
New Smyrna Beach, FL	White-Fox House Archaeological Site	Historic
Titusville, FL	Windover Archaeological Site	Prehistoric
St. Teresa, FL	Yent Mound	Prehistoric (Hopewellian)
Bristol, FL	Yon Mound and Village Site	Prehistoric

Source: (NPS, 2015u)

5.1.11.6. Historic Context

The first European known to have arrived in Florida was Juan Ponce de Leon, who landed near St. Augustine in 1513 and was the person who gave the name to the state. Ponce de Leon and his men explored the state in search of gold and the legendary "fountain of youth" about which he had heard stories, but he did not establish a permanent settlement. In 1521, Ponce de Leon returned to Florida, this time along the southwest coast of Florida near Charlotte Harbor, where he was fatally wounded in a skirmish with the Calusa and died after returning to Cuba. Other Spanish followed both of Ponce de Leon's voyages, including Panfilo de Narvaez who landed at Tampa bay in 1528, Hernando de Soto in 1539 who wintered near Tallahassee on his expedition through the southeast, and Pedro Menendez de Aviles who came in 1565 to oust French interests and established the first permanent settlement of St. Augustine, making it the oldest continually occupied European-founded settlement in the United States. (Florida Department of State, 2015c)

North of St. Augustine, France attempted to establish a Huguenot colony near what is today the City of Jacksonville in 1564 by Rene Goulaine de Laudonniere. The territorial claim to Florida by the Spanish resulted in the destruction of the French settlement known as Fort Caroline in 1565 by Menendez de Aviles. Sir Francis Drake, an English privateer, also attacked St. Augustine in 1586, but failed to weaken Spanish control over Florida.[135] The fear of attacks led the Spanish to build the fortress known as the Castillo de San Marcos, which was constructed in St. Augustine from 1672 – 1695, and remains today as a prominent reminder of Florida's Spanish heritage. In the 17th Century, Mission San Luis de Apalachee was established in present-day Tallahassee in the same location as Hernando de Soto's 1539 encampment. The site is now open to visitors and interpreted historically (Florida Department of State, 2015c).

Beginning in the early 18th Century, England tried several times to wrest control of Florida from Spain, finally doing so in 1763 as a part of the Treaty of Paris. England divided Florida into two territories, East Florida and West Florida, with their respective capitals in St. Augustine and Pensacola. Spain regained control of Florida following the America Revolution in 1783, but ceded it to the United States in 1821. Florida's first territorial governor, General Andrew Jackson, established a territorial government, and East and West Florida were reunited into a single territory in 1824 (Florida Department of State, 2015c). Tallahassee was selected to be the capital because it was equidistant between St. Augustine and Pensacola; it is also the site of Anhaica, the former capital of the Apalachee people and of Mission San Luis (Bureau of Historic Preservation, 2012).

The Seminole Indian Wars, which occurred during the early to mid-19th Century, resulted in the removal of much of Florida's remaining American Indian population. A small group of Seminoles and Miccosukees fled south, seeking refuge in the Florida Everglades, where some of their descendants still reside. On March 3, 1845, Florida was added as the 27th state in the Union, and the construction of a state capitol was completed just prior to admission in anticipation of statehood; the building serves as a museum today (Florida Department of State, 2015c). During the mid-19th Century, settlement grew in northern and central Florida and was dominated largely by plantation owners relocating from neighboring southern states (Hatton, 1987). Southern Florida, other than Key West (founded in 1822), remained largely vacant of new settlements.

On January 10, 1861, Florida became the third state to secede from the Union as a part of the Civil War. Only one major battle occurred in Florida, the Battle of Olustee in February 1864, which ended with a Confederate victory. Tallahassee was the only southern capital east of the Mississippi that was not captured (Hatton, 1987). Following Reconstruction in the 1870s, industries such as sponge harvesting, citrus agriculture, and cigar manufacturing helped grow the state's economy during the late 19th Century. In the 1880s, following a visit to St. Augustine, Henry Flagler began to develop Florida's Atlantic coast as a tourist destination through his construction of hotels and the Florida East Coast Railroad (Florida Department of State, 2015c).

[135] A "privateer" was essentially a pirate that was sponsored by a government.

Following World War I (WWI), the Florida Land Boom sent real estate prices into a frenzy, which resulted in unprecedented development of the southern portion of the state, but in 1926, following a devastating hurricane, the real estate market crashed and development stagnated. While the real estate crash was worsened by the beginning of the Great Depression in 1929. However, the development of military training bases during World War II (WWII) helped revitalize the economy. The modernization of airports and highways increased accessibility, and the development of Cape Canaveral during the 1960s put Florida at the center of the "Space Race." Tourism tied to Florida's natural resources and theme park industry continued to grow through the late 20th Century (Florida Department of State, 2015c).

Florida has 1,702 NRHP listed sites, as well as 45 National Historic Landmarks (NHL) (NPS, 2014d). While there are no National Heritage Areas (NHA) entirely within the state's borders, the Gullah/Geechee Heritage Corridor spans a large portion of the southeast Atlantic coastline, stretching from North Carolina southward into northern Florida (NPS, 2015v). Figure 5.1.11-3 shows the location of NHA and NRHP sites in Florida.[136]

5.1.11.7. Architectural Context

Cultural resources within Florida vary greatly based on the history of the area in which they are located, making it helpful to examine resources separately based on these different areas. Figure 5.1.11-4 depicts the regions that are described in the following subsections. As is always the case with the sharing of cultural practices, boundaries are fluid, and those shown in Figure 5.1.11-4 are only approximations of past and current architectural regions.

Florida Panhandle

A settlement at Pensacola was first attempted by the Spanish expedition led by Tristan de Luna y Arellano in 1559, but was beset by disasters and the last soldiers at a garrison left in 1561. In 1698, with the establishment of the Presidio Santa Maria de Galve (the site of the Naval Air Station Pensacola), the re-establishment of the settlement of Pensacola began. The site of the presidio moved to its present location in downtown Pensacola in 1754. Fort San Carlos de Barrancas is located at the Naval Air Station and was completed by the Spanish in 1797 atop earlier Spanish and British fortifications there. Downtown Pensacola's historic district also includes the Julee Cottage (1805), owned by a free woman of color, as well as the Lavalle House (1805) owned by a French creole family, among others. "The circa 1825 Barkley House, located on Pensacola Bay, is the oldest surviving example of a high-house in the city" (University of West Florida Historic Trust, 2016).

[136] See Section 5.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

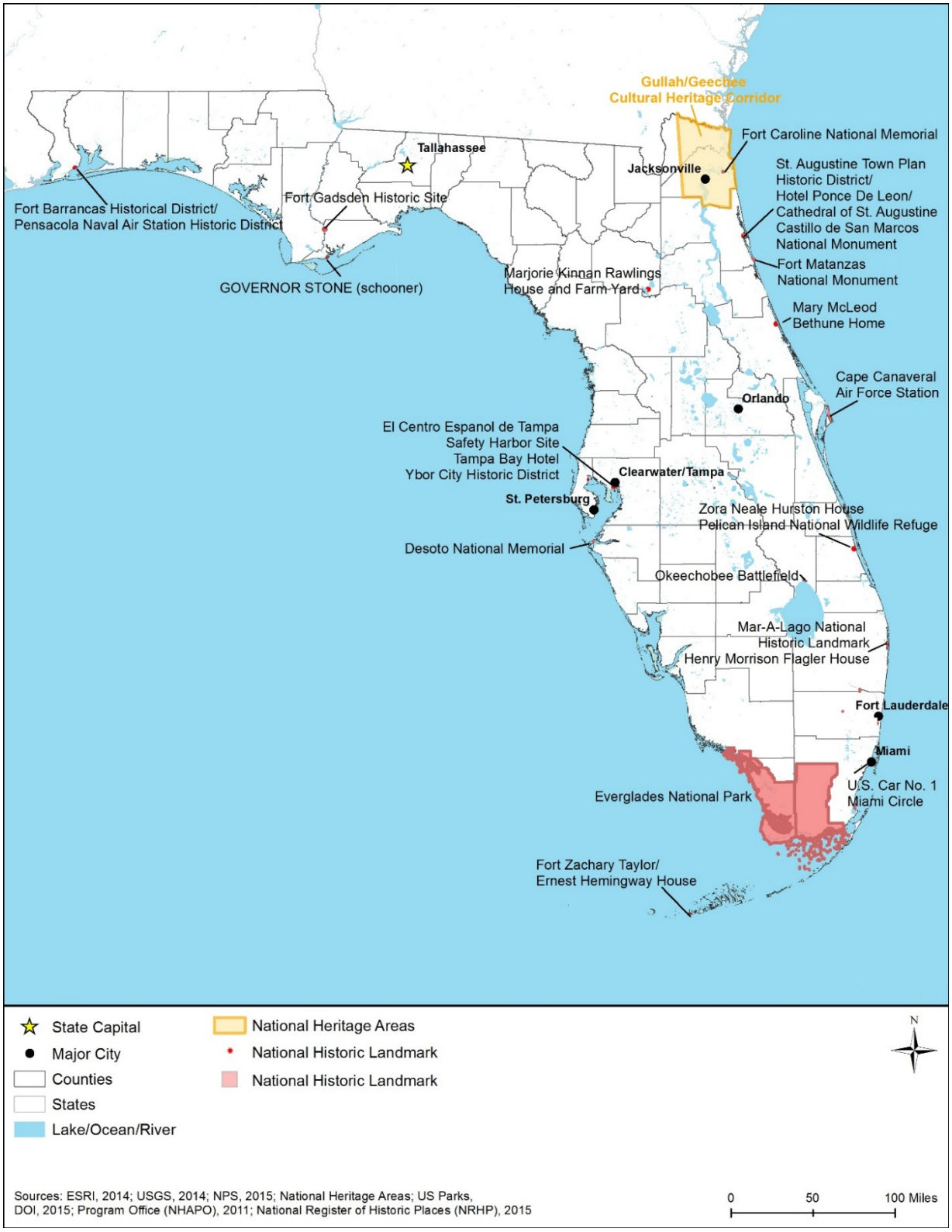


Figure 5.1.11-3: National Heritage Areas (NHA) and National Register of Historic Places (NRHP) Sites in Florida

Although Tallahassee was chosen as the capital in 1824; however, European activity in the area dates back to Hernando de Soto's winter encampment there in 1539 and to the 17th century Mission San Luis, as described above. Today, both Apalachee and Spanish structures from the time of the mission have been reconstructed and the site is a popular park and living history museum (Friends of Mission San Luis, Inc., 2015). About 20 miles south of Tallahassee, at the intersection of the St. Marks and the Wakulla Rivers, the remains of an 18th century Spanish stone fort, San Marcos de Apalache, draws both tourists and recreationalists to the area.

In 1821, Spain ceded Florida to the United States and southern plantation owners began relocating to Florida. Enslaved workers constructed large framed-houses, often two-stories in height, and generally less ornate than their counterparts in Georgia and the Carolinas (Hatton, 1987). Tallahassee includes a wide collection of architectural types and styles including Greek Revival, Victorian, Florida Cracker, bungalow, Colonial Revival, and ranch houses.[137] The Florida Historic Capitol building (1845), was replaced by the current capitol building in 1977 and is now open to visitors as a museum (Florida Department of State, 2015c). Historic institutional buildings, such as schools and churches, populate the city as well. While most plantations were in the northern portion of the state, they stretched south towards Gainesville and Bradenton as well; towns such as Mariana, Monticello, and Tallahassee contain large collections of early architecture (Hatton, 1987).

Other resources within the panhandle include 20th Century military installations, such as Naval Air Station Pensacola, which was established in 1913 and is significant to the development of military aviation (Pedrotty, Webster, & Chmiel, 1999). Tyndall Air Force Base and Eglin Air Force Base are two examples that were established during WWII and have stayed in operation since that time. Historic lighthouses are common and were important to the history of the state. The St. Marks Light on the Apalachee Bay (1842), is the second oldest continually operating light station in Florida (NRHP, 2002).

Northeast Florida

St. Augustine is the oldest continuously inhabited European settlement in the United States. The area was first explored by the Spanish in 1513, and finally settled in 1565. Early architecture in St. Augustine would have been utilitarian, lacking well-developed ornamentation. In 1672, Spain began constructing the fort Castillo de San Marcos, which remains significant today and attracts visitors to the area (Hatton, 1987). The Castillo de San Marcos was built of local coquina (a soft limestone formed of crushed shells), and took approximately 25 years to complete (Bureau of Historic Preservation, 2012). To protect the Matanzas Inlet passage to Saint Augustine, the Spanish built Fort Matanzas from 1740–1742, also from local coquina. By the 17th and 18th Centuries, residential and commercial structures were being made of wood and from coquina stone with tabby mortar.[138] Larger houses often had masonry ground floors and wooden second floors; a design that was likely transplanted from the Caribbean. In 1763, Spain

[137] Florida Cracker is a vernacular housing style that originated in the southern United States during the 19th Century (Hatton, 1987).

[138] Tabby is a type of concrete formed from a mixture of sand, burnt oyster shells, and sometimes sugar or ash. Tabby was common along the coasts of Florida, Georgia, North Carolina, and South Carolina during the 17th, 18th, and early 19th centuries.

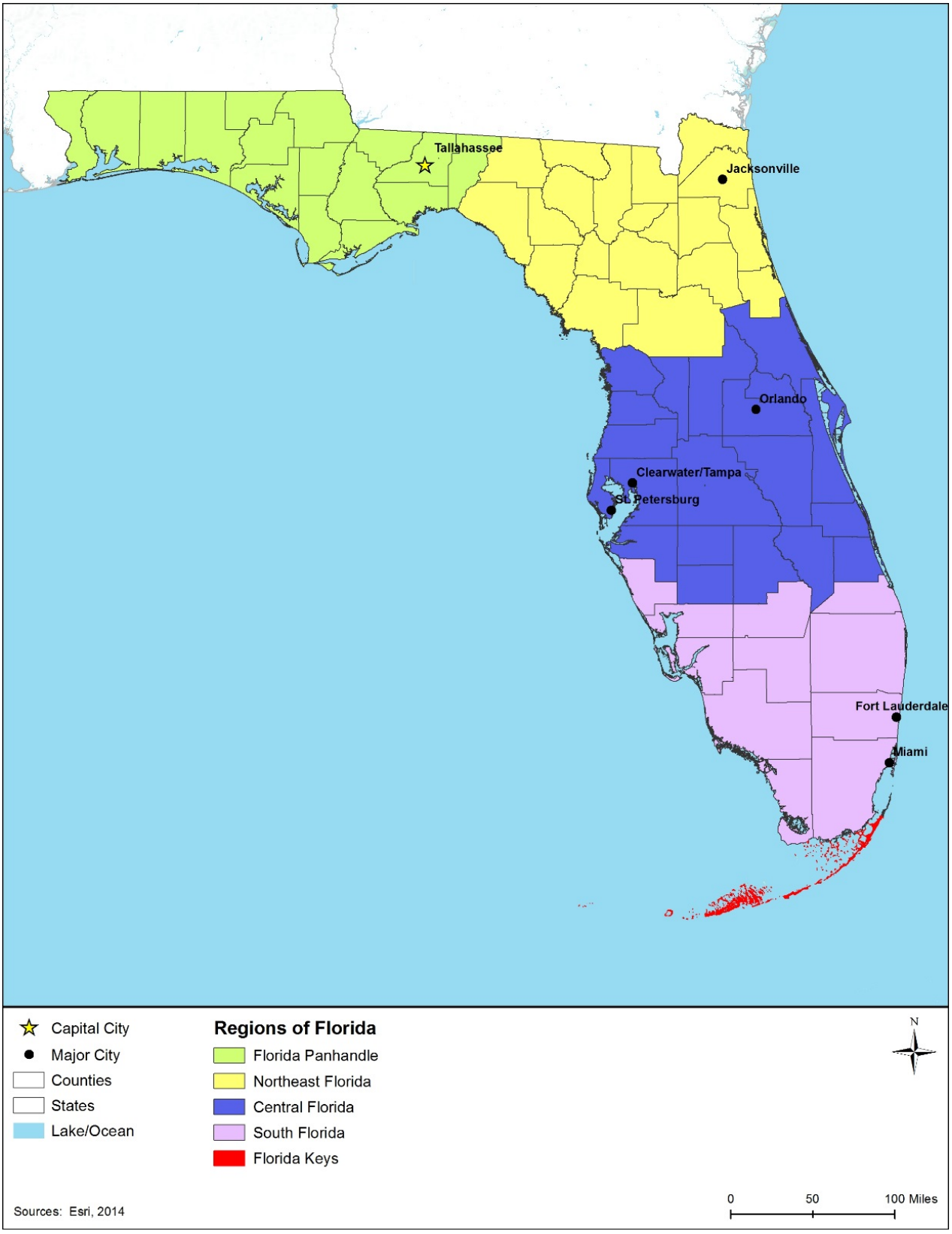


Figure 5.1.11-4: Architectural Regions of Analysis for Florida

ceded Florida to England, and many early buildings were removed. Structures left in place were modified with fireplaces, additional wings, and wooden roofs (Hatton, 1987). St. Augustine retains a large collection of 17th through 19th Century architecture.

While St. Augustine was surpassed in population by Jacksonville during the mid-19th Century, the town became prominent for tourists during the late 19th Century due to Henry Flagler's development activities. Flagler opened the Ponce de Leon Hotel in 1887 (now the campus of Flagler College), which remains an excellent example of Spanish Renaissance Revival architecture. The Alcazar and the Cordova, two additional Flagler buildings that remain today, complete a trio of Gilded Age hotels that anchored St. Augustine during that time (Hatton, 1987).

Jacksonville experienced significant growth during the late 19th Century associated with the lumber industry, rail lines, and shipping ports. The "Great Fire of 1901" destroyed much of the older buildings (148 blocks and 2,300 buildings), resulting in the construction of much of the building stock that exist today. Downtown Jacksonville contains early skyscrapers, religious structures, and early 20th Century commercial buildings. Architect Henry John Klutho brought elements of the Chicago and Prairie styles to the city. The St. James Building (1912), Klutho's most well-known commission, is now used as City Hall (NRHP, 1992). Residential building styles in Jacksonville include Prairie style, Craftsmen, and Colonial Revival (Hatton, 1987). Jacksonville also contains an extensive collection of Mid-Century and Modernist architecture, including several well-developed ranch house neighborhoods.

Much of northeast Florida remains rural and contains architecture similar to the panhandle. During the late 19th Century, Palatka was one of several towns along the St. John's River that grew rapidly as a result of riverboat tourism, but has nearly faded from history in the present (Hatton, 1987). Above Jacksonville, the town of Fernandina Beach was established in 1811 by the Spanish on Amelia Island, and contains a number of 19th-century structures, as well as the brick masonry Fort Clinch (1847). Coastal towns on the Gulf of Mexico, such as Steinhatchee and Cedar Key, contain resources associated with maritime activities. Amelia Island Light (1838), near Jacksonville, is the oldest active lighthouse in the state (Hatton, 1987).

Central Florida

Tampa was explored by the Spanish in the 16th Century, but was not settled until the 1820s and the military post, Fort Brooke, was established there in 1824. Considerable growth did not occur until the late 19th Century as a result of railroad and hotel construction by Henry Plant. In 1891, Plant constructed the Tampa Bay Hotel, built in a Moorish/Arabic Revival style and meant to rival Henry Flagler's Ponce de Leon Hotel in St. Augustine; the building now houses the University of Tampa. Ybor City, dating to the 1880s, is a historic neighborhood within the city of Tampa containing a variety of architectural styles built largely of red brick. The neighborhood was developed separately from Tampa by cigar manufacturer Vicente Martinze-Ybor as something of a company town, but was later annexed by its neighbor (Hatton, 1987). The greater Tampa/St. Petersburg area is characterized by sprawling development with strip malls and suburban housing tracts dating to the 20th Century; historic housing styles include bungalow, minimal traditional, and ranch houses.

On the Atlantic side, New Smyrna Beach was established in 1768 by Dr. Andrew Turnbull—a friend of British colonial governor of East Florida, James Grant—and settled by 1,300 colonists mostly from Minorca and Greece. Most of the colonists eventually moved north to Saint Augustine, but the coquina ruins of their settlement are preserved in Turnbull Park. During the Civil War, rural central Florida was home to scattered small, wood-frame vernacular "Cracker" farmhouses and cattle ranches and served as a major supplier of salt and beef to Confederate forces. "In 1853, the state supported a small school in Ocala, called the East Florida Seminary, which eventually became University of Florida" (Gladwin, 1992).

Orlando became a major hub for the citrus industry in the late 19th Century. Citrus producers eventually migrated south to escape hard freezes, and many former groves have been destroyed as result of suburban growth (Bureau of Historic Preservation, 2012). Following the opening of Walt Disney World in 1971, the theme park industry has come to define the area, and development in Orlando is characterized by sprawling suburbs and strip malls connected by large highways. On the east coast, the Kennedy Space Center (1957) placed Florida at the center of aerospace activities in the 1960s (Bureau of Historic Preservation, 2012).

South Florida

As an aid to navigation, the U.S. government built the Cape Florida Lighthouse on the southern end of Key Biscayne in 1825 and was rebuilt in 1846 to repair damage from a Seminole attack in 1836. It is the oldest standing structure in its original location and "The Barnacle" (1891) in Coconut Grove is the oldest house in Miami-Dade County still in its original location. In 1896, Flagler's railroad reached Miami and the area began to develop rapidly. Large "balloon-frame" hotels were built to house tourists (most are now gone).[139] Coral Gables, developed by George Merrick in the 1920s as one of the country's first planned neighborhoods, includes a collection of revival style housing, the spring-fed Venetian Pool, and the Biltmore Hotel (Hatton, 1987). The Art Deco style was popular in Miami, and the Miami Beach Art Deco District contains many examples of this style (Bureau of Historic Preservation, 2012). Villa Vizcaya (1916), built by John Deering on Biscayne Bay, is Florida's first example of Mediterranean Revival architecture, which would become popular throughout the state during the early 20th Century. The Miami Modern, or MiMo style, was common following WWII and represents Miami's regional interpretation of popular architectural trends from that era (Hatton, 1987).

Miami is in the middle of a large area of sprawling Mid-Century commercial and residential development. Houses include bungalows, ranches, and mid-to-late 20th Century styles. Palm Bay, north of Miami, was once one of the wealthiest communities in the country and contained many Gilded Age structures; Flagler's Whitehall is an excellent example (Hatton, 1987). In Fort Lauderdale, the Stranahan House (1901) is a two story wood vernacular structure situated on the New River and it served as a trading post with the Seminole Indians and local settlers and is the oldest structure in the city. The nearby Bonnet House (1920) estate on Fort Lauderdale Beach

[139] Balloon-framing involves the construction of buildings using sawn dimensional lumber and construction techniques similar to those used today. Residential homes were often built in the Cracker style that was common throughout the state.

was the winter retreat of artist Frederic Clay Bartlett and was gifted to the Florida Trust for Historic Preservation in 1983 and is open to the public.

Sarasota was settled in the late 19th Century, and early houses were wood-framed with side gables and large porches (NRHP, 1982). The Mediterranean Revival style was common in residential and commercial structure, and the Cá d'Zan Mansion on Sarasota Bay, home of the Ringling Brothers Museum, exemplifies this style. New College (1960), near the Cá d'Zan Mansion, includes a collection of Modernist buildings (New College of Florida, 2015). The settlement of Fort Meyers began in the late 19th Century; however, growth did not pick up until the early 20th Century with the arrival of the railroad. Thomas Edison and Henry Ford built vacation homes in the late 19th Century and both are now open to visitors as house museums. Automobile oriented suburban development has dominated the area in recent years.

Florida Keys

Once Florida became a territory, "wreckers" began moving to the Florida Keys, and by 1850, Key West was the wealthiest city in the United States per capita due to the wrecking industry.[140] "Conch architecture" developed in in Key West during the 19th Century, incorporating a variety of styles and often built with wood salvaged from ships. Large porches and verandas were common, as were overhanging eaves, louvered shutters, decorative trellises, balustrades, and columns. Later Victorian-styles with decorative "gingerbreading" are common as well (Hatton, 1987). The Ernest Hemingway House (1851) is an excellent example of Key West architecture.

Fort Jefferson, which was constructed from 1846 – 1875 in the Dry Tortugas islands located 70 miles west of Key West, was incorporated into the Dry Tortugas National Park in 1992 and designated as a National Monument in 1995. The fort, which remains "the largest all-masonry fort in the United States," was decommissioned 1888 and is now a museum (NPS, 2015w). In 1912, Henry Flagler completed the Overseas Railroad from Miami to Key West. This significant engineering achievement was largely destroyed by a hurricane in 1935; however, some of the former railway structures were reused to build the Overseas Highway (United States Route 1). Lighthouses and light stations were critically important, and in the 1840s open skeleton iron lighthouses were developed and implemented with great success. Carysfort Reef Light, constructed in 1852 near Key Largo, was the first open skeleton lighthouse to be installed and is still in use today (Hatton, 1987).

[140] "Wreckers" were people who made a living off of salvaging and selling goods from shipwrecks. This was very profitable due to the amount of wrecks that occurred in the shallow waters of the Florida Straits.



Figure 5.1.11-5: Representative Architectural Styles of Florida

- Top Left – St. Marks Light (St. Marks, FL) – (Highsmith, Carol M., 1980a)
- Top Right – Ponce de Leon Hotel (St. Augustine, FL) – (Detroit Publishing Company, 1880)
- Bottom Left – Marjorie Kinnan Rawlings House (Florida Cracker architecture (Cross Creek, FL) – (Historic American Buildings Survey, 1933)
- Bottom Center – Castillo de San Marcos (St. Augustine, FL) – (Wolfe, 1920)
- Bottom Right – Old Florida Capitol (Tallahassee, FL) – (Highsmith, Carol M., 1980b)

5.1.12. Air Quality

5.1.12.1. Definition of the Resource

Air Quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[141] of the area, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[142] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[143] This section discusses the existing

[141] Topography: The unique features and shapes of the land (e.g., valleys and mountains).

[142] Equivalent to 1 milligram per liter (mg/L).

[143] Averaging Time: "The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard" (USEPA, 2015o).

air quality in Florida. The USEPA designates areas within the United States as attainment,[144] nonattainment,[145] maintenance,[146] or unclassifiable[147] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or Alternatives.

5.1.12.2. Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_x). The NAAQS establish various standards, either primary[148] or secondary,[149] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E. In 2012, Florida repealed its ambient air quality standards, and has since adopted the NAAQS (DEP, 2015y).

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2016c). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

Title V Operating Permits/State Operating Permits

Florida has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA

[144] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015p).
[145] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015p).
[146] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (USEPA, 2015p).
[147] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015p).
[148] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014c).
[149] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014c).

requirements for the facility into one permit (USEPA, 2015d). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015d). Florida Administrative Code (F.A.C.) Chapter 62-213 describes the applicability of Title V operating permits. Florida requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 5.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 5.1.12-1: Major Air Pollutant Source Thresholds

Pollutant	Tons per year (TPY)
Any Pollutant	100
Single HAP	10
Total/Cumulative HAPs	25

Source: (USEPA, 2014b)

Exempt Activities

In accordance with F.A.C. Chapter 62-210.300(3)(a), the following activities are exempt from non-Title V air operating and air construction permits:

- "Fire and safety equipment…
- …Fossil fuel steam generators, hot water generators, and other external combustion heating units with heat input capacity equal to or less than 10 million Btu per hour, provided all the conditions [of 62-210.300(3)(a).33.a-33.c] are met…
- …Fossil fuel steam generators, hot water generators, and other external combustion heating units with heat input capacity less than 100 million Btu per hour, provided all the conditions [of 62-210.300(3)(a).34.a-34.h] are met…
- …Stationary Reciprocating Internal Combustion Engines, provided all the conditions [of 62-210.300(3)(a).35.a-35.h] are met, [including]…:
    - The engine is not subject to the Acid Rain Program, [Clean Air Interstate Rule] Program, or any other unit-specific limitation or requirement…
    - The engine shall not burn used oil or any fuels other than natural gas, propane, gasoline, and diesel fuel…
    - …If burning only one type of fuel, the collective annual amount of fuel burned by all engines claiming this exemption at the same facility shall not exceed 5,400 gallons of gasoline, 64,000 gallons of diesel fuel, 288,000 gallons of propane, or 8.8 million standard cubic feet of natural gas.
    - If burning more than one type of fuel, the equivalent collective annual amount of each fuel burned by the engines claiming this exemption at the same facility shall not exceed

the collective maximum annual amount of such fuel, as given in [the above condition], multiplied by a fuel percentage[150]…" (DEP, 2014f)

Generic emission units or activities that are not exempt by F.A.C. Chapter 62-210.300(3)(a) are exempt from non-Title V air operating and air construction permits if the following five conditions are met:

- "[The emission source] would not be subject to any unit-specific limitation or requirement.
- [The] emissions, in combination with the emissions of other units and activities at the facility, would not cause the facility to emit or have the potential to emit any pollutant in such amount as to create a Title V source.
- [The source] would neither emit nor have the potential to emit 500 pounds per year or more of lead and lead compounds expressed as lead, 1,000 pounds per year or more of any hazardous air pollutant, 2,500 pounds per year or more of total hazardous air pollutants, or 5.0 tons per year or more of any other regulated air pollutant as defined at Rule 62-210.200, F.A.C.
- In the case of a proposed new emissions unit at an existing facility, the emissions of such unit, in combination with the emissions of any other proposed new or modified units and activities at the facility, would not result in a modification subject to the preconstruction review requirements of subparagraph 62-204.800(11)(d)2., Rule 62- 212.400 or 62-212.500, F.A.C.
- In the case of a proposed new pollutant-emitting activity, such activity would not constitute a modification of any existing non-exempt emissions unit at a non-Title V source or any existing non-insignificant emissions unit at a Title V source." (DEP, 2014f)

In accordance with F.A.C. Chapter 62-212.500(3), temporary emission units with a total operating time less than two year, and relocatable facilities requiring preconstruction review, are exempt from emissions offset and net air quality improvement requirements.

Temporary Emissions Sources Permits

Florida does not have regulations for temporary emission source operating permits. Any temporary emission sources should review stationary source requirements in F.A.C. Chapter 62-210, or contact the state for additional assistance.

State Preconstruction Permits

Under F.A.C. Chapter 62-210.300(1), an air construction permit is required for "any proposed new, reconstructed, or modified facility or emissions unit" (DEP, 2014f). Pursuant to F.A.C. Chapter 62-212, major stationary sources located in nonattainment areas must perform a preconstruction review, which involves an impact analysis (DEP, 2012b).

[150] Fuel Percentage: "the percentage ratio of the total amount of the fuel burned by all engines … at the same facility to the total amount of such fuel allowed to be burned" (DEP, 2014a)

General Conformity

Established under Section 176(c)(4) of the CAA, "the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality" outlined in the state implementation plan (SIP) (USEPA, 2013a). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and I, federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (GPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[151] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 5.1.12-2). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 5.1.12-2: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an Ozone Transport Region (OTR)	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

Source: (GPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 5.1.12-2, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 5.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a

[151] de minimis: USEPA states that "40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas" (USEPA, 2016g).

new violation of the NAAQS. To demonstrate conformity,[152] the agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;
- Show the emissions would be fully offset by implementing reductions from another source in the same area; and
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2010).

State Implementation Plan Requirements

The Florida SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Florida's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Florida's SIP actions are codified under 40 CFR Part 52 Subpart K. A list of all air rules associated with Florida's SIP can be found on the Florida DEP's website (http://www.dep.state.fl.us/air/rules/current.htm).

5.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 5.1.12-1 and Table 5.1.12-3, below, present the nonattainment areas in Florida as of January 30, 2015. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standard for that pollutant; note that, for lead and SO_2, these standards listed are in effect. Table 5.1.12-3, contains a list of the counties and their respective current nonattainment status of each criteria pollutant. Note certain pollutants have more than one standard in effect (e.g., lead and SO_x). Unlike Table 5.1.12-3, Figure 5.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ merge in the figure to count as a single pollutant.

[152] Conformity: Compliance with the State Implementation Plan.

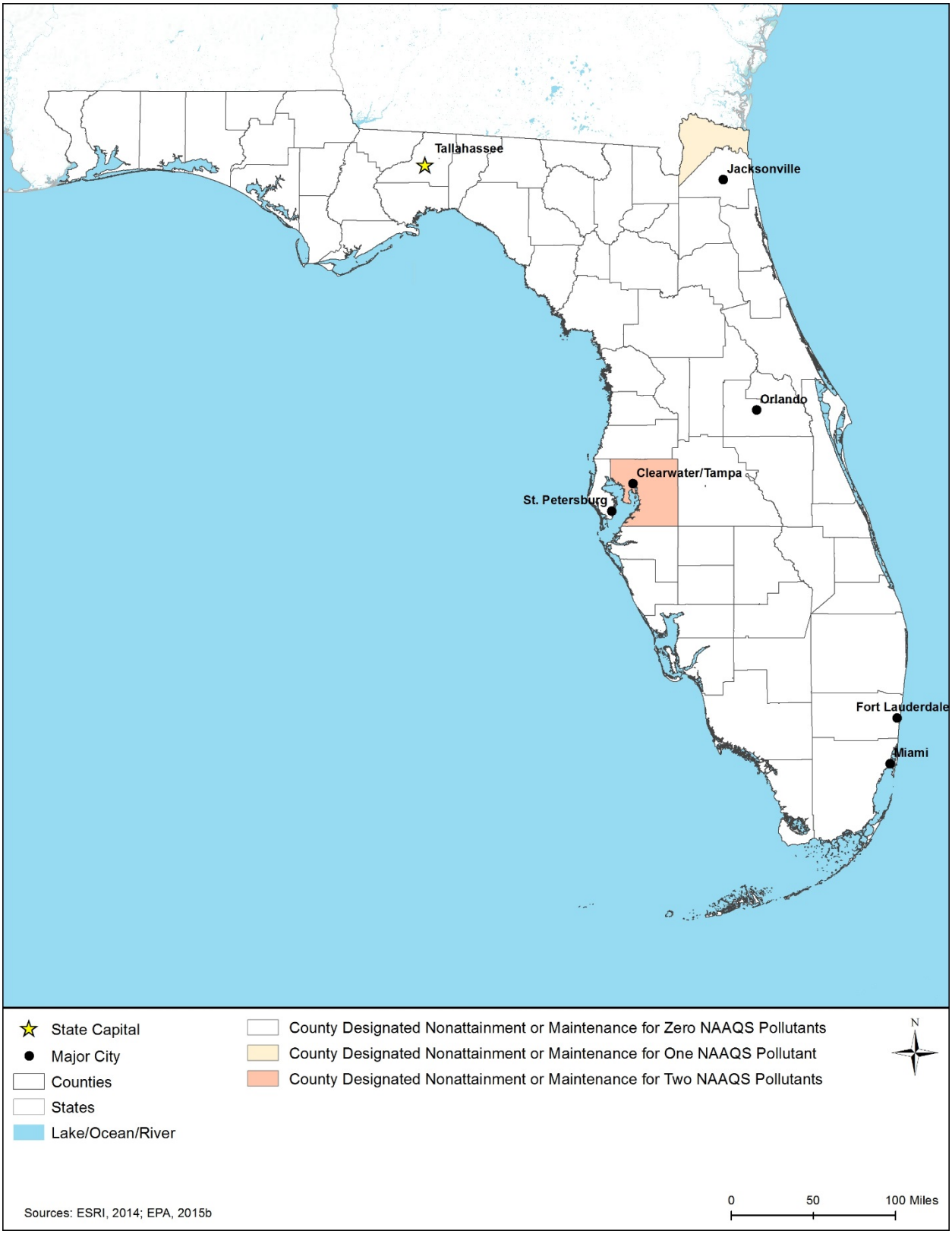


Figure 5.1.12-1: Nonattainment and Maintenance Counties in Florida

Table 5.1.12-3: Florida Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
County	**1971**	**1978**	**2008**	**1971**	**1987**	**1997**	**2006**	**1997**	**2008**	**1971**	**2010**
Hillsborough			X-6								X-6
Nassau											X-6

Source: (USEPA, 2015e)

X-1 = Nonattainment Area (Extreme)
X-2 = Nonattainment Area (Severe)
X-3 = Nonattainment Area (Serious)
X-4 = Nonattainment Area (Moderate)
X-5 = Nonattainment Area (Marginal)
X-6 = Nonattainment Area (Unclassified)
M = Maintenance Area

Air Quality Monitoring and Reporting

DEP measures air pollutants at 104 sites across the state as part of the National Air Monitoring Stations Network and the state and local Air Monitoring Stations Network (DEP, 2015z). DEP also prepares Annual Air Quality Reports, containing pollutant data summarized by region. When available, the Office of Air Monitoring posts air quality advisories to on their website (http://www.dep.state.fl.us/air/air_quality/airdata.htm).

During 2012, Florida's air monitoring system detected exceedances for four of the six criteria pollutants. The Hillsborough County stations, monitoring for lead, recorded 58 exceedances. Duval County experienced eight exceedances of the federal 24-hour standard for $PM_{2.5}$. Of the 14 O_3 exceedances across Florida, there were 5 in Polk County, 3 in Hillsborough County, and 2 in Orange County. Brevard, Broward, Martin, and Sarasota Counties all recorded single O_3 exceedances. Hillsborough and Nassau Counties shared the 11 SO_2 exceedances, with the higher concentrations of SO_2 occurring in Hillsborough County. (DEP, 2012c)

Air Quality Control Regions

The USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR) (42 U.S.C. § 7470). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although the USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (42 U.S.C. § 7470).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (USEPA, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit

requirements and within 100 kilometers[153] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 100 kilometers (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).

Florida contains four Federal Class I areas; all other land within the state is classified as Class II (USEPA, 2012b). If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis should analyze the impacts to air quality within 100 kilometers from the source. Georgia also has two Class I areas where the 100-kilometer buffer intersects several Florida counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 5.1.12-2 provides a map of Florida highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses. The numbers next to each of the highlighted Class I areas in Figure 5.1.12-2 correspond to the numbers and Class I areas listed in Table 5.1.12-4.

Table 5.1.12-4: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Everglades National Park	1,397,429	FL
2	Bradwell Bay Wilderness Area	24,602	FL
3	Saint Marks NWR	67,968	FL
4	Chassahowitzka Wilderness Area	23,360	FL
5	Wolf Island NWR	5,126	GA
6	Okefenokee Wilderness Area	343,850	GA

[a] The numbers correspond to the shaded regions in Figure 5.1.12-2.

Source: (USEPA, 2012b)

[153] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.

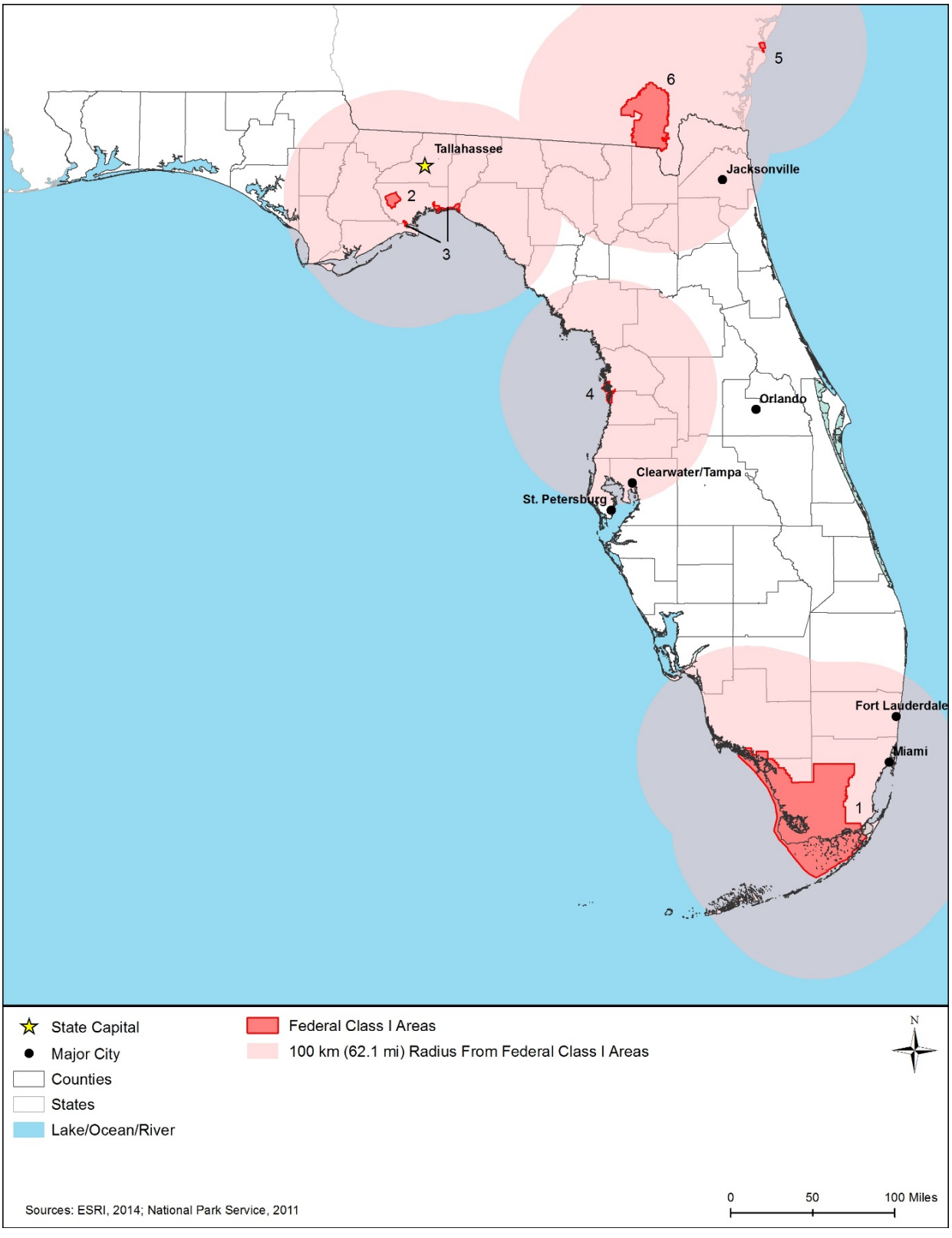


Figure 5.1.12-2: Federal Class I Areas with Implications for Florida

5.1.13. Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

5.1.13.1. Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012c). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety (USEPA, 2015f).

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain") (OSHA, 2016a). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (FTA, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015g). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2016a).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 2006):

- The total sound energy radiated by a source, usually reported as a sound power level;
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location);
- The duration of a sound; and
- The changes in frequency characteristics or pressure levels through time.

Figure 5.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.

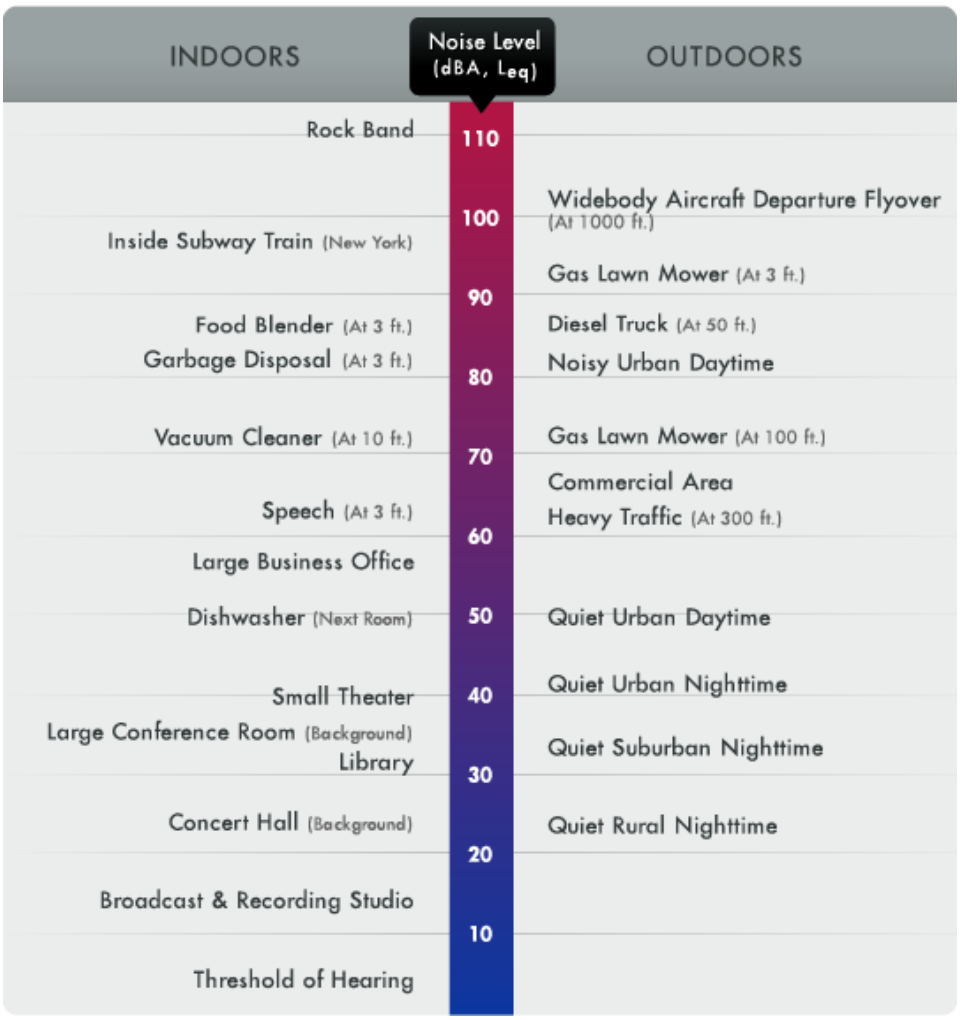


Figure 5.1.13-1: Sound Levels of Typical Sounds

Leq: Equivalent Continuous Sound Level

Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels are categorized as follows (FTA, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB (USEPA, 1973). Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

5.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, Environmental Laws and Regulations, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, most states have no quantitative noise-limit regulations.

Florida has several statewide noise statutes that affect the sales and operation of motor vehicles. Table 5.1.13-1 provides an overview of Florida's state laws relating to noise.

Table 5.1.13-1: Relevant Florida Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Title 23: 316-271	Florida Legislature	Bans the use of an unreasonably loud or harsh noise from motor vehicle horns.
Title 23: 316-272	Florida Legislature (Department of Environmental Protection and Department of Highway Safety and Motor Vehicles)	Requires the use of a muffler in good working order for motor vehicle exhaust systems.
Title 23: 316-293	Florida Legislature	Establishes noise limits for motor vehicles operating in Florida.
Title 23: 316-3045	Florida Legislature	Limits the operation of a "mechanical sound making device" (e.g., radios) from being louder than necessary for convenient hearing.
Title 26: 335-17	Florida Legislature	Requires the adoption of noise abatement methods during highway construction projects.
Title 29: 403-415	Florida Legislature	Establishes noise limits for new vehicles sold in Florida.

Source: (Florida Legislature, 2015b)

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Miami, Tampa, and Orlando are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011).

5.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Florida varies widely based on the area and environment of the area. The population of Florida can choose to live and interact in areas that are large cities, rural or suburban communities, small towns, and national and state parks. Figure 5.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Florida may experience on a day-to-day basis. These noise levels represent a

wide range and are not specific to Florida. As such, this section describes the areas where the population of Florida can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (USDOI, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Miami (and the surrounding metropolitan area), Tampa, Orlando, Jacksonville, and North Port.
- **Airports:** Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012a). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities resulting in noise exposures from aircraft operations (arrivals/departures) to surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Florida, Miami International Airport (MIA), Orlando International Airport (MCO), Fort Lauderdale International Airport (FLL), Tampa International Airport (TPA), Southwest Florida International Airport (RSW), Palm Beach International Airport (PBI), and Jacksonville International Airport (JAX) have combined annual operations of more than 1,449,000 flights (FAA, 2015i). These operations result in increased ambient noise levels in the surrounding communities. See Section 5.1.7, Land Use, Recreation, and Airspace, and Table 5.1.7-8 for more information about airports in the state.
- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015f). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015f). See Section 5.1.1, Infrastructure, Figure 5.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (Department of Transportation, 2015a). Florida has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Jacksonville to Sanford and Miami and from Pensacola to

Orlando (FDOT, 2010). See Section 5.1.1, Infrastructure, and Figure 5.1.1-1 for more information about rail corridors in the state.

- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas to preserve these areas in their natural environment. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014e). Florida has 11 NPS units and 18 National Natural Landmarks (NPS, 2015x). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 5.1.8, Visual Resources, and Figure 5.1.8-4 for more information about national and state parks for Florida.

5.1.13.4. Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities, towns, and villages in Florida have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors throughout the state of Florida.

5.1.14. Climate Change

5.1.14.1. Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity" (IPCC, 2007).

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012d). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent[154] (MT CO_2e), which equalizes for the different global warming potential of each type of GHG. Where this document references

[154] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_{2e}$ = (million metric tons of a gas) * (GWP of the gas)." (USEPA 2015)

emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 5.2.14, Environmental Consequences – Climate Change). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; 3) sea level; and 4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

5.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. Florida has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 5.1.14-1, they are the primary policy drivers on climate change preparedness and GHG emissions.

Table 5.1.14-1: Relevant Florida Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Florida EO 07-127: Establishing Immediate Actions to Reduce Greenhouse Gas Emissions within Florida (2007)	State of Florida	Establishes immediate actions to reduce GHG emissions within Florida established the following reduction goals: • By 2017, reduce GHG emissions to 2000 levels; • By 2025, reduce GHG emissions to 1990 levels; and • By 2050, reduce GHG emissions by 80 percent of 1990 levels. (State of Florida, 2007)
Florida EO 07-128: Establishing the Florida Governor's Action Team on Energy and Climate Change (2007)	State of Florida	Establishes the Florida Governor's Action Team on Energy and Climate Change to: • Create an Action Team on Energy and Climate Change; and • Develop a comprehensive Energy and Climate Change Action Plan that would fully achieve or surpass Executive Order targets for statewide GHG reductions. (State of Florida, 2007)
Southeast Florida Regional Climate Change Compact (October 2012)	Southeastern Counties of Florida	Developed a Regional Climate Action Plan to assess the vulnerability of the region and identify sources of regional GHG emissions for Palm Beach, Broward, Miami-Dade, Monroe Counties, their municipalities and partners. (Southeast Regional Climate Change Compact, 2012)

5.1.14.3. Florida Greenhouse Gas Emissions

Estimates of Florida's total GHG emissions vary. The Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level data on emissions of CO_2 from fossil fuels by state. In addition, EIA maintains data on other GHGs such as CH_4 and nitrous oxide (NO_x), but these are not broken down by state (EIA, 2015d). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015g). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHGs in different ways.

For the purposes of this PEIS, the EIA data on CO_2 emissions from fossil fuels will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH4, they will be described and cited.

According to the EIA, Florida emitted a total of 217.6 MMT of CO_2 in 2013 (EIA, 2015e). Florida's CO_2 emissions profile is dominated by the electric power and transportation sectors, which account for 44.0 percent and 48.1 percent of total CO_2 emissions respectively. The electric power sector is responsible for almost all of the emissions from coal, which have been falling since a maximum of 71.8 MMT in 2000, with a corresponding increase in emissions from natural gas (Table 5.1.14-2) (EIA, 2015f). Annual emissions between 1980 and 2013 are displayed in Figure 5.1.14-1. Between 1980 and 2013, Florida's CO_2 emissions increased to a maximum of 259.4 MMT in 2005 before declining to the 2013 level: a reduction of almost 16 percent. Florida was the 6th-largest CO_2 emitter among the fifty states and the District of Columbia in 2013, and ranked 39th in per capita CO_2 emissions (EIA, 2015g).

Table 5.1.14-2: Florida CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	47.7	Residential	1.1
Petroleum Products	103.9	Commercial	5.1
Natural Gas	66.1	Industrial	11.0
		Transportation	95.8
		Electric Power	104.6
Total	**217.6**	**Total**	**217.6**

Source: (EIA, 2015h)

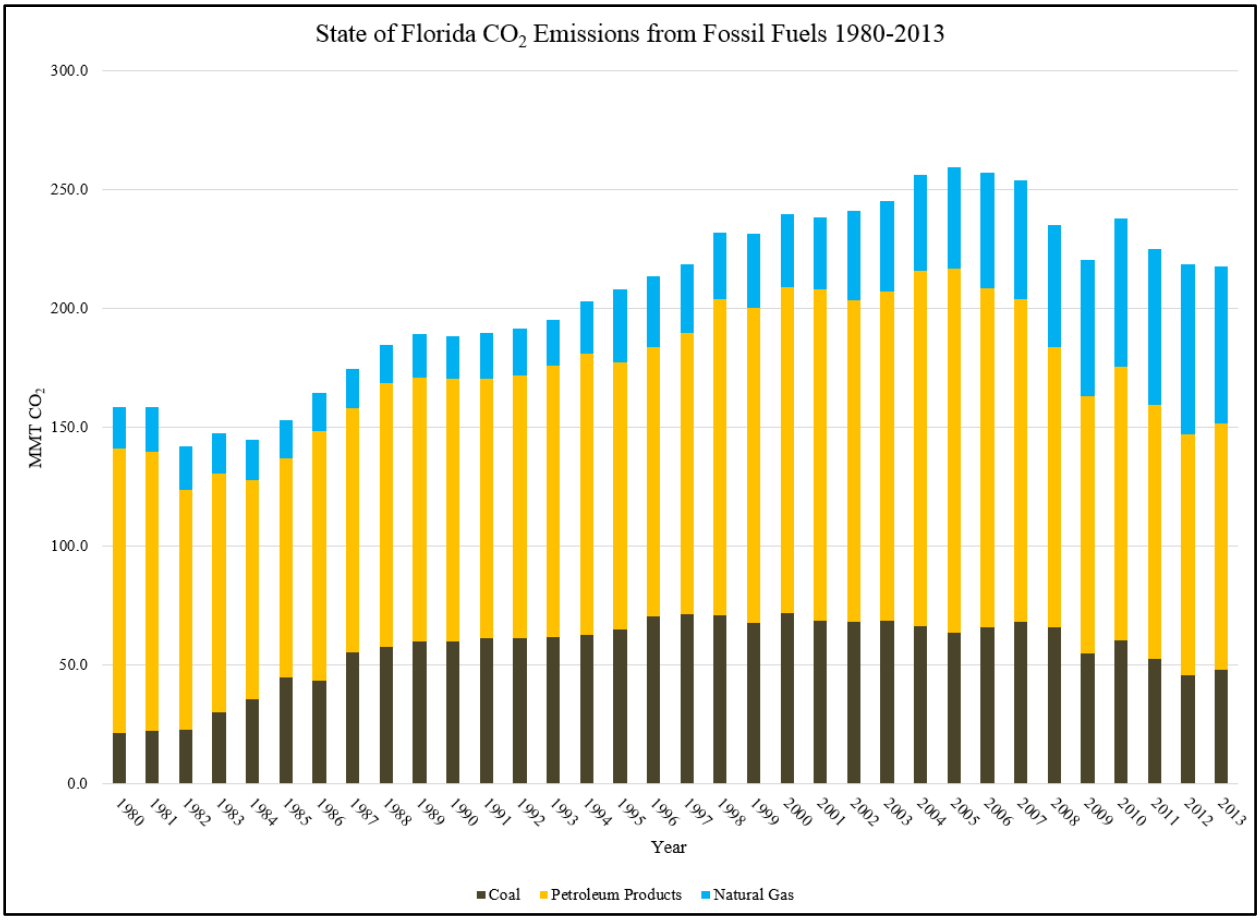


Figure 5.1.14-1: Florida CO_2 Emissions by Source 1980-2013

Source: (EIA, 2015h)

Florida maintains its own GHG inventory, which was most recently updated in 2007 (FLDEP, 2008). In 2005, the most recent year for which data are available, Florida was responsible for gross emissions (not accounting for sequestration) of 337 $MMTCO_2e$. Florida's GHG emissions increased by roughly 9 percent between 1990 and 2005. Florida's gross emissions are rising faster than the national average, although per capita GHG emissions have been in decline, indicating that the GHG intensity of Florida's economy is being reduced (FLDEP, 2008). The report estimates that in the future emissions will remain constant with only slight changes within the different sectors related to electricity fluctuations. The largest contributor for future emissions is the transportation sector, which is related to an increase in tourism and population growth (FLDEP, 2008).

Because Florida has a large year-round tourist population, most of the petroleum is used in the transportation sector, specifically from planes and out-of-state vehicles (EIA, 2015i). However, because much of the emissions come from a tourist-based rental fleet composed of relatively new cars, the average fuel economy for vehicles in Florida is probably higher than the national average (FLDEP, 2008).

Because of Florida's size and large population, it is the third-largest energy consuming state. However, when considered on a per-capita basis it is below the U.S. average, largely because Florida produces such a small amount of crude oil, natural gas, and coal. It receives nearly all of its natural gas imported from the Florida Gas Transmission pipeline and the Gulfstream pipeline and a very small amount from the Southern Natural pipeline from Georgia. In the late 1970's, the state produced roughly 100,000 barrels of oil a day, but in 1990, Florida enacted a drilling ban for state waters which resulted in the state only producing 6,000 barrels a day (EIA, 2015i). This resulted in the long-term depression in Florida's GHG emissions profile (Center for Climate Change Strategies, 2008).

5.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (NWS, 2011b).

Across the United States, the five most common climate groups are (A), (B), (C), (D), and I. The majority of Florida falls into climate group (C) (see Figure 5.2.14-2). Climates classified as (C) are generally warm, with humid summers and mild winters (NWS, 2011a) (NWS, 2011b). During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a). In addition, convective thunderstorms are dominant during summer months. Although the majority of the state falls into the climate group (C), portions of southern Florida fall into climate group (A). Climates classified as (A) are moist, tropical climates, with all months averaging temperatures that are greater than 64°F. The average annual precipitation accumulation in (A) climate groups is greater than 59 inches (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011a) (NWS, 2011b).

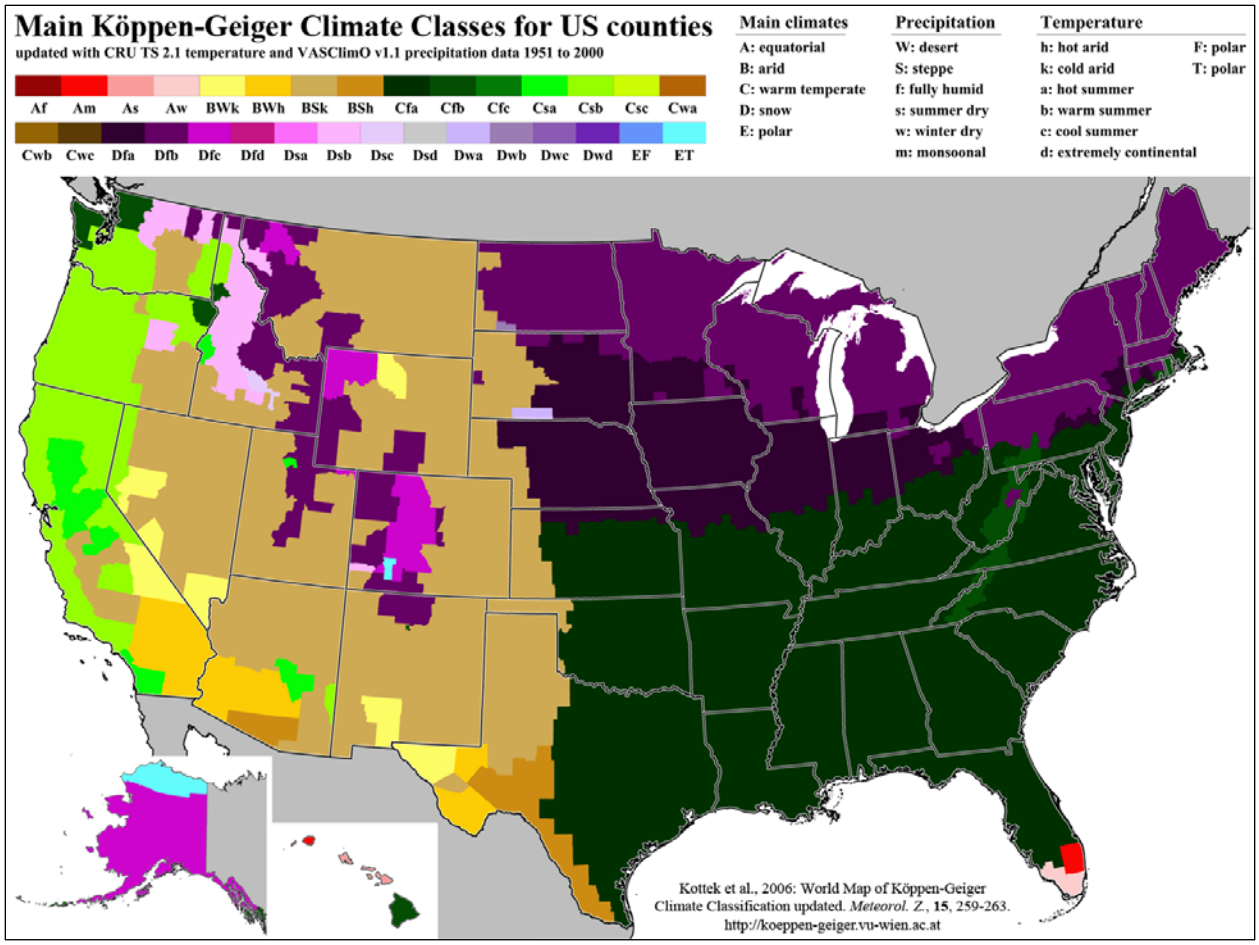


Figure 5.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

Florida has three sub-climate categories, which are described in the following paragraphs.

Cfa – The Köppen-Geiger climate classification system classifies the majority of Florida as Cfa. Cfa climates are generally warm, with humid summers and mild winters. Florida's secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. The tertiary classification indicates mild, hot summers with an average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F (NWS, 2011a) (NWS, 2011b).

Am – The Köppen-Geiger climate classification system classifies a portion of southern Florida as Am. Climates classified as Am are equatorial monsoon climates, characterized "by all twelve months having a mean temperature of greater than or equal to" 64 °F (GLOBE SCRC, 2015) (NWS, 2011a). In addition, Am climates experience "a pronounced wet season," and short dry seasons (NWS, 2011a). In Am climates, "there are only one or more months with less than 2.40 inches of precipitation" (NWS, 2011a). The highest annual temperatures to occur in Am climates typically occur just before the wet season (NWS, 2011a) (NWS, 2011b).

Aw – The Köppen-Geiger climate classification system classifies the southern tip of Florida as Aw. Climates classified as Aw are topical savannah climates, with more than two months experiencing less than 2.40 inches of rainfall. Average monthly temperatures in Aw climates are higher than 64 °F. In topical savannah climates, winter is typically the region's dry season. (NWS, 2011a) (NWS, 2011b)

This section discusses the current state of Florida's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in Florida's three climate regions, Cfa, Am, and Aw.

Air Temperature

Florida is a peninsula, extending into the Gulf of Mexico and the Atlantic Ocean. With the exception of the northwest, there is no area in Florida "more than 80 miles from both the Gulf of Mexico and the Atlantic Ocean" (Griffin, 2015). Such a close proximity to two bodies of water has a profound effect on temperature and precipitation throughout the state. (Griffin, 2015)

The average temperature in Florida is approximately 70.2 °F (NOAA, 2015i). The highest temperature to occur in Florida was on June 29, 1931 with a record high of 109 °F (NOAA, 2015j). The coldest temperature to occur in Florida was on February 13, 1899 with a record low of negative 2 °F (NOAA, 2015j). January is Florida's coldest month, with average temperatures ranging "from the lower 50s in the north to the upper 60s in the south" (Griffin, 2015).

The following paragraphs describe temperature variations as they occur within Florida's various climate classification zones:

Cfa – Tallahassee, Jacksonville, and Orlando are all located with the climate classification Cfa. Tallahassee, located in Florida's northwestern panhandle, has an average annual temperature of 67.7 °F; 53.0 °F during winter months; 81.3 °F during summer months; 67.0 °F during spring months; and 69.3 °F during autumn months (NOAA, 2015k). Jacksonville, located along Florida's northeastern coast, has an average annual temperature of 68.6 °F; 54.9 °F during winter months; 81.4 °F during summer months; 67.6 °F during spring months; and 70.3 °F during autumn months (NOAA, 2015k). Orlando, located in central Florida, has an average annual temperature of 72.8 °F; 61.9 °F during winter months; 82.3 °F during summer months; 71.8 °F during spring months; and 75.0 °F during autumn months (NOAA, 2015k).

Am – West Palm Beach, located in southern Florida along the eastern coast, is within the climate classification zone Am. West Palm Beach has an average temperature of 75.4 °F; 67.2 °F during winter months; 82.4 °F during summer months; 74.2 °F during spring months; and 77.6 °F during autumn months (NOAA, 2015k).

Aw – Miami, located on the southern tip of Florida, is within the climate classification zone Aw. Miami has an average temperature of 77.2 °F; 69.6 °F during winter months; 83.7 °F during summer months; 76.1 °F during spring months; and 79.2 °F during autumn months (NOAA, 2015k).

Precipitation

Due to Florida's close proximity to the Gulf of Mexico and the Atlantic Ocean, the state is "among the wettest states in the nation," with an atmosphere "that is so humid that its summers are among the most uncomfortable" (Griffin, 2015). Each year, approximately 54 inches of precipitation falls in Florida, with at least 50 percent of the state's annual precipitation falling between May and August. The majority of this precipitation results from "local thunderstorms, or thunderstorms that develop in long squall lines created when the hot humid air from the Atlantic Ocean converges with equally hot and humid air from the Gulf of Mexico" (Griffin, 2015). In addition to heavy rainfall, these thunderstorms bring heavy lightning storms; "Florida is known was the Lightening Capital of the United States" (Griffin, 2015). An additional large share of Florida's rainfall is the results of torrential rain, "defined as 3 inches or more within a 24-hour period" (Griffin, 2015). Lastly, hurricanes, tropical depressions, and tropical storms also contribute significantly to annual rainfall accumulation totals, with totals of 10 to 20 inches commonly occurring over wide areas. During one historic rainfall event, approximately "38.70 inches of rain reportedly fell in a 24-hour period at Yankeetown, Florida on September 5, 1950 during Hurricane Easy" (Griffin, 2015). With such a warm climate, snowfall accumulation is very uncommon to Florida. However, a 24-hour snowfall record was set on March 6, 1955 with a total accumulation of 4 inches (NOAA, 2015j).

The following paragraphs describe precipitation as it occurs within Florida's various climate classification zones:

Cfa – Tallahassee, Jacksonville, and Orlando are all located with the climate classification Cfa. In the northeastern and northwestern panhandle region, approximately 56 to 70 inches of precipitation falls annually. Tallahassee, located in Florida's northwestern panhandle region, receives an average of 59.23 inches of precipitation annually; 13.09 inches during winter months; 22.25 inches during summer months; 12.47 inches during spring months; and 11.42 inches during autumn months (NOAA, 2015k). Jacksonville, located along Florida's northeastern coast, receives an average of 52.39 inches of precipitation annually; 9.29 inches during winter months; 19.80 inches during summer months; 9.07 inches during spring months; and 14.23 inches during autumn months (NOAA, 2015k). Lastly, Orlando, located in central Florida, receives an average of 50.73 inches of precipitation annually; 7.31 inches during winter months; 21.98 inches during summer months; 9.90 inches during spring months; and 11.54 inches during autumn months (NOAA, 2015k).

Am – Florida's wettest region, the southeastern coast, is the wettest part of the state, receiving approximately 58 to 62 inches on average per year (Griffin, 2015). West Palm Beach is located along this southeastern coast, within the climate classification zone Am. On average, West Palm Beach receives 62.33 inches of precipitation annually; 9.33 inches during winter; 22.01 inches during summer months; 12.76 inches during spring months; and 18.23 inches during autumn months (NOAA, 2015k).

Aw – Miami, located on the southern tip of Florida, is within the climate classification zone Aw. Miami receives 61.90 inches of precipitation annually; 5.91 inches during winter months; 25.05 inches during summer months; 11.48 inches during spring months; and 19.46 inches during

autumn months (NOAA, 2015k). The Florida Keys are also located within the climate classification zone Aw but receive an average of less than 50 inches per year, making the Florida Keys the driest area in Florida (Griffin, 2015).

Sea Level

Florida has approximately 1,350 miles of coastline, with 8,246 miles of tidal shoreline (U.S. Census Bureau, 2015y). Much of this shoreline is at risk for damage from strong winds, heavy rainfall, flooding, hurricanes, tropical storms, and tropical depressions. "The longest record of sea levels in the Western Hemisphere began in 1846 in Key West, Florida" (FDOT, 2015g). Since 1900, sea level in Florida has risen approximately 9 inches (FDOT, 2015g). In addition to sea level rise, coastal and tidal areas of Florida are experiencing land subsidence. Further land subsidence is putting already low-lying areas of Florida at an even greater risk for flooding, storm surges, and inundation. Although the majority of Florida is at risk to sea level rise implications, the southern tip of Florida is most susceptible to rising sea level due to the already low-lying topography.

Severe Weather Events

With regard to severe weather, Florida is most susceptible to hurricanes, tropical storms, tropical depressions, thunderstorms, and associated flooding. Common types of flooding in Florida include flash flooding, river flooding, tropical systems and coastal flooding, and dam breaks and/or levee failure (NWS, 2015a).

In 1947, the Cape Sable Hurricane brought rainfall totals, which ranged from five to 14-inches. Although these totals seem manageable, much of this rainfall occurred in an extremely short period. For example, the Hialeah Water Plant "measured 6 inches of rain in 75 minutes before the gage overflowed" (NWS, 2015a). In Miami, record measured 3.60 inches in one hour, "of which, 1.32 inches fell in 10 minutes" (NWS, 2015a). After the hurricane dissipated, "approximately 90% of the eastern Florida peninsula" was flooded (NWS, 2015a). In total, more than 500,000 acres were inundated with water, ranging from 6 inches to 10 feet of water. As a result of this historic flooding event, Florida created the South Florida Water Management District (SFWMD), an agency tasked with developing "an improved flood control plan for south Florida" (NWS, 2015a).

In June 2012, Tropical Storm Debby "led to torrential and persistent heavy rainfall for 36 to 48 hours across north Florida" (NWS, 2015a). The peak rainfall total occurred in Curtis Mill, located in southwestern Florida, with an accumulation of 28.78 inches. Rainfall south of Tallahassee resulted in extensive flash flooding throughout much of Wakulla County and led to a record crest and 29-foot rise in water level on the Sopchoppy River (NWS, 2015a). Other rivers, such as the Suwannee River, the St. Mary's River, the Anclote River, and the Pithlachascotee River also experienced record high waters and crests. As a result, FEMA reported $40 million in flood damages across the state of Florida and 22 counties were declared Federal Disaster Areas (NWS, 2015a).

Despite receiving significant amounts of rainfall, Florida has still "experienced numerous dry periods and droughts" (Griffin, 2015). For example, in 1998, a particularly active wildfire season "was brought on by an abnormally dry period; and during the drought in 2007, the water level in Lake Okeechobee fell to the historic low of 8.82 feet" (Griffin, 2015). In 2008, this lake was replenished by the heavy precipitation resulting from Tropical Storm Fay.

5.1.15. Human Health and Safety

5.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicle traffic. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 5.1.1, Infrastructure.

5.1.15.2. Specific Regulatory Considerations

Federal organizations, such as the Department of Labor, Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. DEP regulates waste and environmental pollution. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. Florida does not have an OSHA-approved "State Plan." Therefore, private and public sector occupational safety and health programs in the state of Florida are enforced by OSHA. All private and public sector occupational safety and health programs in Florida are enforced by OSHA. Health and safety of the general public is regulated by the Florida Department of Public Health (FLDOH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 5.1.15-1 below summarizes the major Florida laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 5.1.15-1: Relevant Florida Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
FAC: Chapter 62-780	DEP	Outlines requirements for environmental cleanup programs, such as contamination reporting, certifications, emergency response, risk assessments, active remediation, and natural attenuation monitoring.
FAC: Chapter 62-785	DEP	Outlines the DEP Brownfield cleanup program, including site and risk assessments, remediation, and natural attenuation.
FAC: Chapter 62-701	DEP	Provides standards for the operation of solid waste management facilities, certification of recovery equipment, management of used oil, and disbursement of grants.

5.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights or confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016b). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015a). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the general public who may be observing the work or transiting the area (IFC, 2007).

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[155] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and in small trenches (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (OSHA, 2016c)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement

[155] Manholes may be used for telecommunications activities, especially in cities and urban areas, depending on the location of other utilities. In cities, power, water, and telecommunication lines are often co-located; if access is through a manhole in the street, that access will be used.

trucks, and cranes are used to prepare the ground, transport materials and soil, and raise large sections of towers and antennas. Telecommunications workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016c)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work. (IFC, 2007)

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (IFC, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (TWA) (see Section 5.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016c).

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require use of potentially hazardous products (e.g., herbicides). Secondary hazardous materials (e.g., exhaust fumes) may be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 2016c).

Aquatic environments – Installation of telecommunication lines may include laying, burying, or boring lines under waterways and wetlands, such as lakes, rivers, ponds, or streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and

other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia. (OSHA, 2016c).

Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings. (OSHA, 2016c).

Telecommunication Worker Occupational Health and Safety

The U.S. Department of Labor BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers or repairers, except line installers (SOC code 49-2022), or telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

Spotlight on Florida Occupational Safety: Southeast Florida Fatalities

With 239 reported fatalities in 2013 (the most recent data available), Florida is third in the United States for of occupational fatalities, behind Texas and California. Most occupational fatalities occurred in southeast Florida, with construction, transportation and warehousing, and administrative and waste services being the most accident-prone. Reported incidents in southeast Florida during 2013 include workers contacting overhead lines while working from an aerial lift basket, lightning strikes while working on a rooftop, and falling into and being crushed in an excavation along I-95 during an expansion project. (South Florida Council on OSHA, 2015)

As of May 2014, there were 17,540 telecommunication equipment installers and repairers, and 5,790 telecommunication line installation and repair workers (Figure 5.1.15-1) working in Florida (BLS, 2015c). In 2010, the most recent data available, Florida had 2.1 reportable cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were also 2.1 nonfatal occupational injuries or illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014a).

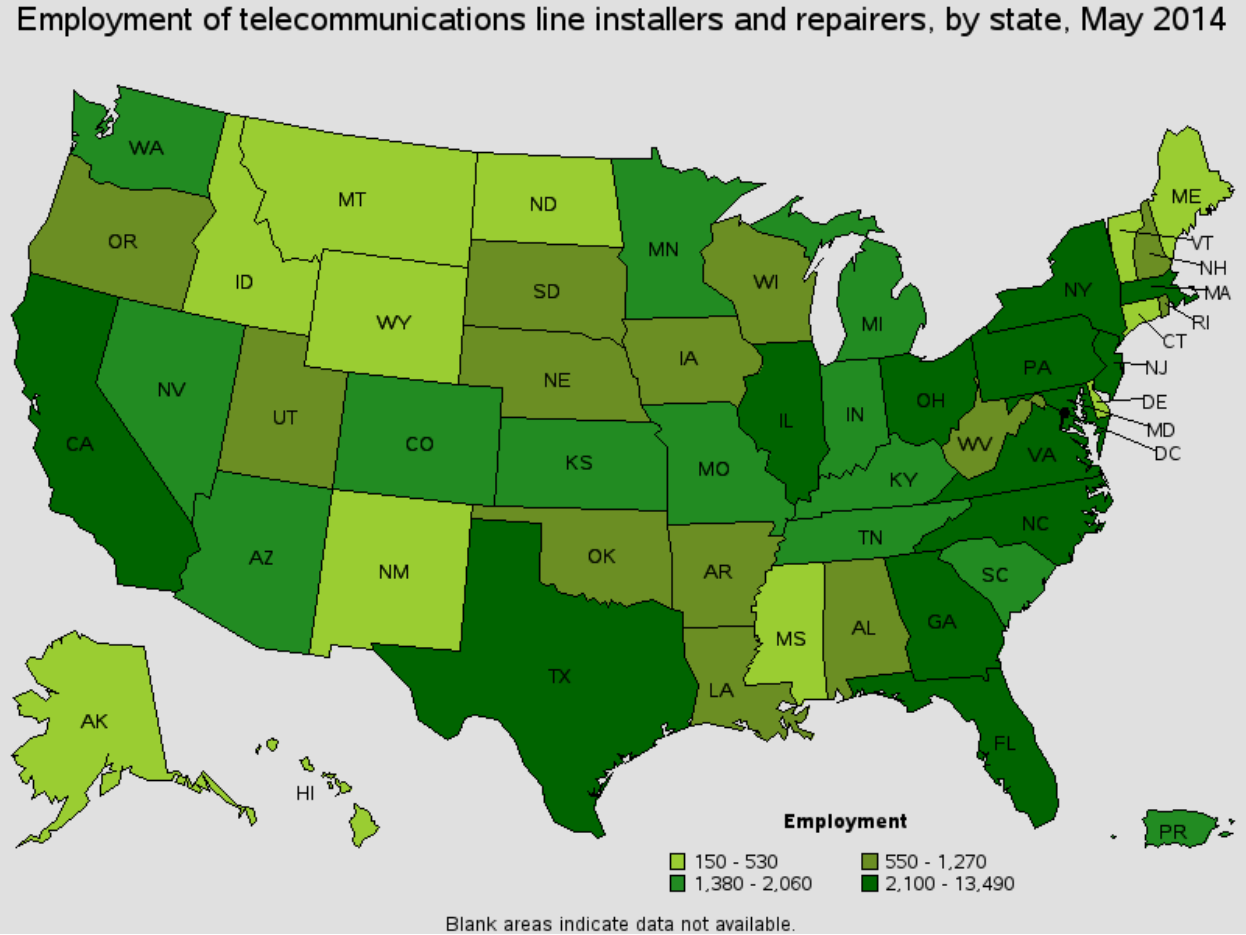


Figure 5.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015d)

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013b). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total).

Public Health and Safety

The public is unlikely to encounter occupational hazards at telecommunication sites, due to limited access. Environmental and public health data is reported at the federal level through the Centers for Disease Control (CDC) and Prevention Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, between 1999 and 2013, there were 506 fatalities due to a fall from, out of, or through a building or structure; 58 fatalities due to being caught, crushed, jammed or pinched in or between objects; and 144 fatalities due to exposure to electric

transmission lines (CDC, 2015). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

5.1.15.4. Environmental Setting: Contaminated Properties and Abandoned Mine Lands at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of site occupants at telecommunication sites, prior to creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[156] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

The DEP, Division of Waste Management, is responsible for the cleanup of sites contaminated with petroleum products, solvents, or hazardous wastes. The division has three program areas: Permitting and Compliance Assistance, Waste Cleanup, and Petroleum Restoration (DEP, 2015aa). Florida also has a State-Funded Cleanup Program to address sites where no responsible entity has been identified, and the site poses a hazard but does not qualify for federal Superfund (DEP, 2013). As of October 2015, Florida had 104 RCRA Corrective Action sites,[157] 1,211 brownfields, and 56 proposed or final Superfund/NPL sites (USEPA, 2015h). Based on an October 2015 search of USEPA's Cleanups in My Community (CIMC) database, two Superfund sites still exist in Florida where contamination has been detected at an unsafe level, or a reasonable human exposure risk exists (Tyndall AFB Range, and American Creosote Works Inc.) (USEPA, 2015i). The goals of Florida's Brownfield Redevelopment Program is to reduce public health hazards on abandoned sites, create financial and regulatory incentives for cleanup and redevelopment, and derive cleanup target levels for corrective action (DEP, 2015ab).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of

[156] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C, Environmental Laws and Regulations (USEPA, 2011).

[157] Data gathered using the USEPA's Cleanups in My Community (CIMC) search on October 1, 2015, for all sites in the State of Montana, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013b).

an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of September 2015, Florida had 627 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2013, the most recent data available, Florida generated 67.2 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the chemicals industry. This accounted for 1.64 percent of nationwide TRI releases, ranking Florida 21 of 56 states and territories (USEPA, 2015j).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 12, 2015, Florida had 231 major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015k).

The National Institutes of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (National Institutes of Health, 2015a). Figure 5.1.15-2 provides an overview of potentially hazardous sites in Florida.

In addition to hazardous waste contamination, another health and safety hazard in Florida includes surface mines. Health and safety hazards known to be present at active mines include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015a). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 5.1.3, Geology. Mining in the state of Florida primarily consists of large surface mining operations, and will generally have no adverse effect on telecommunication sites.

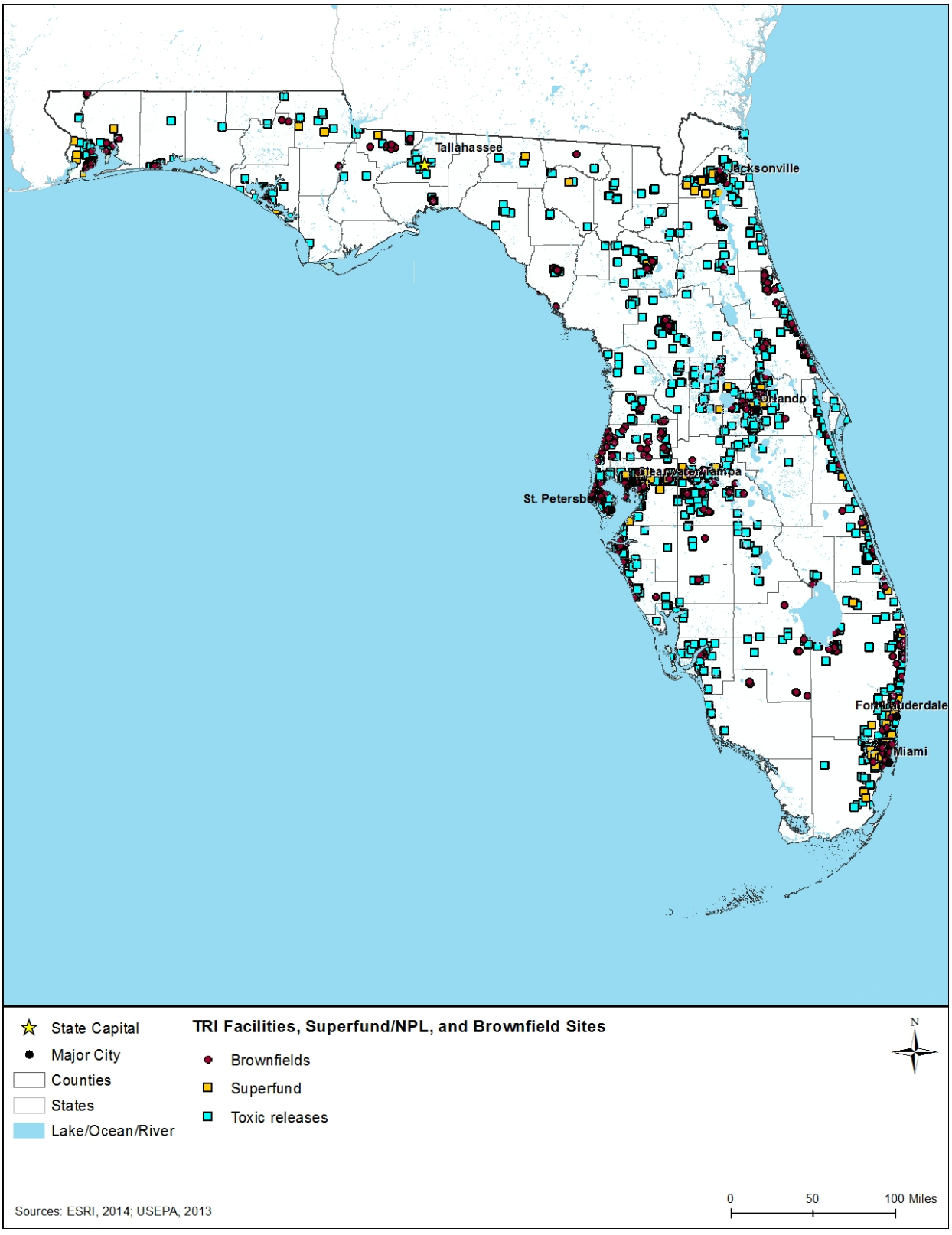


Figure 5.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Florida (2013)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of October 2015, there are 63 USEPA-regulated telecommunications sites in Florida. These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases (USEPA, 2015l).

According to BLS data, Florida had 8 fatal occupational injuries within the installation, maintenance, and repair occupations (SOC code 49-0000) resulting from "exposure to harmful substances or environments" in 2013, 5 in 2012, 10 in 2009, 6 in 2008, 4 in 2007, 5 in 2006, 8 in 2005, 3 in 2004, and 7 in 2003 (BLS, 2015e). However, none of these fatalities was specific to the telecommunications industry or telecommunications occupations. By comparison, the BLS reported three fatalities in 2011 and three[158] fatalities in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015f). In 2014, BLS also reported four fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (BLS, 2014b).

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. The FLDOH is responsible for collecting public health data resulting from exposure to hazardous substances, and provides publicly available health assessments and consultations for documented hazardous waste sites (FLDOH, 2015).

5.1.15.5. Environmental Setting: Natural & Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the general public. Telecommunications, including

[158] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data is expected to be released in spring 2016 (BLS, 2015g).

public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster in Florida is hurricanes. Hurricanes have the potential to cause widespread damage to transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Floodwaters caused by hurricanes are often contaminated by hazardous chemicals and sanitary wastes, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). Florida is in the path of many hurricanes, and experiences significant damage during a hurricane because of its flat topography and extensive coastal development. Another natural hazard in Florida is lightning strikes. According to NOAA, Florida reported the highest number of lightning fatalities (6) for any state, compared to 26 throughout the United States in 2014 (NOAA, 2015f).

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, or falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards might not have been fully identified or assessed. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response operations, their rescue and treatment might over-extend staff and medical facilities that are delivering care to victims of the initial incident.

Currently, FLDOH and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. Of the 899 NRC-reported incidents for Florida in 2015 with known causes, 15 incidents were attributed to natural disaster (e.g., flood, hurricane, tornado, or other natural phenomenon), while 884 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, suicide, transport accident, or trespasser) or other indeterminate causes (USCG, 2015). In Jacksonville, FL, for example, a transformer was damaged due to a lightning strike in August 2012, spilling transformer oil that flowed into stormwater control infrastructure (USCG, 2012). Such incidents present unique, hazardous challenges to telecommunication workers during natural and manmade disasters.

Spotlight on Florida Natural Disaster Sites: Hurricane Andrew

In 1992, Hurricane Andrew caused widespread infrastructure damage in Florida, with sustained winds of 145 miles per hour and a storm surge of greater than 14 feet (Figure 5.1.15-3). The storm destroyed 126,000 houses and caused $25B in damage to the electrical grids of Homestead and Florida City. Communications between the National Hurricane Center (NHC) in Miami and the Weather Service Offices (WSO) in Key West failed as the storm made landfall, and Key West was out of contact with the state and national Automation of Field Operations and Services (AFOS) office for two days. (NOAA, 2014g)

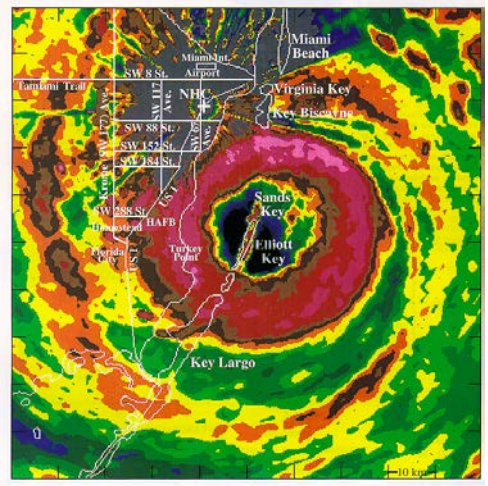


Figure 5.1.15-3: Radar Image of Hurricane Andrew over Miami

Source: (NOAA, 2014g)

In the aftermath of Hurricane Andrew, communications were disabled in affected areas. Frist responders and infrastructure restoration were hindered by many roadways were blocked with debris or washed out. Many local first responders were unable to mobilize after having experienced widespread damage to their own infrastructure, as well as staffing problems due to personal being unable to reach their work sites. Outside response teams were deployed, but they were often hindered by lack of unfamiliarity with affected areas, which further delayed response efforts. (CDC, 1992)

Public Health and Safety

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, Florida experienced 51 weather-related injuries and 20 fatalities (NWS, 2015b). By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year (NWS, 2015b).

5.2. ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews.

At the programmatic level, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action Alternative provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each Alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

5.2.1. Infrastructure

5.2.1.1. Introduction

This section describes potential impacts to infrastructure in Florida associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 16, Best Management Practices (BMPs) and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 5.2.1-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type,

including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

Table 5.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments).	Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments).	No effect on traffic congestion or delay, or transportation incidents.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Persisting indefinitely.		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase.	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the project activities.	Effect is potentially significant, but with mitigation is less than significant.	Minor delays to access to care and emergency services that do not impact health outcomes.	No impacts on access to care or emergency services.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Duration is constant during construction and deployment phase.		Rare event during construction and deployment phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities.	.Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in the ability to communicate with and between public safety entities.	No perceptible change in existing response times or the ability to communicate with and between public safety entities.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service.		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service.	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities.	Effect that is potentially significant, but with mitigation is less than significant.	Minor changes in level of service and communications while transitioning to the new system.	No perceptible effect to level of service or communications while transitioning to the new system.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service.		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems.	Effect that is potentially significant, but with mitigation is less than significant.	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services.	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase.		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase.	NA

NA = Not Applicable

5.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, railway companies, and harbormasters) to ensure proper coordination during deployment. The Florida Department of Transportation (FDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state, and would be the primary agency with which to coordinate.

Based on the impact significance criteria presented in Table 5.2.1-1, such impacts would be less than significant at the programmatic level due to the temporary nature of the construction activities, even if impacts would be realized at one or more isolated locations. These impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts at the programmatic level during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare, if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 5.2.1-1, potential negative impacts would be less than significant. at the programmatic level Substantial beneficial impacts are likely to result from implementation.

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a manner that directly affects Public Safety Communication Capabilities and Response Times

The Proposed Action and Alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 5.2.1-1, any potential impacts would be less than significant (at the programmatic level) during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus the infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known. Any negative impacts would be expected to be less than significant at the programmatic level given the short-term nature of the deployment activities.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial assets would be using a different spectrum for communications; as such, commercial telecommunication systems, communications, or level of service would experience no impacts. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized. [159] Additionally, Florida has over 4,400 commercial towers and FirstNet may be able to lease or leverage such assets for public safety use. Anticipated impacts would be less than significant at the programmatic level due to the limited extent and temporary nature of deployment.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The activities proposed by FirstNet would have less than significant impacts (at the programmatic level) on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on

[159] Telecommunications equipment for specific spectrum use can be built where other equipment for other spectrum use already exists. If the new equipment and spectrum is not fully utilized, the geographic region may experience "over-build," where an abundance of under-utilized equipment may exist in that geographic location. This situation can be caused by a variety of factors including changes in current and future use patterns, changes in spectrum allocation, changes in laws and regulations, and other factors.

a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States. The Florida Public Service Commission regulates water utilities and electricity utilities, while the Florida Department of Environmental Protection (DEP) manages solid waste; coordination with these state agencies may be necessary depending on the project-specific implementation plans.

5.2.1.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any

impacts to infrastructure resources, given that construction activities would occur on existing structures, and would not be expected to interfere with existing equipment. Transportation capacity and safety, and access to emergency services would not be impacted.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs),[160] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase; however, it is anticipated that this tie-in would cause less than significant impacts at the programmatic level as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new, or replacement of existing, telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable, depending on the exact site location and proximity to existing infrastructure.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation

[160] Points of Presence are connections or access points between two different networks, or different components of one network.

corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and tower site such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site-specific plans.
  - Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are composed of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be utilized but launched from existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new

telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant at the programmatic level as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts at the programmatic level to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts at the programmatic level would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

5.2.2. Soils

5.2.2.1. Introduction

This section describes potential impacts to soil resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 5.2.2-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

Table 5.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years.		Isolated, temporary, or short-term erosion that that is reversed over few months or less.	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal mixing of the topsoil and subsoil layers has occurred.	No perceptible evidence that the topsoil and subsoil layers have been mixed.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible compaction and rutting in comparison to baseline conditions.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years.		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less.	No perceptible change in baseline conditions.

NA = Not Applicable

5.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern for nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Florida and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Most soil types that occur in Florida are poorly drained and have a medium to high potential for erosion. Those soil types include Alfisols, Entisols, Inceptisols, Spodosols, Mollisols, Ultisols, and Histosolos, (see Section 5.1.2.4, Soil Suborders and Figure 5.1.2-2).

Based on the impact significance criteria presented in Table 5.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant at the programmatic level given the short-term and temporary duration of the activities.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures, where practicable and feasible, to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 16).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 5.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites, as well as the implementation of BMPs and mitigation measures (Chapter 16), minimal topsoil mixing is anticipated.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 5.1.2.4, Soil Suborders). The most compaction susceptible soils in Florida are Aqualfs, Aquents, Aquepts, Aquods, Aquolls, Aquults, Hemists, and Saprists, as they are mostly hydric soils with poor drainage conditions. These soils are found throughout Florida (see Figure 5.1.2-2). The

potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 5.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant at the programmatic level, due to the extent of susceptible soils in the state.

5.2.2.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of proposed action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to soil resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras, would not impact soil resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shores or the banks of waterbodies that accept the submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant at the programmatic level as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant at the programmatic level due to the temporary nature and small-scale of operations activities with the potential to create impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources at the programmatic level, regardless of whether the deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved

areas. However, these potential impacts are expected to be less than significant at the programmatic level due to the small-scale and short term nature of the deployment. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant impacts (at the programmatic level) associated with soil compaction and rutting could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts at the programmatic level as described above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.2, Soils.

5.2.3. Geology

5.2.3.1. Introduction

This section describes potential impacts to Florida geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 5.2.3-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with

mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

Table 5.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Seismic Hazard	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault.	No likelihood of a project activity being located in an earthquake hazard zone or active fault.
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory.		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable.	Earthquake hazard zones or active faults do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Volcanic Activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located near a volcanic ash area of influence.	No likelihood of a project activity located within a volcano hazard zone.
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory.		Volcano ash areas of influence occur within the state/territory, but may be avoidable.	Volcano hazard zones do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within a landslide area.	No likelihood of a project activity located within a landslide hazard area.
	Geographic Extent	Landslide areas are highly prevalent within the state/territory.		Landslide areas occur within the state/territory, but may be avoidable.	Landslide hazard areas do not occur within the state/territory.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain).	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an area with a hazard for subsidence.	Project activity located outside an area with a hazard for subsidence.
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory.		Areas with a high hazard for subsidence occur within the state/territory, but may be avoidable.	Areas with a high hazard for subsidence do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Potential Mineral and Fossil Fuel Resource Impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to mineral and/or fossil resources.	No perceptible change in mineral and/or fossil fuel resources.
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory.		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable.	Mineral or fossil fuel extraction areas do not occur within the state/territory.
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources.		Temporary degradation or depletion of mineral and fossil fuel resources.	NA
Potential Paleontological	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to paleontological and/or fossil resources.	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Resources Impacts	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is potentially significant, but with mitigation is less than significant.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory.		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA = Not Applicable

5.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence and effects on mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

A concern related to deployment is placement of equipment in highly active seismic zones. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. As discussed in Section 5.1.3.8, the state of Florida is not at risk for significant earthquake events. As shown in Figure 5.1.3-5, the areas of greatest seismicity in Florida are concentrated in the northeast and western portion of the Florida Panhandle. Based on the impact significance criteria presented in Table 5.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor earthquakes in parts of Florida, some amount of infrastructure may be subject to earthquake hazards. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for Florida, as they do not occur in the state; therefore, volcanoes do not present a hazard to the state.

Landslides

Similar to seismic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 5.1.3.8, landslides are uncommon in Florida, and the majority of Florida is at low risk of experiencing landslide events. Based on the impact significance criteria presented in Table 5.2.3-1, potential impacts to landslide potential from deployment or operation of the Proposed Action would have less than significant impacts at the programmatic level as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures

that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Land Subsidence

Equipment that is exposed to land subsidence, such as sinkholes created by karst topography is subject to misalignment, alteration, or, in extreme cases, destruction. Significant long-term land subsidence, due to factors such as aquifer compaction, in coastal areas could lead to relative sea level rise[161] and inundation of equipment. All of these activities could result in connectivity loss.

As discussed in Section 5.1.3.8, portions of Florida are vulnerable to land subsidence due to sinkholes and the presence of limestone bedrock, which could slowly dissolve under natural conditions. Based on the impact significance criteria presented in Table 5.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impact at the programmatic level s; however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to sinkholes or limestone bedrock. To the extent practicable, FirstNet would avoid deployment in known areas of historic sinkholes, or that are subject to sea level rise. However, given that sinkholes and limestone bedrock occur in many counties throughout the state, especially on the Gulf side, some amount of infrastructure may be subject to subsidence hazards, in which case BMPs and mitigation measures would help avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources is not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 5.2.3-1, impacts to mineral and fossil fuel resources is unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 5.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological

[161] Relative Sea Level Rise: "[Sea level rise that] includes the combined movement of both water and land. Even if sea level was constant, there could be changes in relative sea level. For example, a rising land surface would produce a relative fall in sea level, whereas a sinking land surface would produce a relative rise in sea level." (USGS, 2015f)

resources during construction activities. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to paleontological resources should be considered on a site-by-site basis, and BMPs and mitigation measures could further help avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 5.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and be less than significant at the programmatic level as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures could be implemented to help avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.3.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if the additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. Where

equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could result in incidental removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet Proposed Actions are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale. As a result, these potential impacts are expected to be less than significant. at the programmatic level For that same reason, impacts at the programmatic level to deployment from geologic hazards are likely to be less than significant as well. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant at the programmatic level as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.3.5. Alternatives Impact Assessment

The following section assesses potential impacts to geology associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to geology as a result of implementation of this Alternative could be as described below.

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant at the programmatic level due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative because there would be no ground disturbance.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant at the programmatic level as the deployment would be temporary and likely would attempt to avoid locations that were subject to increased seismic activity, landslides, and land subsidence. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.3, Geology.

5.2.4. Water Resources

5.2.4.1. Introduction

This section describes potential impacts to water resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 5.2.4-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 5.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) – sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation[a]	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

[a] Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690). (See http://www.archives.gov/federal-register/codification/executive-order/11988.html and https://www.federalregister.gov/articles/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and).
NA = Not Applicable

5.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 503(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Most of Florida's assessed rivers, streams, estuaries, bays, lakes, reservoirs, ponds, and coastal shoreline are impaired (see Table 5.1.4-2, Figure 5.1.4-4). Most of these waterbodies are impaired by dissolved oxygen, mercury in fish tissue, nutrients, turbidity, and pathogens. Groundwater quality within the state is generally good.

Deployment activities could contribute pollutants in a number of ways but the primary likely manner is increased sediment in surface waters. Vegetation removal onsite exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a State or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, Safe Drinking Water Act), and local regulations, cause a threat to the human environment,

biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality. Therefore, based on the impact significance criteria presented in Table 5.2.4-1, water quality impacts would likely be less than significant at the programmatic level, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[162] or tower construction were to occur near or below the existing water table (depth to water), then dewatering would be anticipated at the location. Residual contaminated groundwater could be encountered during dewatering activities. Construction activities would need to comply with Florida dewatering requirements. Any groundwater extracted during dewatering activities, or subject to the terms of a dewatering permit, may be required to be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most Florida aquifers, there is potential for groundwater contamination within a watershed or multiple watersheds. It is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 5.2.4-1, there would likely be less than significant impacts at the programmatic level on groundwater quality within most of the state. In areas where groundwater is close to the surface, site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on human beings, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 5.2.4-1, floodplain degradation impacts would be potentially less than significant at the programmatic level since the majority of FirstNet's deployment, on the watershed or subwatershed level, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency.

[162] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

Additionally, any effects would be temporary, lasting no more than one season or water year[163], or occur only during an emergency.

Examples of activities that would have less than significant impacts at the programmatic level include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations;
- Land uses that include pervious surfaces such as gravel parking lots;
- Land uses that do not change the flow of water or drainage patterns; and
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures could reduce the risk of additional impacts to floodplain degradation (see Chapter 16).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could changes drainage patterns. Storm water runoff causes erosion while construction activities and land clearing could change drainage patterns. Clearing or grading activities, or the creation of walls or berms could alter water flow in an area or cause changes to drainage patterns. Drainage could be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns could be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 5.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant at the programmatic level.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained onsite and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be less than significant at the programmatic level. BMPs and mitigation measures could be implemented to further reduce any potentially significant impacts.

[163] A water year is defined as "the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months" (USGS, 2016b).

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals could alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow could increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 5.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations;
- Land uses that are maintaining or increasing pervious surfaces;
- Land uses that do not change the flow of water or drainage patterns offsite or into surface water bodies that have not received that volume of stormwater previously; and
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant at the programmatic level to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 5.1.4.7, Groundwater, the majority of Florida's drinking water (approximately 90 percent) is provided by productive aquifers, serving over 19 million residents with potable water. Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Generally, the water quality of Florida's aquifers is suitable for drinking and daily water needs. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would be unlikely to cause significant impacts to water quality due to the expected small volume of these materials. Activities that may cause changes in groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant at the programmatic level since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. It is likely that areas that utilize groundwater for potable water purposes, would be avoided.. According to Table 5.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.4.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to water resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit

points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be

expected to impact water resources or the overall amount of runoff and nonpoint pollution.

- Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in direct and indirect impacts to water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance.
  - Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and

deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant at the programmatic level due to the small-scale of individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant at the programmatic level due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.4.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Therefore, potential impacts to water resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts at the programmatic level to water resources if these activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving; however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up, and therefore would have less than significant impacts at the programmatic level. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be no impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies; however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. at the programmatic level Site maintenance, including mowing or herbicides, may result in less than significant effects at the programmatic level to water quality, due to the small-scale of expected FirstNet activities in any particular location. In

addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.4, Water Resources.

5.2.5. Wetlands

5.2.5.1. Introduction

This section describes potential impacts to wetlands in Florida associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 5.2.5-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

Table 5.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMP and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude[a] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 504 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMP and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect Effects: [b] Change in Function(s)[c] Change in Wetland Type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands.
[b] Indirect Effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.
[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.
NA= Not Applicable

5.2.5.3. Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet, and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 16).

There are approximately 11.4 million acres of wetlands in Florida and wetland habitat makes up approximately 29 percent of the state, more than any other state in the continental U.S. The wetlands are composed of freshwater wetlands (90 percent) and marine and estuarine intertidal wetlands (10 percent). Florida is predominately palustrine wetlands, while estuarine/marine wetlands are found in the eastern and southern portion of the state and along the coast, as shown in Section 5.1.5, Wetlands, Figure 5.1.5-1, Figure 5.1.5-2, and Figure 5.1.5-3.

Based on the impact significance criteria presented in Table 5.2.5-1, the deployment activities would most likely have less than significant direct impacts (at the programmatic level) on wetlands. Additionally, the deployment activities would be unlikely to violate applicable federal, state, or local regulations.

In Florida, as discussed Section 5.1.5, Wetlands, regulated high quality wetlands include seepage wetlands, such as bay heads, bay swamps, hydric hammocks, and flood-plain seepage swamps, found in central Florida; the Florida Everglades, located in southern Florida, which are one of the largest wetlands in the world and are made up of several wetland types, including mangrove swamps, cypress domes, marshes, and estuarine wetlands; the Lake Okeechobee watershed; and other important wetland sites including Wildlife Management Areas, National Natural Landmarks, and other wetlands protected under easements or agreements through voluntary

government programs and resource conservation groups. Further information about these wetlands and special protections can be found in Section 5.1.5.4, Wetlands of Special Concern or Value. If any of the proposed deployment activities were to occur in these high-quality wetlands, potentially significant impacts could occur. High-quality wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Other Direct Effects

Other direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, other direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 5.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to high- and low-quality wetlands would be less than significant at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Examples of activities that could have other direct effects to wetlands in Florida include:

- *Vegetation Clearing:* removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance:* Increased amounts of stormwater runoff in wetlands could alter water level response times, depths, and duration of water detention. Reduction of watershed

infiltration capacity could cause wetland water depths to rise more rapidly following storm events.

- *Direct Hydrologic Changes (flooding or draining):* Greater frequency and duration of flooding could destroy native plant communities, as could depriving them of their water supply. Hydrologic changes could make a wetland more vulnerable to pollution. Increased water depths or flooding frequency could distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.
- *Direct Soil Changes:* Changes in soil chemistry could lead to degradation of wetlands that have a specific pH range and/or other parameters.
- *Water Quality Degradation (spills or sedimentation):* The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) could reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff could interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[164] Change in Function(s)[165] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures, as practicable and feasible (see Chapter 16).

Examples of functions related to wetlands in Florida that could potentially be impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they could lower flood peaks by providing detention of storm flows. Correspondingly,

[164] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.

[165] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

disturbance of wetlands (e.g., dredging or filling) could proportionately reduce water storage function.

- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils could eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 5.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant at the programmatic level. In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations would be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

      Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if the additional

power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur. Implementing BMPs and mitigation measures could reduce impact intensity.

- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, blimps, or piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected. These impacts are expected to be less than significant at the programmatic level due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

It is anticipated that there would be less than significant impacts to wetlands at the programmatic level associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility rights-of-way would be utilized for maintenance and inspection

activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands, due to the limited nature of site maintenance activities, including mowing and application of herbicides. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.5, Wetlands.

5.2.6. Biological Resources

5.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Florida associated with deployment and operation of the Proposed Action and its Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.6.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 5.2.6-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 5.2.6.3, 5.2.6.4, and 5.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 5.2.6.6 for impact assessment methodology and significance criteria associated with threatened and endangered species in Florida.

Table 5.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within Florida for at least one species. Anthropogenic[a] disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within Florida for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics, or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within Florida for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience, and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed within Florida for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within Florida for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning or stress, abandonment and loss of productivity for endemics, or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Florida.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

[a] Anthropogenic: "Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities" (USEPA, 2016d).

NA = Not Applicable

5.2.6.3. Terrestrial Vegetation

Potential impacts to terrestrial vegetation occurring in Florida are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 5.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale and therefore would have less than significant impacts at the programmatic level. The implementation of BMPs and mitigation measures and avoidance measures could help to minimize or altogether avoid potential impacts to plant population survival. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the potential impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat. Areas along the Atlantic coast and Gulf of Mexico coast have experienced extensive land use changes from urbanization, while central Florida has experienced extensive land use changes from agriculture. However, a large portion of the state remains relatively unfragmented, particularly in the Everglades, Apalachicola National Forest, Tate's Hell State Forest, and Ocala National Forest regions.

Construction of new infrastructure and long-term facility maintenance could result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. In general, these impacts are expected to be less than significant at the programmatic level due to the short-term, localized nature of the deployment activities. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures could be recommended and consultation with appropriate resource agencies, if required, could be undertaken to minimize or avoid potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Indirect Injury/Mortality

Indirect effects are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment. Overall, these impacts are expected to be less than significant at the programmatic level due to the short-term and small-scale nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action, given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action, given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species could have a dramatic effect on natural resources and biodiversity. According to the Florida Statutes (Chapter 581, Section 083), "The introduction into or release within this state of any plant pest, noxious weed, genetically engineered plant or plant pest, or any other organism which may directly or indirectly affect the plant life of this state as an injurious pest, parasite, or predator of other organisms, or any arthropod, is prohibited, except under special permit issued by the department through the division, which shall be the sole issuing agency for such special permits" (The Florida Senate, 2012).

As described in Section 5.1.6.4, when non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. The Florida Department of Agriculture and Consumer Services (FDACS) maintains a list of 78 noxious weeds (referred to as the "Noxious Weeds and Invasive Plants List") (FDOS, 2013). Even if native species are not completely eliminated, the ecosystem often becomes much less diverse (USFWS, 2012a). The potential to introduce invasive plants within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities

are complete. Overall, these impacts are expected to be less than significant at the programmatic level due to the small-scale and localized nature of likely FirstNet activities. BMPs could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts at the programmatic level, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology,[166] and the nature as well as the extent of the habitats affected. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to terrestrial vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.

[166] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
    - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
    - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment

use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, vegetation loss, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to terrestrial vegetation. However, if the additional power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.

    Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general, the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. Despite the variability, these potential impacts are expected to be less than significant at the programmatic level due to the small scale and limited geographic scope of expected deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet

and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. Site maintenance, including mowing or herbicides, may result in less than significant effects at the programmatic level due to the small-scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however, impacts are expected to be less than significant at the programmatic level due to the small-scale of expected activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to terrestrial vegetation as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts at the programmatic level from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. Nonetheless, impacts are expected to remain less than significant at the programmatic level due to the relatively small-scale of FirstNet activities at individual locations. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. The impacts could vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant at the programmatic level. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts at the programmatic level to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.3, Terrestrial Vegetation.

5.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Florida and Florida's near offshore environment (i.e., less than two miles from the edge of the coast) are discussed in this section. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common

direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 5.2.6-1, less than significant impacts would be anticipated at the programmatic level given that the majority of the proposed deployment activities are likely to be small-scale and would be dependent on the location and type of deployment activity. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed; therefore, impacts are generally expected to be less than significant at the programmatic level, as discussed further below. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Florida. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, foraging, and migration (FHWA, 2009). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

For example, if bats, and particularly maternity colonies, are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species. Generally, collision events occur to night-migrating birds, “poor” fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (FAA, 2012b) (Gehring, Kerlinger, & Manville, 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

Direct mortality and injury to birds of Florida are not likely to be widespread or affect populations of species as a whole; individual impacts may be realized depending on the location and type of the deployment activity. Direct injury/mortality is not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 16), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures, as defined through consultation with USFWS.

Reptiles and Amphibians

Some reptile and amphibian species are distributed throughout Florida (e.g., southern leopard frog), while others are highly localized species that occur only in specific environments or areas of the state (Fletcher, 2012). Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these effects are expected to be temporary and isolated, affecting only individual animals.

Five species of marine turtles – four listed as threatened or endangered under the ESA – occur in Florida's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 5.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invertebrates

The terrestrial and aquatic invertebrate populations of Florida are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

As described in Section 5.2.6.3, habitat loss could occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the

Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

In general, potential effects of vegetation and habitat loss, alteration, or fragmentation are expected to be less than significant at the programmatic level because of the small-scale nature and limited geographic scope of expected deployment activities. These potential impacts are described for Florida's wildlife species below. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Florida and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear, Florida panther) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., bats, foxes) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures (see Chapter 16).

Marine Mammals

While there are several species of dolphins that occur in Florida's coastal waters, the bottlenose dolphin is the most common and can be observed in Florida's estuaries and coastal ocean waters (FWC, 2015x). Manatees live in Florida's rivers and coastal waters, easily moving from fresh to estuarine to marine environments (FWC, 2015x). In addition, there are several species of whales that can be observed off the coast of Florida, including finback whales, humpback whales, and North Atlantic right whales (FWC, 2015x). Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving (USFWS, 2001a). Manatees could be temporarily excluded from a resource due to the presence of humans, noise, or vessel traffic during deployment activities. Effects on manatees from exclusion from resources would be low magnitude and temporary in duration.

Loss of habitat or exclusions from these areas for dolphins, manatees, and whales could potentially be avoided or minimized through implementation of BMPs and mitigation measures (see Chapter 16). Environmental consequences pertaining to the endangered whales and West Indian manatee protected under the ESA are discussed in Section 5.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the Florida FWC provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could affect avian species directly by loss of nesting, foraging, stopover, and cover habitats.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[167] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Florida's amphibians and reptiles typically consist of wetlands and, in some cases as with the timber rattlesnake, the surrounding upland forest. Impacts are expected to be less than significant at the programmatic level given the short-term nature and limited geographic scope of individual activities. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 16) could be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 5.1.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Florida's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[168]

Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Given that the majority of FirstNet deployment activities are not expected to be located in aquatic environments, less than significant impacts to no impacts at the programmatic level would be anticipated for aquatic invertebrates. Impacts to sensitive invertebrate species are discussed below in Section 5.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment. Overall, impacts are expected to remain less than significant at the programmatic level due to the short-term nature and limited geographic scope of expected activities, though

[167] Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.
[168] See Section 5.2.5, Wetlands, for a discussion of BMPs for wetlands.

BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would be unlikely to occur.

Marine Mammals

Repeated disturbance (e.g., from vessel traffic) could cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not expected to be located offshore or in the oceanic environment, less than significant impacts to no impacts at the programmatic level would be anticipated for marine mammals.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would be unlikely to occur.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts. at the programmatic level.

Invertebrates

Terrestrial invertebrates could experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of terrestrial invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant. at the programmatic level. Given that the majority of FirstNet deployment activities are not expected to be located in aquatic environments, less than significant impacts to no impacts at the programmatic level would be anticipated for aquatic invertebrates.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Overall, potential impacts are anticipated to be less than significant at the programmatic level due to the small-scale and localized nature of expected activities, which would be unlikely to result in long-term avoidance. Potential effects to migration patterns of Florida's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and invertebrates are described below. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Some large mammals (e.g., black bears) will perform short seasonal migrations between foraging/breeding habitats and denning habitats. Some small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[169]

Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Florida could impact marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds.[170] Marine mammals have the capacity to divert from sound sources during migration, and therefore impacts are expected to be less than significant at the programmatic level since noise generating activities would be of short duration and are not likely to result in long-term avoidance. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over great distances often involving many different countries. For example, as a group, shorebirds migrating through Florida undertake some of the longest distance migrations of all animals. Florida is located within the Atlantic Flyway, which

[169] A location chosen by an animal for hibernation.

[170] Level A: 190 dB re 1µPa (rms) for seals and 180 dB re 1µPa (rms) for whales, dolphins, and porpoises. It is the minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss. Level B: 160 dB re 1µPa (rms). It is defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing. (Southall, et al., 2007)

spans more than 3,000 miles from the Arctic tundra to the Caribbean. Florida has 100 IBAs throughout the state serving as important stopover, breeding, and wintering areas for migratory birds (NAS, 2011). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, but impacts are expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate in Florida. Post-metamorphic salamanders, such as the frosted flatwoods salamander, migrate out of the ponds where they were born and into the uplands where they live until they move back to ponds to breed as adults (USFWS, 2009a). Gopher frogs inhabit burrows in upland habitats. During breeding season, the gopher frog will travel a mile or more to breed and lay eggs in temporary ponds (FWC, 2015c). Mortality and barriers to movement could occur as result of the Proposed Action (Berven & Grudzien, 1990) (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but impacts are expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Florida's invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Overall, potential impacts are anticipated to be less than significant at the programmatic level due to the short-term and limited nature of expected activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as the Florida black bear, has the potential to negatively affect body condition and reproductive success of mammals in Florida. For example, pregnant Florida black bears use certain types of habitats that allow for more effective defense of their cubs from predators (FWC, 2015d).

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant at the programmatic level. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Marine Mammals

Marine mammals return to their calving grounds annually for reproductive success. Although unlikely, the displacement of female manatees from preferred calving habitats, may reduce fitness and survival of calves potentially affecting overall productivity. However, activities are likely to be small-scale in nature and contribute only minimally to minor, short-term displacement. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Disturbance to marine mammals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale. Applicable BMPs and mitigation measures as defined through consultation with USFWS for MBTA or BGEPA, if required, could help to avoid or minimize any potential impacts. Environmental consequences pertaining to federally listed species will be discussed in Section 5.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the loggerhead sea turtle leaves its breeding habitat in the coastal waters of the Atlantic and travels to nesting sites on sand beaches along the Atlantic coast.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, or alter water quality through sediment infiltration or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; therefore, no reproductive effects to invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. Florida has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select wildlife species. According to the Florida Administrative Code ([F.A.C.] Chapter 68-5), "No person shall transport into the state, introduce, or possess, for any purpose that might reasonably be expected to result in liberation into the state, any freshwater fish, aquatic invertebrate, marine plant, marine animal, or wild animal life not native to the state, without having secured a permit from the [FWC].[171]"

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites; although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, potential impacts are expected to be less than significant at the programmatic level.

Potential invasive species effects to Florida's wildlife are described below.

Terrestrial Mammals

In Florida, wild hogs adversely impact several native large and small mammals, including turkey, squirrels, and deer (USIFAS, 2013). They feed on young mammals, destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to protect sites from other locations.

Marine Mammals

Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited.

Birds

In Florida, invasive pest species such as European starlings could impact native birds by aggressively competing for tree cavities (FWC, 2015r). FirstNet deployment activities could

[171] The following species are exempt: fathead minnow, variable platy, coturnix quail, ring-necked pheasant (State of Florida 2008).

result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities from machinery or construction workers.

Reptiles and Amphibians

In Florida, the Burmese python and Cuban tree frog are invasive species that are known to frequently prey on native species and compete with native species for food and habitat (FWC, 2015e) (FWC, 2015f). Although FirstNet deployment activities could result in short-term or temporary changes to specific project sites, these sites are expected to return to their natural state in a year or two. Additionally, invasive reptile or amphibian species are not expected to be introduced at project sites as part of the deployment activities.

Invertebrates

Invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific food sources on which they depend. Effects from invasive plant species to terrestrial and aquatic invertebrates would be similar to those described for habitat loss and degradation. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native aquatic species would be limited.

Invasive insects could pose a threat to Florida's forest and agricultural resources. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive terrestrial invertebrate species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts at the programmatic level, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected. Chapter 16, BMPS and

Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to wildlife resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.

      Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to

avoid construction activities (e.g., reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individuals as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
- New Build – Submarine Fiber Optic Plant: The installation of cables in nearshore or inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could potentially impact wildlife, marine mammals in particular (see Section 5.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless

towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if additional power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

  Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to wildlife on roadways from vehicular movement. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. For a discussion of radio frequency emissions, refer to Section 2.4, RF Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant at the programmatic level given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore expected to remain less than significant at the programmatic level. Proposed FirstNet actions at some individual sites may have a higher level of impacts due to location-specific conditions, and therefore those proposed activities would undergo site-specific environmental review. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would

result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources at the programmatic level associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, and may result in less than significant effects to wildlife at the programmatic level, including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides. Potential spills of these materials would be expected to be in small quantities.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individuals and unlikely to cause population-level impacts, and therefore would likely be less than significant at the programmatic level given the short-term nature and limited geographic scope for individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Therefore, potential impacts to wildlife resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts at the programmatic level from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant at the programmatic level because deployment activities are expected to be temporary and localized, likely affecting only a small number of wildlife. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts at the programmatic level because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. Proposed FirstNet actions at specific individual sites may have a higher level of impacts due to location-specific conditions, and therefore those proposed activities would undergo site-specific environmental review. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.4, Terrestrial Wildlife.

5.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Florida and its near offshore environment are discussed in this section. Chapter 16, BMPS and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Description of Environmental Concerns

Direct Injury/Mortality

The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012e).

Based on the impact significance criteria presented in Table 5.2.6-1, less than significant impacts would be anticipated at the programmatic level given that the majority of proposed deployment activities are likely to be small-scale and would be dependent on the location and type of deployment activity. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Therefore, potential impacts are expected to be less than significant at the programmatic level. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats could be addressed through BMPs and mitigation measures as defined through consultation with the appropriate resource agency.

Indirect Injury/Mortality

Erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could have potential impacts on water quality. Exposure to contaminants from accidental spills from vehicles and equipment could also potentially affect water quality. These potential effects could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. Nonetheless, these impacts are expected to be less than significant at the programmatic level due to the short-term nature and limited geographic scope of deployment activities. BMPs and mitigation measures to protect water resources (see Chapter 16) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts would vary depending on the species, time of year, and duration of deployment, but would be localized and at a small-scale, and therefore are expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are not anticipated, and therefore impacts are expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to further avoid or minimize any potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones could occur from vessels and equipment being transported from one region to another. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore impacts are expected to be less than significant at the programmatic level. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the

ecoregion, the species' phenology, and the nature and extent of the habitats affected. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to fisheries and aquatic habitats would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential /deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other

associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if additional power units, replacement towers, structural hardening, physical

security measures require ground disturbance, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, RF Emissions.

Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant at the programmatic level due to the small-scale and localized nature of deployment activities that have the potential to impact aquatic habitats. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated, at the programmatic level, that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance activities that might include accidental spills from maintenance equipment or pesticide runoff near fish habitat are anticipated to result in less than significant effects to fisheries and aquatic habitats at the programmatic level due to the limited nature of such activities and the likely small quantities of potentially harmful liquids used.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition,

the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant at the programmatic level due to the small-scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small-scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts at the programmatic level from habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the District. However, impacts are expected to remain less than significant at the programmatic level due to the limited nature of expected deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, the impacts could vary greatly among species and geographic region. Nonetheless, it is anticipated that there would be less than significant at the programmatic level impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.5, Fisheries and Aquatic Habitats.

5.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Florida and Florida's offshore environment associated with deployment and operation of the Proposed Action and Alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 5.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Table 5.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 5.2.6-2, any direct injury or mortality of a listed species at the individual-level, as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency, may affect and likely adversely affect a listed species. Direct injury/mortality environmental concerns pertaining to federally listed mammals, birds, reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Florida are described below. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Mammals

Sixteen federally listed mammal species (15 endangered and one threatened) are known to occur in the state of Florida. Direct mortality or injury to the six federally listed mice could occur from vehicles strikes or trampling due to increased traffic near the beaches and sand dunes these mice inhabit. Direct mortality or injury to the Florida salt marsh vole could occur from trampling due to increased foot traffic in their coastal habitat. Impacts to these species would likely be isolated, individual events.

Direct mortality or injury to the Key Largo woodrat or the silver rice rat could occur if domestic cats or black rats were accidentally introduced to the habitats where these species are found. Introductions of black rats and domestic cats are unlikely to occur as a result of the Proposed Action in Florida.

Direct mortality or injury to the federally listed Florida bonneted bat could occur if tree clearing activities occurred at roosting sites and bats were present (USFWS, 2015q). Direct mortality or injury to the federally listed gray bat could occur if caves were flooded or blocked off and bats were present (USFWS, 1997b) While projects would not likely directly affect winter roosting habitats, human disturbance in and around these sites when bats are present could lead to adverse effects to these species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015q).

Direct mortality or injury to the Lower Keys marsh rabbit, key deer, Florida panther, or red wolf could occur from vehicle strikes as these species are occasionally found along transportation corridors. Entanglement in fences or other barriers could also be a source of mortality or injury to this species. Overall, impacts would likely be isolated, individual events and therefore may affect, but are not likely to adversely affect, a listed species.

The West Indian manatee often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving (USFWS, 2001a). Direct mortality or injury to the West Indian manatee could occur through entanglements from debris in their aquatic habitats as well as ingestion of debris, but are unlikely due to the limited nature of expected FirstNet activities in a marine environment. Impacts would likely be isolated, individual events, and therefore may affect, but are not likely to adversely affect, a listed species.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Birds

Twelve federally listed bird species (six endangered and six threatened) are known to occur within coastal areas of Florida; they are the Audubon's crested caracara, Bachman's warbler, Cape Sable seaside sparrow, Everglade snail kite, Florida grasshopper sparrow, Florida scrub-jay, Kirkland's warbler, piping plover, red knot, red-cockaded woodpecker, roseate tern, and wood stork. Depending on the project type and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. However, these potential impacts may affect, but are not likely to adversely affect, listed species as FirstNet would attempt to avoid deployment activities in these areas. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Fish

Three federally listed fish species (one endangered and two threatened) are known to occur in the state of Florida. The Gulf sturgeon and the smalltooth sawfish live within coastal and offshore environments of Florida. Direct mortality or injury to these species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action, but are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. The Okaloosa darter is known to occur in streams fed by groundwater within Walton and Okaloosa Counties. This species is unlikely to be affected by the Proposed Action, as the majority of FirstNet deployment projects would not occur in the aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Two federally listed amphibian species (one endangered and one threatened) are known to occur in the state of Florida; they are the frosted flatwoods salamander and the reticulated flatwoods salamander. Direct mortality to these species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events, and FirstNet would attempt to avoid areas where these species may occur. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species.

There are 10 federally listed reptile species (four endangered and six threatened) that are known to occur in the state of Florida. Examples include the American crocodile, Atlantic salt marsh snake, bluetail mole skink, eastern indigo snake, and sand skink. Direct mortality to these species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events; therefore, potential impacts may affect, but are not likely to adversely affect, listed species.

The five federally listed sea turtles known to occur in the coastal area and offshore environment of Florida are the hawksbill sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, green sea turtle, and loggerhead sea turtle. The hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle are known to nest in Florida. Direct mortality or injury could occur from watercraft and vessels strikes, but are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Twenty-two federally listed invertebrate species (12 endangered and 10 threatened) are known to occur in the state of Florida, as summarized in Table 5.1.6-9. These include 14 mussels, two corals, a cave shrimp, three butterflies, and one snail. Direct mortality or injury to the mussels, corals, or shrimp could occur from changes in water quality from ground disturbing activities causing stress and lower productivity resulting from the Proposed Action, but is unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species.

The federally listed terrestrial invertebrates include the Bartram's hairstreak butterfly, Florida leafwing butterfly, Miami blue butterfly, Schaus swallowtail butterfly, and Stock Island tree snail. Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Distribution of most of these species is very limited throughout the state. For example, the Stock Island tree snail is found in only one county in southern Florida. However, FirstNet would attempt to avoid areas where these species may occur; therefore, potential impacts may affect, but are unlikely to adversely, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs

and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Plants

Sixty federally listed plant species (49 endangered and 11 threatened) are known to occur in the state of Florida, as summarized in Table 5.1.6-10. Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. FirstNet would attempt to avoid areas where these species may occur; therefore, potential impacts may affect, but are unlikely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduces the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed mammals, birds, reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Florida are described below.

Mammals

Noise, light, and other human disturbances associated with the Proposed Action could affect federally listed mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities; however, they are anticipated to be small-scale and localized. FirstNet would likely attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Birds

Noise, light, or human disturbance within nesting areas could cause federally listed birds, such as the Florida scrub-jay, to abandon their nests or relocate to less desirable locations, or may result in stress to individuals, reducing survival and reproduction. FirstNet would likely attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Three of the five federally listed sea turtles found in the offshore areas of Florida use Florida beaches as nesting habitat. Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity. However, the majority of FirstNet project activities would not occur in the aquatic environment. Land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Fish

Deployment activities resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 5.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to reproduction for the federally listed species in Florida are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment and FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for federally listed mussels, corals, and the cave shrimp known to occur in Florida. In addition, introduction of invasive aquatic species could also indirectly affect aquatic invertebrates. Impacts to food sources utilized by the federally listed butterflies and the federally listed snail could potentially affect these species, which could result in reduced survival and reproduction. Deployment activities are not expected to cause changes to water quality that could result in impacts, as the majority of FirstNet deployment activities would not occur in the aquatic environment. Potential impacts to federally listed invertebrate species may affect, but are not likely to adversely affect, those species, as FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Plants

Potential impacts could occur from ground disturbing activities to listed plant species as a result of the Proposed Action. However, FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency,

would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed mammals, birds, reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Florida are described below.

Mammals

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect breeding and foraging sites of the federally listed mammals, resulting in reduced survival and productivity. However, the localized nature of disturbances during deployment activities are not anticipated to stress these species. Ground disturbing activities could impact food sources for the federally listed mammals in Florida. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon breeding locations or alter migration patterns. Mammals have the capacity to divert from sound sources during feeding and migration. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over great distances often involving many different countries. For example, the red knot has been found to fly up to 9,300 miles from their breeding and wintering sites and often return to the same stopover sites year and after year in Florida. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in effects to federally listed birds. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect nesting and foraging sites of the federally listed reptile and amphibian species, resulting in reduced survival and productivity; however, the localized nature of disturbances during

deployment activities are not anticipated to stress these species. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the federally listed fish. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or alter migration patterns. Behavioral changes to these species are unlikely as the majority of FirstNet deployment projects would not occur in aquatic environments. Therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed aquatic invertebrates, resulting in lower productivity. Disturbances to food sources utilized by the federally listed terrestrial species, especially during the breeding season, could impact foraging behavior. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases small-scale changes could lead to potentially significant adverse effects, such as impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. Potential effects to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in Florida are described below.

Mammals

Five of the 16 federally listed mammals in Florida have federally designated critical habitat. Critical habitat has been designated in Florida for the Choctawhatchee beach mouse, Perdido Key beach mouse, Silver rice rat, St. Andrew beach mouse, and West Indian manatee. Critical habitat for the Choctawhatchee beach mouse occurs in Henderson Beach, Topsail Hill, Grayton Beach, Deer Lake, and West Crooked Island/Shell Island. Critical habitat for the Perdido Key beach mouse occurs in Gulf State Park, West Perdido Key, Perdido Key State Park, Gulf Beach, and Gulf Islands National Seashore. Critical habitat for the Silver rice rat occurs in Little Pine Key, Water Keys, Big Torch Key, Middle Torch Key, Summerland Key, Cudjoe Key, Johnston Key, Raccoon Key, and Lower Saddlebunch Keys. Critical habitat for the St. Andrew beach mouse occurs in East Crooked Island, Palm Point, and St. Joseph Peninsula. Critical habitat for the West Indian manatee occurs in several of the coastal lagoons and rivers located within Charlotte, Citrus, Collier, De Soto, Hillsborough; Lee County, Manatee, Monroe, and Sarasota Counties in Florida.

Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in Florida could lead to habitat loss or degradation, which could lead to effects to the federally listed terrestrial mammals depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur. West Indian manatee critical habitat loss or degradation is unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed mammal species in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

Three of the 12 federally listed birds in Florida have federally designated critical habitat. Critical habitat for the Cape Sable seaside sparrow in Florida includes marl prairie habitats in the vicinity of the Main Park Road, Shark River Slough, Taylor Slough, and the state owned Southern Glades Wildlife and Environmental Area. Critical habitat for the Everglade snail kite in Florida occurs in the Arthur R. Marshall Loxahatchee National Wildlife Refuge (NWR), Water Conservation Area (WCA) 2, WCA 3, Everglades National Park, western portions of Lake Okeechobee in Hendry and Glades County, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and the St. Johns Reservoir in Indian River County. Critical habitat for the piping plover in Florida occurs in within Bay, Collier, Duval, Escambia, Franklin, Gulf, Hillsborough, Lee, Martin, Monroe, Nassau, Pasco, Pinellas, Santa Rosa, Taylor, and Volusia Counties. Land clearing, excavation activities, and other ground disturbing activities in this region of Florida could lead to habitat loss or degradation, which could lead to effects to the these birds depending

on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed bird species in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

Four of the 11 federally listed amphibians and reptiles in Florida have federally designated critical habitat. Critical habitat for the American crocodile in Florida includes all land and water within an area encompassing the extreme southern tip of Florida, Florida Bay, and the Keys; in Miami-Dade, Monroe, Collier, and Lee Counties in Florida. Critical habitat for the loggerhead sea turtle has been designated in Bay, Brevard, Charlotte, Collier, Duval, Escambia, Flagler, Franklin, Gulf, Indian River, Lee, Manatee, Martin, Monroe, Palm Beach, Sarasota, St. John's, and Volusia Counties in Florida and also includes floating sargassum mats located in the Atlantic Ocean. Critical habitat for the frosted flatwoods salamander has been designated in Baker, Franklin, Jefferson, Liberty, and Wakulla Counties in Florida. Critical habitat for the reticulated flatwoods salamander has been designated in Calhoun, Holmes, Jackson, Santa Rosa, Walton, and Washington Counties in Florida.

Land clearing, excavation activities, and other ground disturbing activities in this region of Florida could lead to habitat loss or degradation, which could lead to effects to the American crocodile, loggerhead sea turtle, frosted flatwoods salamander, and reticulated flatwoods salamander depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed reptile and amphibian species in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Fish

Two of the three federally listed fish in Florida have federally designated critical habitat. Critical habitat for the Gulf sturgeon includes the Apalachicola, Suwanee, Yellow, and Choctawhatchee River systems; the nearshore of the Gulf of Mexico; the Pensacola, Apalachicola, and Choctawhatchee Bays, and the Santa Rosa and Suwannee Sounds. Critical habitat for the smalltooth sawfish exists along the southwestern coast of Florida between Charlotte Harbor and

Florida Bay. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb aquatic critical habitat. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the federally listed Okaloosa darter in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

Critical habitat has been designated for 18 of the federally listed invertebrate species, as described in Table 5.1.6-9. Land clearing, excavation activities, and other ground disturbing activities in this region of Florida could lead to habitat loss or degradation, which could affect these invertebrates depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely to adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the Miami blue butterfly, Schaus swallowtail butterfly, squirrel chimney cave shrimp, or Stock Island tree snail in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

Critical habitat has been identified for six of the 60 federally listed plant species in Florida. Critical habitat for the Aboriginal prickly apple consists of 11 units along the southwest coast of Florida. Critical habitat for the Cape Sable thoroughwort consists of nine units in Miami-Dade and Monroe Counties, Florida. Critical habitat for the Carter's small-flowered flax consists of seven units in Miami-Dade County, Florida. Critical habitat for the Florida Brickell-bush consists of seven units on land in pine rockland habitat on the Miami Rock Ridge, outside of Everglades National Park, in Miami-Dade County, Florida. Critical habitat for the Florida semaphore cactus consists of four units in the Florida Keys. Critical habitat for the Johnson's seagrass exists in Indian River, St. Lucie, Martin, Palm Beach, and Miami-Dade Counties, Florida.

Land clearing, excavation activities, and other ground disturbing activities in this region of Florida could lead to habitat loss or degradation, which could affect these plants depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but

are not likely to adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed plant species in Florida; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential effects to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have no effect on threatened and endangered because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to affect protected species, it is anticipated that this activity would have no effect on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of effects that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential effects to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., reptiles, mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
    - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential effects to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
    - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 5.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

    Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact threatened and endangered species by direct injury/mortality,

reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently, and BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. FirstNet would attempt to avoid areas where these species are known to occur. Therefore, listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. FirstNet would attempt to avoid areas where these species are known to occur. BMPs

and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential effects to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential effects to threatened and endangered species as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. FirstNet would attempt to avoid area where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

5.2.7. Land Use, Recreation, and Airspace

5.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.7.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 5.2.7-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 5.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities.	No disruption or loss of access to recreational lands or activities.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal.	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

5.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of right-of-way or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the ROWs, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts (at the programmatic level) would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 5.2.7-1 less than significant impacts (at the programmatic level) would be anticipated, as any new land use would be small-scale and short-term during the construction phase.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of ROW or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts (at the programmatic level) would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts (at the programmatic level) would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Potential impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 5.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would be unlikely to have a significant impact on airspace resources.

5.2.7.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See Activities With the Potential to Have Impacts below.
    - Recreation: See Activities With the Potential to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See Activities With the Potential to Have Impacts below
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*. (See Section 5.1.7.5 Obstructions to Airspace Considerations).

- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
  - Land Use: See Activities With the Potential to Have Impacts below.
  - Recreation: See Activities With the Potential to Have Impacts below.
  - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are expected to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore or inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See Activities With the Potential s to Have Impacts below.
  - Recreation: See Activities With the Potential to Have Impacts below.
  - Airspace: The installation of cables in or near bodies of water and construction of landings/facilities on shores or the banks of water bodies that accept the submarine cable would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*. (See Section 5.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.

        - Land Use: See Activities With the Potential to Have Impacts below.
        - Recreation: See Activities With the Potential to Have Impacts below.
        - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
        - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
        - Recreation: See Activities With the Potential to Have Impacts below.
        - Airspace: See Activities With the Potential to Have Impacts below.
- Deployable Technologies
    - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
        - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
        - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
        - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet AGL or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 5.1.7.5 Obstructions to Airspace Considerations.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
        - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
        - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.

- Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.

Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact to land use, recreation, or airspace, it is anticipated that this activity would have no impact on land use, recreation, or airspace.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.

    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shores or the banks of waterbodies that accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: No impacts are anticipated – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
    - Airspace: No impacts are anticipated – see previous section.
- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets other criteria listed in Section 5.1.7.5 Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight

patterns of an airport if the aerial fiber optic plant is located in proximity to one of Florida's airports.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
  - Land Use: No impacts are anticipated – see previous section.
  - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
  - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: No impacts are anticipated – see previous section.
    - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Florida airports. Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft and untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.

- Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace could include obstructions. These potential impacts are expected to be less than significant at the programmatic level due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections because there would be no ground disturbance, no airspace activity, and no access restrictions to recreational lands. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above.

Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. Operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections, assuming that the same access roads used for deployment are also used for inspections.

The degree of change in the visual environment (see Section 5.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. Once deployment locations are known, the location would be subject to an environmental review to help ensure environmental concerns are identified. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. FirstNet would coordinate with the FAA

to review required certifications. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts at the programmatic level to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected; however, impacts would be less than significant at the programmatic level due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections.

Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this Alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant at the programmatic level due to the temporary nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 5.1.7, Land Use, Recreation, and Airspace.

5.2.8. Visual Resources

5.2.8.1. Introduction

This section describes potential impacts to visual resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 5.2.8-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

Table 5.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character.	Effect that is potentially significant, but with mitigation is less than significant.	Intermittently noticeable change in aesthetic character that is marginally negative.	No visible effects.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase.	Transient or no visible effects.
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Effect that is potentially significant, but with mitigation is less than significant.	Lighting alters night-sky conditions to a degree that is only intermittently noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase.	Transient or no visible effects.

5.2.8.3. Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In Florida, residents and visitors travel to many national and state parks and forests, such as Everglades National Park, to view its wet sawgrass prairies, mangrove swamps, tropical hardwood hammocks, and rare and endangered species. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Florida's Statutes 267 and 380 regulate impacts to visual resources through protection of historic, cultural, and natural resources via state and local historic preservation acts and land and water management regulations which empower the Division of Historical Resources (DHR) and local governments to preserve these resources.

Based on the impact significance criteria presented in Table 5.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small-scale of likely FirstNet activities, impacts are expected to be less than significant at the programmatic level.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects could be considered potentially significant.

Based on the impact significance criteria presented in Table 5.2.8-1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies, although potentially minimized to less than significant with the implementation of BMPs and mitigation measures, as defined in Chapter 16, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

5.2.8.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lightings and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POPs would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation was removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation was removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape

grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.

  Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lighting.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant at the programmatic level due to the temporary and small-scale nature of deployment activities. As discussed above, potential impacts to night skies from lighting are expected to be less than significant with BMPs and mitigation measures incorporated. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park could be less than significant (at the programmatic level) with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 16, BMPs and Mitigation Measures, provides a listing

of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.8.5. Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant at the programmatic level as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant at the programmatic level given the limited geographic scope for individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that

FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.8, Visual Resources.

5.2.9. Socioeconomics

5.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 5.2.9-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 5.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to spending, income, industries, and public revenues.
	Geographic Extent	Regional impacts observed throughout the state/ territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level.	Effect that is potentially significant, but with mitigation is less than significant.	Low level of job creation at the state/territory level.	No job creation due to project activities at the state/territory level.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender).	Effect that is potentially significant, but with mitigation is less than significant.	Minor increases in population or population composition.	No changes in population or population composition.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

5.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts Related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would reduce response times and improve responses (provide a better fit of the response to the need). These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary across Florida. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $190,000 in the greater Miami area, to slightly over $130,000 in the Cape Coral and Pensacola areas. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary user to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant at the programmatic level t. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the

installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment could be a minor, direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet partner(s) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant at the programmatic level. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Existing Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Florida. The average unemployment rate in 2014 was 6.3 percent, close to the national rate of 6.2 percent. County-level unemployment rates varied across the state, with rates above and below the national average throughout the state.

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system

designers may be located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 5.2.9-1 because they would not constitute a "high level of job creation at the state or territory level."

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

5.2.9.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 5.2.9-1. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to socioeconomics under the conditions described below.

- Satellites and Other Technologies
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level t.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.
    - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be

small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.

- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:

- Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

o New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:

- Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

- Wireless Projects

o New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:

- Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be less than significant at the programmatic level.
- Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

o Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.

- Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

- Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
  - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant at the programmatic level.
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide at the programmatic level.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts at the programmatic level. The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant at the programmatic level. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant at the programmatic level, as described above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. All operational activities would be conducted by public or private sector employees, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant at the programmatic level.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide. The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant at the programmatic level as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within Florida. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.9.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomics resulting from implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant at the programmatic level.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this Alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant at the programmatic level as described above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant at the programmatic level.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this Alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present

over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant at the programmatic level as they would be limited to a relatively small number of sites within the region and state. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 5.1.9, Socioeconomics.

5.2.10. Environmental Justice

5.2.10.1. Introduction

This section describes potential impacts to environmental justice in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 5.2.10-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 5.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated.	Effect that is potentially significant, but with mitigation is less than significant.	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation.	No direct effects on environmental justice communities, as defined by EO 12898.
	Geographic Extent	Effects realized within counties at the Census Block Group level.		Effects realized within counties at the Census Block Group level.	Effects realized within counties at the Census Block Group level.
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

5.2.10.3. Description of Environmental Concerns

Effects Associated with Other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from Council on Environmental Quality (CEQ), require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). See Socioeconomics Environmental Consequences for additional discussion. The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. American Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 5.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 5.1.10.4) as

having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 5.1.10.3, Environmental Setting: Minority and Low-Income Populations, Florida's population has higher percentages of minorities than the region or the nation. The state has a lower rate of poverty than the region and a higher rate than the nation. A large proportion of Florida is categorized as having moderate potential or high potential for environmental justice populations, and these areas are fairly evenly distributed across the state. They occur within the largest population concentrations and in the less densely populated regions of the state. Further analysis using the data developed for the screening analysis in Section 5.1.10.4, Environmental Justice Screening Results, may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2016e).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts could use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

5.2.10.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of proposed action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to environmental justice under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes,

huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access were required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing

facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore or the banks of waterbodies that accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than

significant at the programmatic level, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant at the programmatic level given the short-term nature and limited geographic scope for individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.10.5. Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to environmental justice communities resulting from implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant at the programmatic level because they would be temporary in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant at the programmatic level as operations are expected to be temporary in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 5.1.10, Environmental Justice.

5.2.11. Cultural Resources

5.2.11.1. Introduction

This section describes potential impacts to cultural resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 5.2.11-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

Table 5.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[a]	Effect, but Not Adverse	No Effect
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects Area of Potential Effect (APE).		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[a]**	**Effect, but Not Adverse**	**No Effect**
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including American Indian tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to American Indian tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

5.2.11.3. Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 5.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout Florida, some deployment activities may be in these areas, in which case BMPs (see Chapter 16) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alters historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 16).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to American Indians. It is anticipated that FirstNet would identify potential impacts to such areas through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

5.2.11.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historical artifacts. The types of infrastructure development activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties in Florida.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could impact cultural resources, as coastal areas of Florida where sea level was lower during glacial periods (generally the Middle Archaic Period and earlier) have the potential to contain archaeological sites. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shores or banks of waterbodies that accept submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits are frequently associated with bodies of water), and the associated structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
    - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Miami Beach that have larger numbers of historic public buildings.
    - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or

inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties; however, due to the small-scale of expected activities, these actions could affect, but would not likely adversely effect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.11.5. Alternatives Impact Assessment

The following section assesses potential impacts to cultural resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur; however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.11, Cultural Resources.

5.2.12. Air Quality

5.2.12.1. Introduction

This section describes potential impacts to Florida's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Florida's air quality were evaluated using the significance criteria presented in Table 5.2.12-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to Florida's air quality addressed in this section are presented as a range of possible impacts.

Table 5.2.12-1: Impact Significance Rating Criteria for Air Quality

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant.	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

NA = Not Applicable

5.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant at the programmatic level due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Designated maintenance areas exist in Florida for the following pollutants: lead and SO_x, (see Section 5.1.12, Air Quality, and Table 5.1.12-3).

Based on the significance criteria presented in Table 5.2.12-1, air emission impacts would likely be less than significant at the programmatic level given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Florida; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present in Florida (Table 5.1.12-3), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

5.2.12.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however, this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with Potential Impacts to Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant at the programmatic level due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.

- New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If the delivery of additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site

preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant at the programmatic level due to the limited nature of the deployment. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality (at the programmatic level) associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors additional air quality impacts may occur, however, they would be less than significant at the programmatic level as they would still be limited in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.12.5. Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the

vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant at the programmatic level based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations would dictate the concentrations and associated impacts. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant at the programmatic level, given that these activities are of low-intensity and short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

5.2.13. Noise

5.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Florida. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 5.2.13-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential noise impacts to Florida addressed in this section are presented as a range of possible impacts.

Table 5.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

5.2.13.3. Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see Section 5.1.13, Noise).

Based on the significance criteria presented in Table 5.2.13-1, noise impacts would likely be less than significant at the programmatic level given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures could help to limit impacts on nearby noise-sensitive receptors. However, given that much of the construction and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

5.2.13.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not. In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POPs, huts, or

other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.

- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. Aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. These impacts are expected to be less than significant at the programmatic level due to the temporary duration of deployment activities. Additionally,

pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant at the programmatic level and similar to several of the deployment activities related to routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.13.5. Alternatives Impact Assessment

The following section assesses potential noise impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-

sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant at the programmatic level t, given that these activities are of low-intensity and short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise levels would quickly return to baseline levels. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies. Noise would therefore be the same as described in Section 7.1.9, Noise.

5.2.14. Climate Change

5.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Florida associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.14.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action's installations and infrastructure were evaluated using the significance criteria presented in Table 5.2.14-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or Alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or Alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or Alternatives (Florida Legislature, 2015b).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (Florida Legislature, 2015b). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT in 2013 (USEPA, 2015m), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (Florida Legislature, 2015b). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 5.2.14-1: Impact Significance Rating Criteria for Climate Change

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA = Not Applicable

5.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. There have been increasing numbers of days above 95 °F and nights above 75°F, and decreasing numbers of extremely cold days since 1970 in the southeast. Temperatures across this section of the United States are expected to increase during this century. Major consequences of warming include significant increases in the number of hot days, defined as 95 °F or above, and decreases in freezing events. (USGCRP, 2014a)

Air Temperature

Figure 5.2.14-1 and Figure 5.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Florida from a 1969 to 1971 baseline.

Cfb – Figure 5.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the entire state of Florida under a low emissions scenario would increase by approximately 3 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of Florida would increase by approximately 4° F. (USGCRP, 2009)

Figure 5.2.14-2 shows that under a high emissions scenario for the period 2040 to 2059, temperatures would increase by approximately 3 °F in the majority of the Cfb region. Under a high emissions scenario for the period 2080 to 2099 in the Cfb region of Florida, temperatures would increase by approximately 7° F. However, temperatures in a small portion of the southernmost portion of this region may only increase by up to 6 °F. (USGCRP, 2009)

Am – Temperatures in this region are expected to increase under a low emissions scenario by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfb region. (USGCRP, 2009)

Under a high emissions scenario by mid-century, temperatures in the Am region of Florida will increase by approximately 2 °F in the southern portion of the region and 3 °F in the northern portion of the region. By the end of the century under a high emissions scenario in the Am region, temperatures will increase by 6 °F in the southern portion and by 7 °F in the northern portion of the region. (USGCRP, 2009)

Aw – Temperatures in this region are expected to increase under a low emissions scenario by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfb and Am regions. (USGCRP, 2009)

Temperatures in this region will increase in the same manner as the Am region under a high emissions scenarios for both mid-and-end of the century. (USGCRP, 2009)

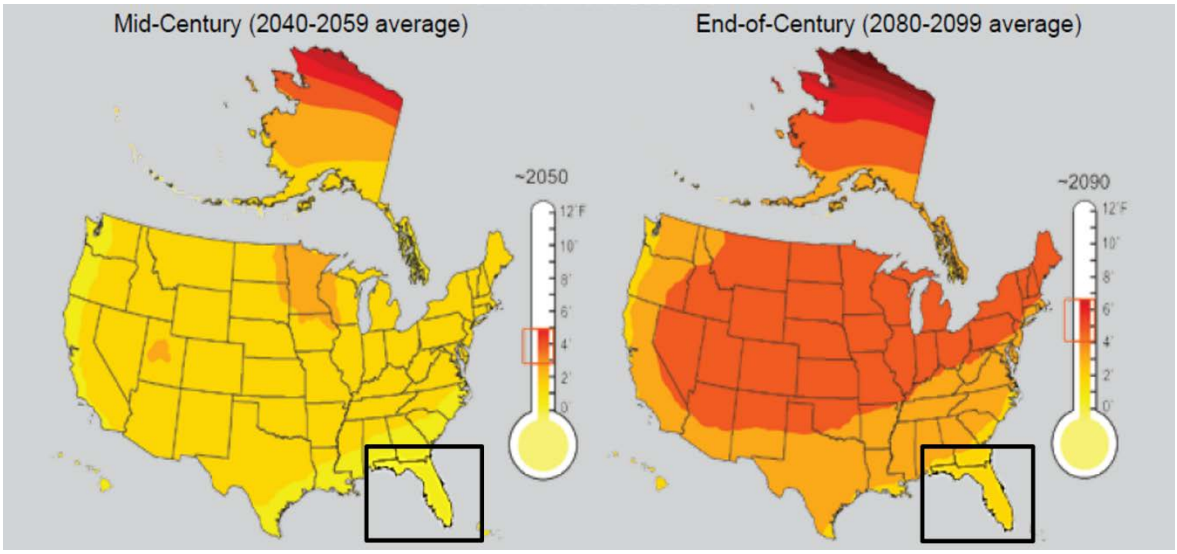


Figure 5.2.14-1: Florida Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

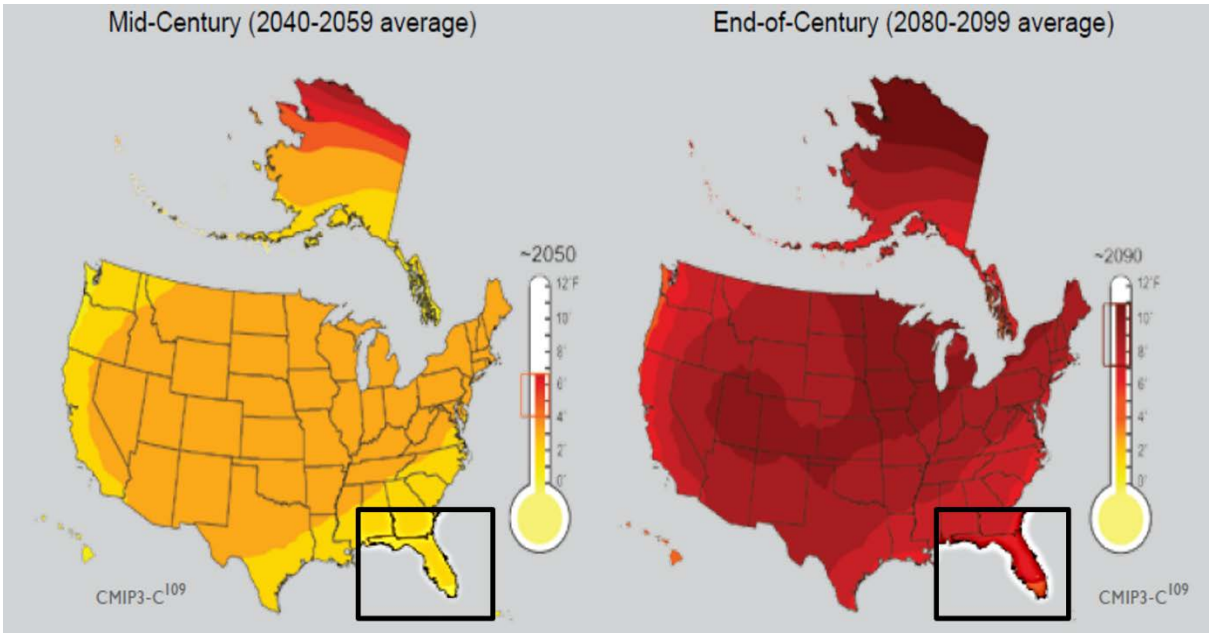


Figure 5.2.14-2: Florida High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

Predicting future precipitation patterns in the southeast are much less certain than projections for temperature. The southeast is located in the transition zone between projected wetter conditions to the north and drier conditions to the southwest, therefore, many of the model projections show only small changes relative to natural variations. However, many models do project drier

conditions in the far southwest portion of the region and wetter conditions in the far northeast portion of the region. (USGCRP, 2014a)

Figure 5.2.14-3 and Figure 5.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 5.1.14.6-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 5.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014b)

Cfb – Figure 5.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and fall in this region of Florida. In spring, precipitation would increase by 10 percent in the northern portion of the region, and in the southern portion of the region there are no expected fluctuations in precipitation. There are no expected increases in precipitation in summer other than fluctuations due to natural variability. (USGCRP, 2014b)

Figure 5.2.14-4 shows that if emissions continue to increase, winter precipitation could increase up to 10 percent over the period 2071 to 2099 in the southern portion of the region with no expected fluctuations in precipitation in the northern portion of the region. In spring, precipitation in this scenario is expected to decrease by 10 percent and possibly even decrease by 20 percent in a tiny southern portion of this region, and in the northernmost portion of this region there are no expected fluctuations in precipitation in spring. In summer, precipitation is expected to decrease in this region by 10 percent in the northern portion; 20 percent in the middle portion of the region; and by 30 percent in the southern portion of the region. Fall precipitation could increase as much as 20 percent over this period. (USGCRP, 2014b)

Am – In a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and fall in this region of Florida. In spring and summer there are no expected fluctuations in precipitation other than fluctuations due to natural variability. (USGCRP, 2014b)

Under a low emissions scenario, precipitation is expected to increase up to 10 percent in winter and 20 percent in fall. Spring precipitation is expected to decrease by 20 percent for the majority of the region, and only decrease by about 10 percent in a very small portion of the northern region of the Am region. In summer, precipitation is expected to decrease up to 30 percent in this region of Florida.

Aw – Precipitation changes in a low emissions scenario and in an increased emissions scenario in the Aw region are consistent with projected changes in the Am region of Florida.

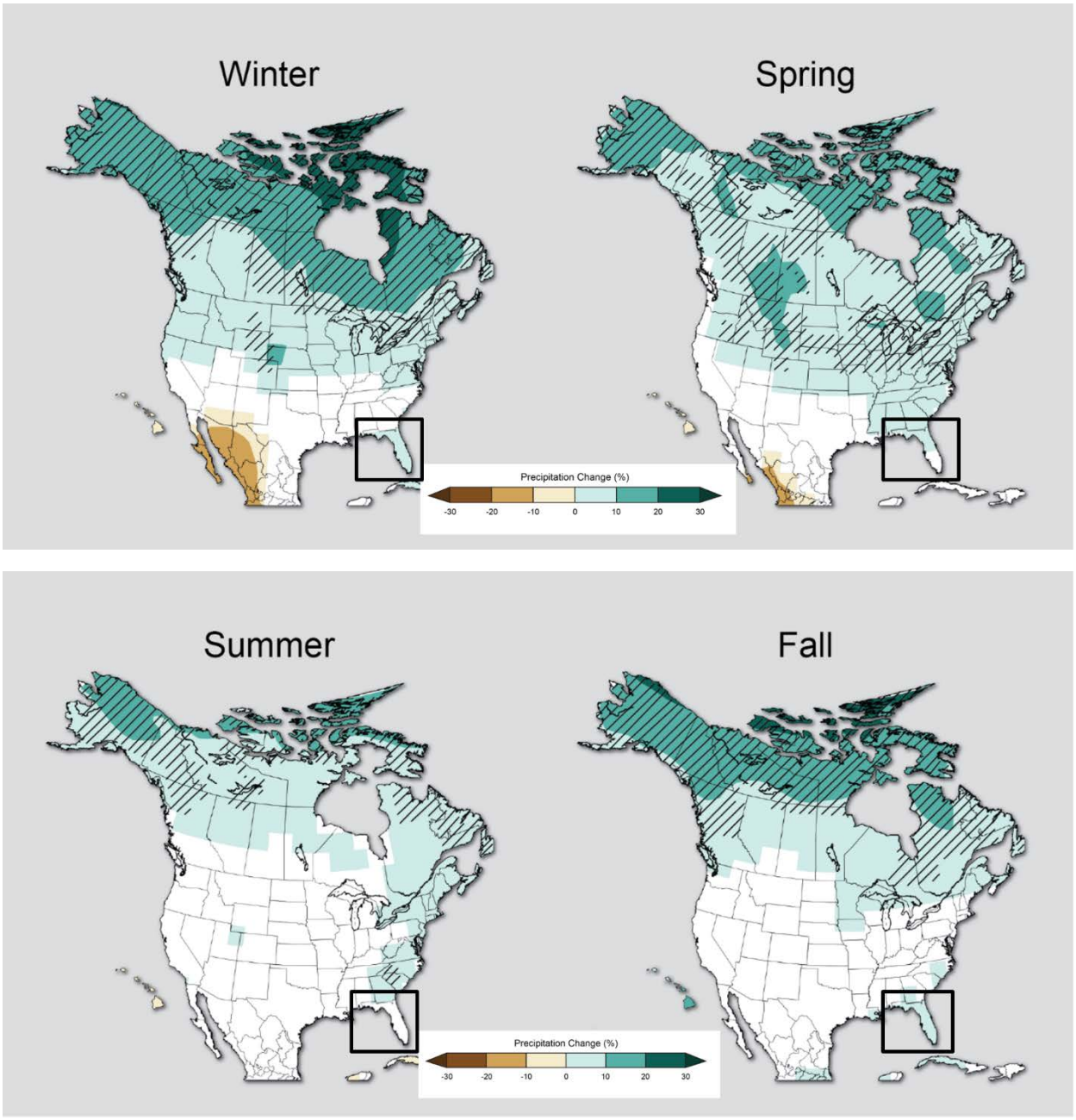


Figure 5.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

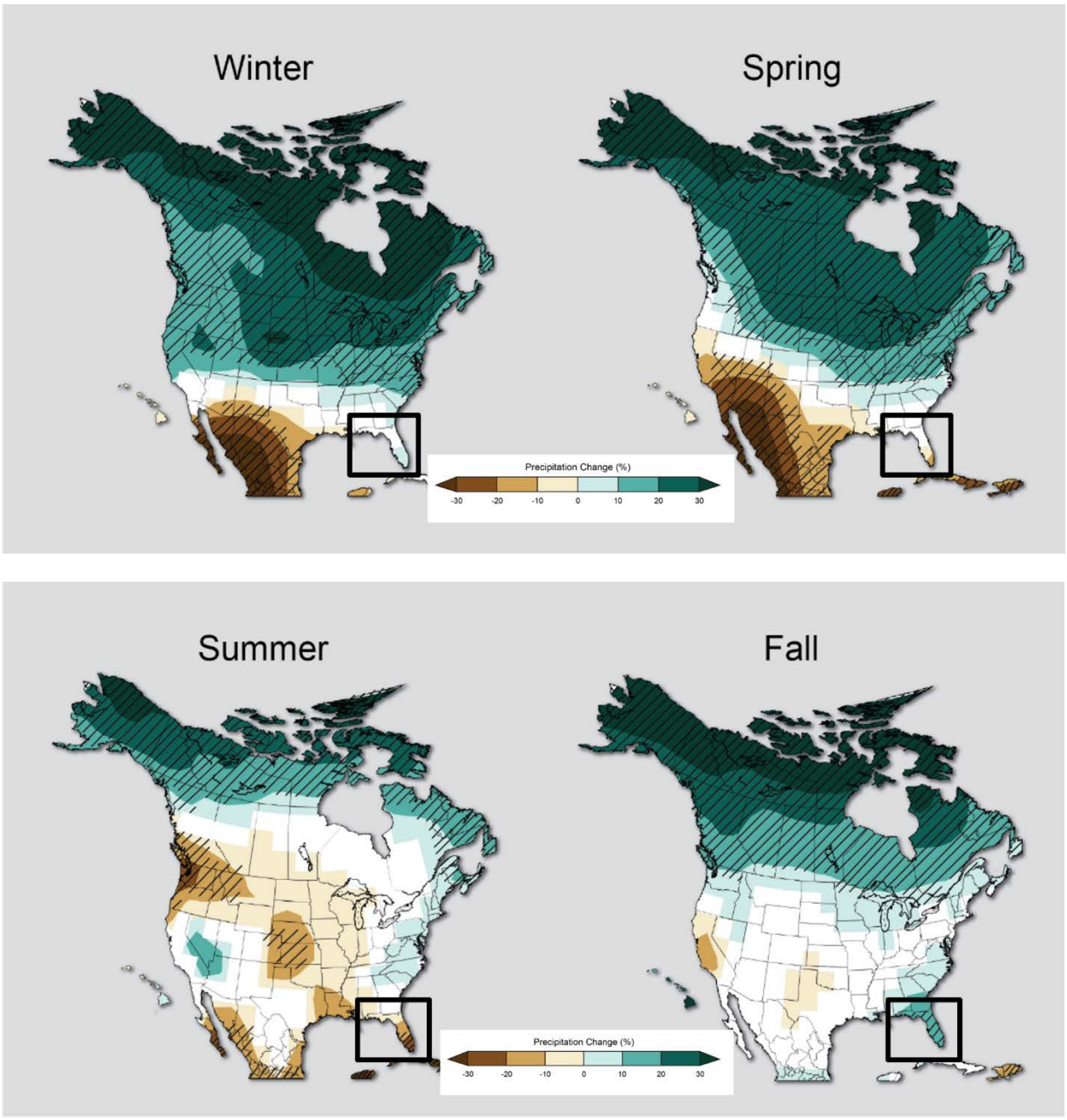


Figure 5.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors would continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012f). When water warms, it also expands, which contributes to sea level rise in the world's oceans. "Several studies have shown that the amount of heat stored in the ocean has increased substantially since the 1950s" (USEPA, 2012f). Sea level and currents could be influenced by the amount of heat stored in the ocean (USEPA, 2012f).

The amount of sea level rise would vary in the future along different stretches of the U.S. coastline and under different absolute global sea level rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment (NCA) potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA; USGS; SERPD; and USACE, 2012). Sea level rise presents specific and major challenges to south Florida's existing coastal water management system due to a combination of increasingly urbanized areas, aging flood control facilities, flat topography, and porous limestone aquifers. For instance, south Florida's freshwater well field protection areas lie close to the current interface between saltwater and freshwater, which will shift inland with rising sea level, affecting water managers' ability to draw drinking water from current resources (USGCRP, 2014a). Figure 5.2.14-5 and Figure 5.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations.

Figure 5.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 5.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

Cfb – Figure 5.2.14-5 presents an 8-inch global average sea level rise above 1992 levels, resulting in a 0.7 to 1 foot sea level rise in 2050 along the west coast of Florida. Figure 5.2.14-6 indicates that a 1.24-foot sea level rise above 1992 level would result in a 1.0 to 1.7 foot sea level rise in 2050 along the west coast of Florida (USGCRP, 2014c). While the figures do not show predictions for the east coast of Florida, there is a moderate risk of vulnerability to sea level rise in the northeastern section of this region up to a very high risk of vulnerability to sea level rise going further south on the coast of this region. (USGCRP, 2014a)

Am – The figures do not show predictions for the Am portion of Florida, however, there is a high to very high risk of vulnerability to sea level rise in this region of Florida. (USGCRP, 2014a)

Aw – Sea level rise in the Aw region of Florida is expected to increase at the same rate as the Cfb region under a rapid reduction scenario and a high emissions scenario.

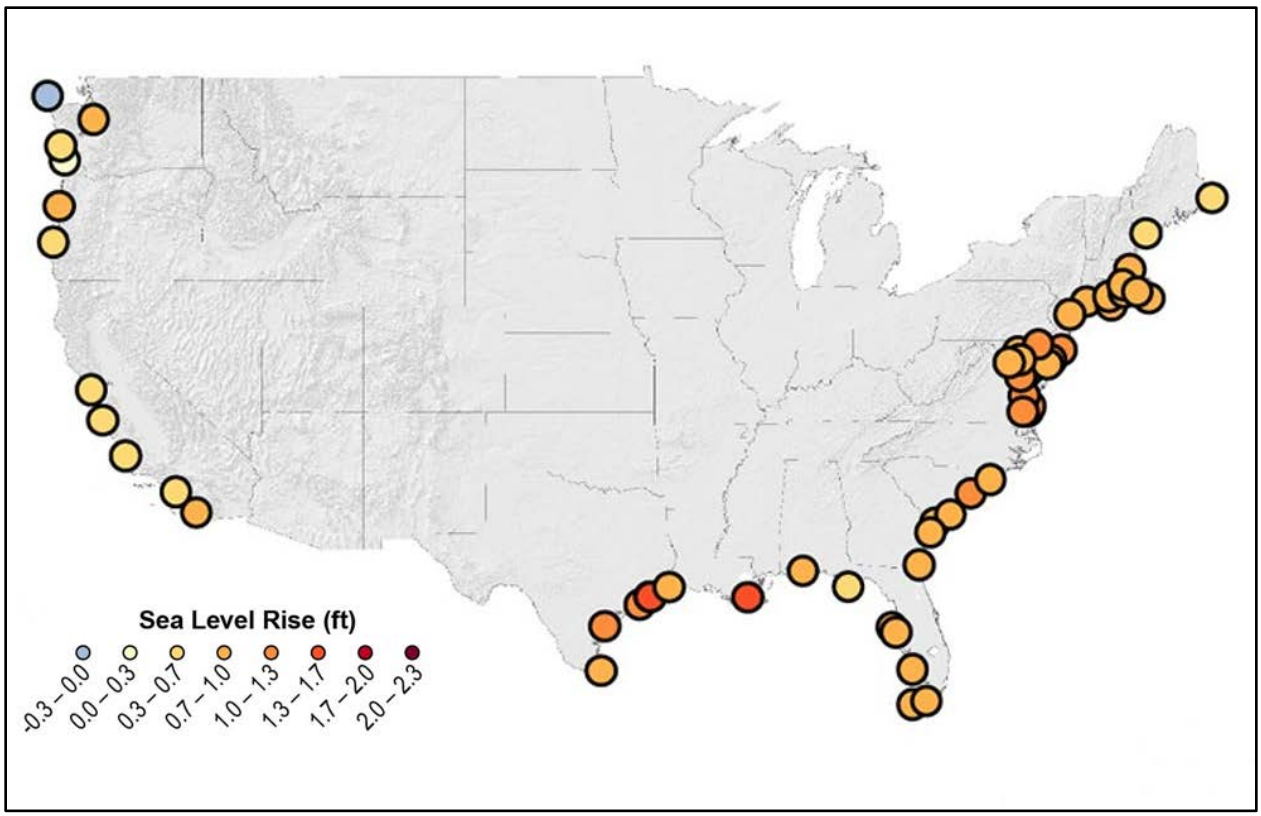


Figure 5.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

Severe Weather Events

Florida is especially susceptible to severe weather events. However, it is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change. (USGCRP, 2014d)

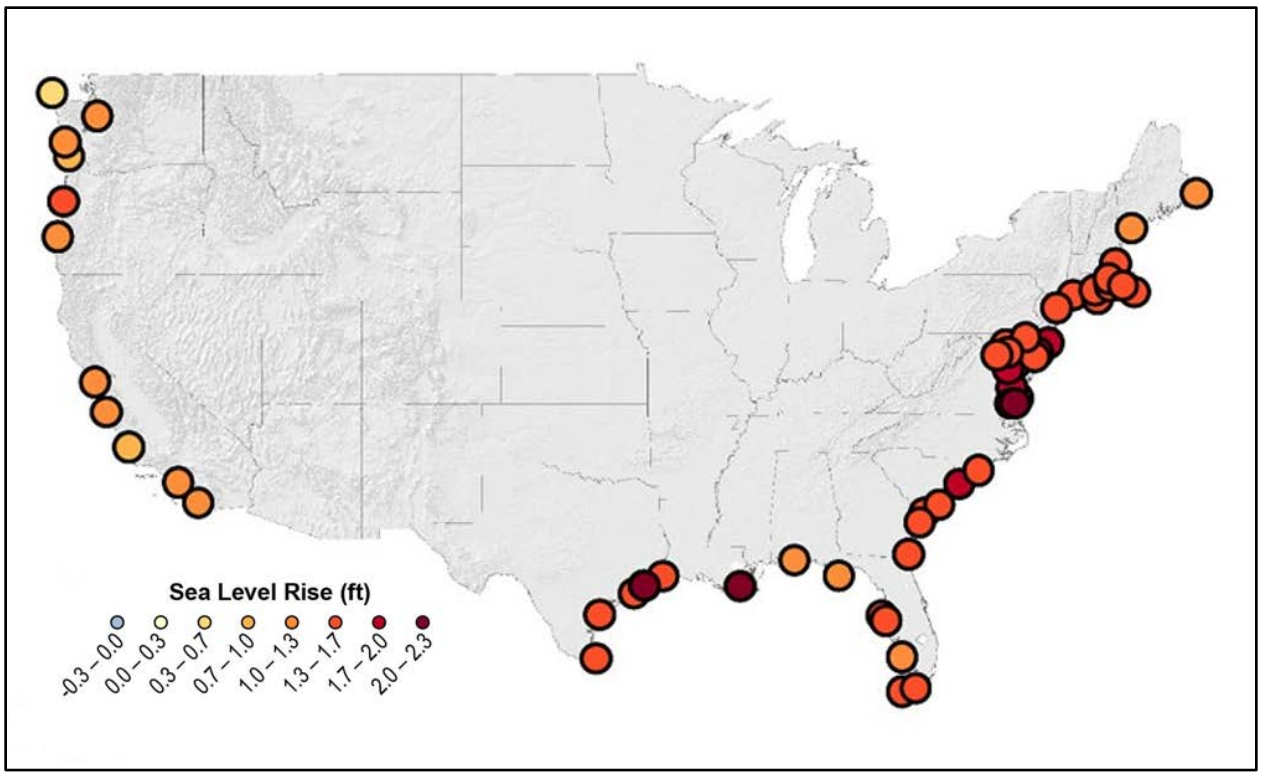


Figure 5.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (USGCRP, 2014a). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends to inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would provide greater certainty (FAA, 2015g).

5.2.14.4. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 5.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's

deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Diesel Service & Supply, 2016). Diesel fuel combustion emits 22.38 lbs. of CO_2 per gallon (EIA, 2015b). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than on-site provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs./MWh (USEPA, 2015m), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Effects of Climate Change on Project-Related Impacts

Climate change may increase project-related impacts by magnifying or otherwise altering impacts in other resource areas. Forested areas of the southeast, including Florida, may be at a higher risk of wildland fires, particularly during the periods of extended drought that are forecasted under warming scenarios (Mitchell 2014). Sea level rise could significantly impact the entire coastline of Florida, resulting in erosion and permanent loss of coastal habitat and profoundly impacting the location and disposition of plant and animal communities (Florida Oceans and Coastal Council 2010).

Impact of Climate Change on FirstNet Installations and Infrastructure

Climate change impacts on FirstNet installations and infrastructure will vary from state to state, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location.

The entire state of Florida is at risk for stronger hurricanes as a result of climate change. Sea level rise would increase the height, areal extent, and persistence of coastal flooding during these events (USGCRP, 2014e). Stronger storms may also increase the potential for damage to FirstNet infrastructure from high winds and wind-borne debris. In inland areas of Florida out of the immediate path of storm surge are nevertheless at risk of flooding. Climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash floods (USGCRP, 2014e). Urban areas in particular will be at risk of increased intensity and duration of heat waves, although overall the increase in heat waves is projected to be less than for other regions of the U.S. (USGCRP, 2014e). Extended periods of extreme heat may impede the operation of the grid in southeastern states (DOE 2015), and overwhelm the capacity of onsite equipment needed to keep microwave and other transmitters cool.

Based on the impact significance criteria presented in Table 5.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

5.2.14.5. Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

The following section assesses potential GHG emission impacts associated with implementation of the Preferred Alternative in Florida, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The

equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.

- Satellites and Other Technologies
  - Distribution of Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
  - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.

- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and backup), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction, as it would not occur. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and backup), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e., months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant at the programmatic level due to the limited and localized nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant at the programmatic level with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations could be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is

sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

5.2.14.6. Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant at the programmatic level based on the defined significance criteria, since activities would be temporary and short-term. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have

a cumulative impact, although this impact is expected to be less than significant at the programmatic level due to the temporary nature of the operation of deployables. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be less than significant at the programmatic level due the limited duration of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant at the programmatic level, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.14, Climate Change.

5.2.15. Human Health and Safety

5.2.15.1. Introduction

This section describes potential impacts to human health and safety in Florida associated with deployment of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.15.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 5.2.15-1. As described in Section 5.2, Environmental

Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 5.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural and Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

5.2.15.3. Description of Environmental Concerns

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 5.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015b).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[172] chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

[172] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents (OSHA, 2016d).

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (USEPA, 2015m). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (USEPA, 2015m). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure.

The State of Florida is not authorized by OSHA to administer a state program for public or private sector employers. Therefore, all regulatory authority and enforcement for occupational safety relating to FirstNet site work would be deferred to the leadership and interpretation of OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and land mines at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed because of site activities. Mines may cause unstable surface and subsurface conditions as a result of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 5.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the

USEPA Cleanups in My Community (CIMC) database and U.S. Department of Interior's Abandoned Mine Lands inventory, through the Florida DEP, or through an equivalent commercial resource.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable Florida state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great, the Florida DEP may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters

could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 5.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact at the programmatic level, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.15.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and maintenance activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to human health and safety under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential

for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore or inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there are no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure, and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.15.5. Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable land-based infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to human health and safety as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts at the programmatic level to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage fuel onsite. These activities could result in less than significant impacts at the programmatic level to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant at the programmatic level because of the small-scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration.

Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.15 Human Health and Safety.

FL APPENDIX A – WATER RESOURCES

Table A1. Characteristics of Florida's Watersheds, as Defined by DEP

Watershed/Size Land Area within NY (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Fisheating Creek (850)	Lake Okeechobee	• Dredging/flow alterations
Lake Okeechobee (5,623)	Lake Okeechobee	• Stormwater runoff • Excess phosphorous • Pathogens • Pesticides • Toxics
Caloosahatchee (1,408)	Caloosahatchee River	• Stormwater runoff • Excess nutrients
Lake Worth Lagoon-Palm Beach Coast (700)	Hillsboro Canal	• Excess nutrients • Sedimentation
Florida Keys (2,476)	Gulf of Mexico	• Failed septic tanks • Hazardous waste • Stormwater runoff
St. Lucie – Loxahatchee (1,328)	Loxahatchee River	• Stormwater runoff • Pesticides • Agricultural runoff • Failed septic tanks
Perdido (400)	Perdido River	• Sedimentation from dirt roads • Urban runoff • Hazardous waste including trichloroethylene •
Everglades West Coast (3,699)	Estero River Estero Bay	• Flow alterations
Everglades (3,793)	North New River Florida Bay	• Flow alterations • Excess nutrients
Charlotte Harbor (857)	Charlotte Harbor	• Excess nutrients • Low dissolved oxygen
Southeast Coast – Biscayne Bay (1,200)	Biscayne Bay Miami River New River	• Stormwater runoff • Failed septic tanks • Flow alterations
Indian River Lagoon (155)	Indian River Lagoon St. Lucie River	• Stormwater runoff
Upper East Coast (692)	Matanzas River	• Stormwater runoff • Agricultural runoff • Failed septic tanks • Pathogens • Excess nutrients
Upper St. Johns (1,888)	Upper St. Johns River	• Excess nutrients • Low dissolved oxygen
Springs Coast (1,205)	Crystal River Anclote River	• Wastewater treatment plants • Hazardous waste
Withlacoochee (2,100)	Withlacoochee River	• Sedimentation
Nassau – St. Mary's (942)	St. Marys River	• Stormwater runoff

Watershed/Size Land Area within NY (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Tampa Bay (2,200)	Tampa Bay	• Stormwater runoff • Excess nutrients • Failed septic tanks • Pathogens
Tampa Pay Tributaries (2,200)	Hillsborough River Alafia River Little Manatee River Manatee River	• Low dissolved oxygen • Stormwater runoff • Excess nutrients • Pesticides • Heavy metals
Kissimmee River (2,932)	Kissimmee River	• Dredging/flow alteration
Apalachicola – Chipola (3,067)	Apalachicola River Chipola River	• Changes in freshwater flows • Dredging
Pensacola Bay (2,100)	Escambia River	• Stormwater runoff • Sedimentation from dirt roads • Excess nutrients
Ochlockonee- St. Marks (1,080)	Ochlockonee River St. Marks River	• Stormwater runoff • Heavy metals • Petroleum hydrocarbons
Ocklawaha (2,769)	Ocklawaha River	• Excess nutrients • Sedimentation • Pesticides
Middle St. Johns (2,037)	St. Johns River Wekiva River	• Stormwater runoff • Agricultural runoff • Excess nutrients • Sedimentation
Lower St. Johns (2,646)	St. Johns River	• Stormwater runoff • Failed septic systems • Failed wastewater treatment plants • Pesticides • Sediment • Excess nutrients
Choctawhatchee-St. Andrew Bay (3,260)	Choctawhatchee River Andrew Bay	• Stormwater runoff • Failed septic systems • Excess nutrients • Low dissolved oxygen
Suwannee (7,702)	Suwannee River	• Excess nitrogen
Sarasota Bay – Peace – Myakka (2,800)	Sarasota Bay Peace River Myakka River	• Excess nutrients • Failed septic tanks • Agricultural runoff • Low dissolved oxygen

Source: (DEP, 2015m)

Table A-2: Outstanding Florida Waters, Special Waters

Apalachicola River
Aucilla River
Blackwater River
Butler Chain of Lakes
Chassahowitzka River System
Chiploa River
Choctawhatchee River
Clermont Chain of Lakes
Crooked Lake
Crystal River
Econlockhatchee River System
Estero Bay Tributaries
Florida Keys
Hillsborough River
Homosassa River System
Kingsley Lake and Black Creek (North Fork)
Lake Disston
Lake Powell
Lemon Bay Estuarine System
Little Manatee River
Lochloosa Lake
Myakka River (lower part)
Ochlockonee River
Oklawaha River
Orange Lake, River Styx, and Cross Creek
Perdido River
Rainbow River
St. Marks River
Santa Fe River System
Sarasota Bay Estuarine System
Shoal River
Silver River
Spruce Creek
Suwannee River
Tomoka River
Wacissa River
Wakulla River
Weekiwachee Riverine System
Wekiva River
Wiggins Pass Estuarine System
Withlacoochee Riverine and Lake System

FL APPENDIX B – BIOLOGICAL RESOURCES

Table B1: Essential Fish Habitat for Mid-Atlantic Species of Florida

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
Albacore Tuna (highly migratory)	No EFH defined	No EFH defined	Offshore along the U.S. east coast from north of Cape Hatteras to Cape Cod, and the mid-east coast of Florida.	Central Gulf of Mexico, mid-east coast of Florida, and Puerto Rico. Atlantic east coast from North Carolina, south of Cape Hatteras to Cape Cod.
Angel Shark (highly migratory)	No EFH egg life stage.	No EFH defined	Localized areas off of eastern Louisiana, and from Mississippi to the Florida Panhandle in the Gulf of Mexico. Atlantic east coast from Cape Lookout to the mid-coast of New Jersey. Offshore in Florida.	Localized areas off of eastern Louisiana, and from Mississippi to the Florida Panhandle in the Gulf of Mexico. Atlantic east coast from Cape Lookout to the mid-coast of New Jersey. Offshore in Florida.
Atlantic butterfish	Pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to the south shore of Long Island, New York, in Chesapeake Bay, and on the continental shelf and slope, primarily from Georges Bank to Cape Hatteras, North Carolina.	Pelagic habitats in inshore estuaries and embayments in Boston harbor, from the south shore of Cape Cod to the Hudson River, and in Delaware and Chesapeake bays, and on the continental shelf from the Great South Channel (western Georges Bank) to Cape Hatteras, North Carolina.	Pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, in inshore waters of the Gulf of Maine and the South Atlantic Bight, and on the inner and outer continental shelf from southern New England to South Carolina.	Pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, inshore waters of the Gulf of Maine and the South Atlantic Bight, on Georges Bank, on the inner continental shelf south of Delaware Bay, and on the outer continental shelf from southern New England to South Carolina.
Atlantic Sharpnose Shark (highly migratory)	No EFH egg life stage.	Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hatteras.	Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hatteras, and a localized area off of Delaware.	Gulf of Mexico from Texas through the Florida Keys out to a depth of 200 meters. In the Atlantic from the mid-coast of Florida to Maryland.
Bigeye Thresher Shark (highly migratory)	No EFH egg life stage.	Offshore along the central Gulf of Mexico and off Key West, Florida.	Offshore along the central Gulf of Mexico and off Key West, Florida.	Offshore along the central Gulf of Mexico and off Key West, Florida. Offshore along

[173] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1" (USEPA, 2015b).

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
		Offshore along the Atlantic east coast from southern to the mid-Florida coast, and from Georgia to southern New England.	Offshore along the Atlantic east coast from southern to the mid-Florida coast, and from Georgia to southern New England.	the Atlantic east coast from southern to the mid-Florida coast, and from Georgia to southern New England.
Bigeye Tuna (highly migratory)	No EFH defined	No EFH defined	Offshore in the Gulf of Mexico south of Louisiana and Mississippi, off the southern west coast of Florida, and south of the Florida Keys; as well as in the Atlantic off the Florida east coast through South Carolina, and from North Carolina, south of Cape Hatteras, to Cape Cod.	Offshore in the central Gulf of Mexico and the mid-east coast of Florida. Atlantic east coast from Cape Hatteras to Cape Cod.
Bignose Shark (highly migratory)	No EFH egg life stage.	No EFH defined	Localized offshore areas from Louisiana through the west coast Florida to the Florida Keys in the Gulf of Mexico, and the east coast of Florida and South Carolina in the Atlantic. Continuous offshore EFH from North Carolina to New Jersey.	Localized offshore areas from Louisiana through the west coast Florida to the Florida Keys in the Gulf of Mexico, and the east coast of Florida and South Carolina in the Atlantic. Continuous offshore EFH from North Carolina to New Jersey.
Blacknose Shark (highly migratory)	No EFH egg life stage.	In the Gulf of Mexico coastal areas from the Florida Panhandle and west coast of Florida. In Atlantic coastal areas from Georgia to southern North Carolina.	Localized areas off Texas and western Louisiana, and coastal areas from Mississippi through the Florida Keys in the Gulf of Mexico. Atlantic east coast from the mid-coast of Florida to Cape Hatteras.	Localized areas off Texas and central Louisiana, and coastal areas from eastern Louisiana through the Florida Keys in the Gulf of Mexico Atlantic east coast from the mid-coast of Florida to Cape Hatteras.
Blacktip Shark (highly migratory)	No EFH egg life stage.	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas from northern Florida through Georgia, and the mid-coast of South Carolina.	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas localized off of the southeast Florida coast and from West	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas southeast Florida to Cape Hatteras.

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
			Palm Beach, Florida to Cape Hatteras.	
Blue Marlin (highly migratory)	Mid-east coast of Florida through the Florida Keys.	Mid-east coast of Florida through the Florida Keys.	In the central Gulf of Mexico from southern Texas to the Florida Panhandle through the Florida Keys to southern Cape Cod.	In the central Gulf of Mexico, from southern Texas to the Florida Panhandle, through the Florida Keys to southern Cape Cod.
Blue Shark (highly migratory)	No EFH egg life stage.	No EFH in Florida.	Localized areas in the Atlantic off the mid-east coast of Florida, South Carolina, and the Gulf of Maine, and from Cape Hatteras to New England.	Localized areas in the Atlantic off Florida and Georgia, and from South Carolina to the Gulf of Maine.
Bluefin Tuna (highly migratory)	In the Gulf of Mexico from the 100 meter depth contour to the EEZ, continuing to the mid-east coast of Florida.	In the Gulf of Mexico from the 100 meter depth contour to the EEZ, continuing to the mid-east coast of Florida.	In waters off North Carolina, south of Cape Hatteras, to Cape Cod (no EFH in Florida).	In pelagic waters of the central Gulf of Mexico and the mid-east coast of Florida. North Carolina from Cape Lookout to Cape Hatteras, and New England from Connecticut to the mid-coast of Maine.
Bluefish	Offshore, the pelagic waters over the Continental Shelf (from the coast out to the eastern wall of the Gulf Stream), at mid-shelf depths.	Offshore, the pelagic waters greater than 45 feet over the Continental Shelf, and the "slope sea" and Gulf Stream between latitudes 29º 00 N and 40º 00 N.	Offshore, the pelagic waters over the Continental Shelf (from the coast out to the eastern wall of the Gulf Stream), and the "slope sea" and Gulf Stream between latitudes 29 00 N and 40 00 N. Inshore, EFH includes all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida.	Offshore, the pelagic waters over the Continental Shelf (from the coast out to the eastern wall of the Gulf Stream). Inshore, EFH includes all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida.
Bonnethead Shark (highly migratory)	No EFH egg life stage.	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the mid-coast of Florida to Cape Lookout.
Bull Shark (highly Migratory)	No EFH egg life stage.	Gulf of Mexico coastal areas along Texas, and localized	Gulf of Mexico coastal areas along the Texas coast,	Gulf of Mexico along the southern and mid-coast of Texas to

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
		areas off of Mississippi, the Florida Panhandle, and west coast of Florida; as well as the Atlantic mid-east coast of Florida.	eastern Louisiana to the Florida Panhandle, and the west coast of Florida through the Florida Keys. Atlantic coastal areas localized from the mid-east coast of Florida to South Carolina.	western Louisiana, eastern Louisiana to the Florida Keys. East coast of Florida to South Carolina in the Atlantic.
Common Thresher Shark (highly migratory)	No EFH egg life stage.	Localized areas in the central Gulf of Mexico and Florida Keys. In the Atlantic, localized areas off the mid-east coast of Florida, Georgia, South Carolina, and the Gulf of Maine, and from North Carolina through Cape Cod.	Localized areas in the central Gulf of Mexico and Florida Keys. In the Atlantic, localized areas off the mid-east coast of Florida, Georgia, South Carolina, and the Gulf of Maine, and from North Carolina through Cape Cod.	Localized areas in the central Gulf of Mexico and Florida Keys. In the Atlantic, localized areas off the mid-east coast of Florida, Georgia, South Carolina, and the Gulf of Maine, and from North Carolina through Cape Cod.
Dusky Shark (highly migratory)	No EFH egg life stage.	Areas along the Atlantic east coast of Florida to the mid-coast of Georgia, South Carolina to southern Cape Cod.	Localized areas in the central Gulf of Mexico, southern Texas, the Florida Panhandle, mid-west coast of Florida, and Florida Keys. Atlantic east coast of Florida, and South Carolina to southern Cape Cod.	Localized areas in the central Gulf of Mexico, southern Texas, the Florida Panhandle, mid-west coast of Florida, and Florida Keys. Atlantic east coast of Florida, and South Carolina to southern Cape Cod.
Finetooth Shark (highly migratory)	No EFH egg life stage.	Along the Gulf of Mexico coast of Texas, eastern Louisiana, Mississippi, Alabama, and the Florida Panhandle. Atlantic east coast along Georgia and South Carolina.	Localized coastal areas along southern Texas and Key West, Florida, and from eastern Louisiana through the Florida Panhandle in the Gulf of Mexico. Atlantic east coast from the mid-coast of Florida to Cape Hatteras.	Localized coastal areas along southern Texas and Key West, Florida, and from eastern Louisiana through the Florida Panhandle in the Gulf of Mexico. Atlantic east coast from the mid-coast of Florida to Cape Hatteras.
Great Hammerhead Shark (highly migratory)	No EFH egg life stage.	Coastal areas throughout the west coast of Florida and scattered in the Gulf of Mexico from Alabama to Texas. Atlantic east coast from the Florida Keys to New Jersey.	Coastal areas throughout the west coast of Florida and scattered in the Gulf of Mexico from Alabama to Texas. Atlantic east coast from the Florida Keys to New Jersey.	Coastal areas throughout the west coast of Florida and scattered in the Gulf of Mexico from Alabama to Texas. Atlantic east coast from the Florida Keys to New Jersey.

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
Lemon Shark (highly migratory)	No EFH egg life stage.	Gulf of Mexico coastal areas along the Texas midcoast and the Florida Keys, and a localized area on the mid-west coast of Florida.	Gulf of Mexico coastal areas along Texas, eastern Louisiana, and the Florida Panhandle through the Florida Keys. Coastal areas along the Atlantic east coast of Florida.	Gulf of Mexico coastal areas along the west coast of Florida through the Florida Keys. Localized coastal areas along the southern and northern east coast of Florida in the Atlantic.
Longbill Spearfish (highly migratory).	No EFH designated.	No EFH designated.	In the central Gulf of Mexico through eastern Louisiana to the Florida Panhandle. In the Atlantic from Florida Keys to the mid-east coast of Florida and localized areas from northern Florida to Cape Cod, with concentrations from North Carolina to Delaware.	Same as juvenile EFH.
Longfin Mako Shark (highly migratory)	No EFH egg life stage.	Offshore central Gulf of Mexico through the Florida Keys. In the Atlantic from southern Florida through South Carolina, off North Carolina, and Cape Hatteras to Cape Cod.	Offshore central Gulf of Mexico through the Florida Keys. In the Atlantic from southern Florida through South Carolina, off North Carolina, and Cape Hatteras to Cape Cod.	Offshore central Gulf of Mexico through the Florida Keys. In the Atlantic from southern Florida through South Carolina, off North Carolina, and Cape Hatteras to Cape Cod.
Night Shark (highly migratory)	No EFH egg life stage.	Offshore in the Gulf of Mexico off Texas, Louisiana, and the Florida Panhandle to the Florida Keys. Southern and mid-east coast of Florida and South Carolina to Delaware in the Atlantic.	Offshore in the Gulf of Mexico off Texas, Louisiana, and the Florida Panhandle to the Florida Keys. Southern and mid-east coast of Florida and South Carolina to Delaware in the Atlantic.	Offshore in the Gulf of Mexico off Texas, Louisiana, and the Florida Panhandle to the Florida Keys. Southern and mid-east coast of Florida and South Carolina to Delaware in the Atlantic.
Nurse Shark (highly migratory)	No EFH egg life stage.	No EFH designated.	Coastal areas in the Gulf of Mexico from the Florida Panhandle to the Florida Keys. Atlantic east coast of Florida to southern Georgia.	Coastal areas in the Gulf of Mexico from the Florida Panhandle to the Florida Keys. Atlantic east coast of Florida.
Oceanic Whitetip	No EFH egg life stage.	Offshore at localized areas in the central Gulf of Mexico and	Offshore at localized areas in the central Gulf of Mexico and	Offshore at localized areas in the central Gulf of Mexico and Florida

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
Shark (highly migratory)		Florida Keys. Offshore in the Atlantic in depths greater than 200 meters from Florida to southern New England.	Florida Keys. Offshore in the Atlantic in depths greater than 200 meters from Florida to southern New England.	Keys. Offshore in the Atlantic in depths greater than 200 meters from Florida to southern New England.
Porbeagle Shark (highly migratory)	No EFH egg life stage.	Localized offshore areas in the Atlantic off northern North Carolina, Delaware, and New Jersey. Southern New England through the Gulf of Maine.	Localized offshore areas in the Atlantic off northern North Carolina, Delaware, and New Jersey. Southern New England through the Gulf of Maine.	Localized offshore areas in the Atlantic off northern North Carolina, Delaware, and New Jersey. Southern New England through the Gulf of Maine.
Roundscale Spearfish (highly migratory, similar to white marlin)	No EFH designated.	No EFH designated.	Offshore in the central Gulf of Mexico from southern Texas to the Florida Panhandle. Florida Keys to mid-east coast of Florida, and Georgia to Cape Cod.	Offshore in the central Gulf of Mexico from southern Texas to the Florida Panhandle. Florida Keys to the mid-east coast of Florida, and South Carolina to Cape Cod.
Sailfish (highly migratory)	Off the southeast coast of Florida to Key West, FL, associated with waters of the Gulf Stream and Florida Straits from 5 mi offshore out to the EEZ boundary.	Off the southeast coast of Florida to Key West, FL, associated with waters of the Gulf Stream and Florida Straits from 5 mi offshore out to the EEZ boundary.	In the central Gulf of Mexico, and off southern Texas, Louisiana, and the Florida Panhandle. Atlantic east coast from the Florida Keys to mid-coast of South Carolina, the Outer Banks of North Carolina, and Maryland.	In the central Gulf of Mexico, and off southern Texas, Louisiana, and the Florida Panhandle. Atlantic east coast from the Florida Keys to mid-coast of South Carolina, the Outer Banks of North Carolina, and Maryland.
Sand Tiger Shark (highly migratory)	No EFH egg life stage.	Along the Atlantic east coast from northern Florida to Cape Cod.	Localized areas along the mid-east coast of Florida and South Carolina and from North Carolina to mid-New Jersey coast in the Atlantic.	Localized areas along the mid and northern east coast of Florida, South Carolina, and southern North Carolina, and from Cape Lookout to southern New Jersey in the Atlantic.
Sandbar Shark (highly migratory)	No EFH egg life stage.	Localized coastal area on the Florida Panhandle. Atlantic coastal areas localized along Georgia and South Carolina, and from Cape Lookout to Long Island, New York.	Localized areas along the Atlantic coast of Florida, South Carolina, and southern North Carolina, and from Cape Lookout to southern New England.	Localized area off of Alabama, and coastal areas from the Florida Panhandle to the Florida Keys in the Gulf of Mexico. Atlantic coastal areas throughout Florida to southern New England.

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
Scalloped Hammerhead Shark (highly migratory)	No EFH egg life stage.	Coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida. Atlantic east coast from the mid-east coast of Florida to southern North Carolina.	Coastal areas in the Gulf of Mexico from the southern to mid-coast of Texas, eastern Louisiana to the southern west coast of Florida, and the Florida Keys. Offshore from the mid-coast of Texas to eastern Louisiana. Atlantic east coast of Florida through New Jersey.	Coastal areas in the Gulf of Mexico along the southern Texas coast, and eastern Louisiana through the Florida Keys. Offshore from southern Texas to eastern Louisiana.
Shortfin Mako Shark (highly migratory)	No EFH egg life stage.	Localized areas in the central Gulf of Mexico and the Florida Keys. In the Atlantic, localized areas off of Florida, South Carolina, and Maine, and from Cape Lookout though southern New England.	Localized areas in the central Gulf of Mexico and the Florida Keys. In the Atlantic, localized areas off of Florida, South Carolina, and Maine, and from Cape Lookout though southern New England.	Localized areas in the central Gulf of Mexico and the Florida Keys. In the Atlantic, localized areas off of Florida, South Carolina, and Maine, and from Cape Lookout though southern New England.
Silky Shark (highly migratory)	No EFH egg life stage.	In the Gulf of Mexico from the southern coast of Texas across the central Gulf of Mexico, and from eastern Louisiana to the Florida Keys. Atlantic east coast from Florida to New Jersey, with localized areas in southern New England.	In the Gulf of Mexico from the southern coast of Texas across the central Gulf of Mexico, and from eastern Louisiana to the Florida Keys. Atlantic east coast from Florida to New Jersey, with localized areas in southern New England.	In the Gulf of Mexico from the southern coast of Texas across the central Gulf of Mexico, and from eastern Louisiana to the Florida Keys. Atlantic east coast from Florida to New Jersey, with localized areas in southern New England.
Skipjack Tuna (highly migratory)	In offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits.	In offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits.	Localized areas in the central Gulf of Mexico from Louisiana through the Florida Panhandle. Localized areas in the Atlantic off of Georgia, South Carolina, and North Carolina to Maryland, and from Delaware to Cape Cod and the southern east coast of Florida through the Florida Keys.	In the central Gulf of Mexico, off of Texas through Florida. Localized areas in the Atlantic off of South Carolina and the northern east coast of Florida, and from Cape Hatteras to Cape Cod and the southern east coast of Florida through the Florida Keys.

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
Smooth dogfish (highly migratory)	No EFH egg life stage.	Offshore areas within the Gulf of Mexico from Texas through Florida. In the Atlantic, nearshore and offshore areas from South Carolina north to Cape Cod and Georges Bank.	Offshore areas within the Gulf of Mexico from Texas through Florida. In the Atlantic, nearshore and offshore areas from South Carolina north to Cape Cod and Georges Bank.	Offshore areas within the Gulf of Mexico from Texas through Florida. In the Atlantic, nearshore and offshore areas from South Carolina north to Cape Cod and Georges Bank.
Spinner shark (highly migratory)	No EFH egg life stage.	Localized coastal areas in the Gulf of Mexico along Texas, eastern Louisiana, the Florida Panhandle, Florida west coast, and the Florida Keys; and in the Atlantic along the east coast of Florida to southern North Carolina.	Gulf of Mexico coastal areas from Texas to the Florida Panhandle, and the mid-west coast of Florida to the Florida Keys. Atlantic east coast of Florida through North Carolina.	Localized areas in the Gulf of Mexico off of southern Texas, Louisiana through the Florida Panhandle, and from the mid-coast of Florida through the Florida Keys. In the Atlantic along the east coast of Florida, and localized areas from South Carolina to Virginia.
Summer flounder	EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral, Florida, to depths of 360 ft.	EFH is the nearshore waters of the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral Florida, in nearshore waters (out to 50 miles from shore). Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database, in the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as greater than 25 ppt) salinity zones.	EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft., from Cape Hatteras, North Carolina to Cape Canaveral, Florida. Inshore, EFH is all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones.	EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft., from Cape Hatteras, North Carolina to Cape Canaveral, Florida. Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer Continental Shelf at depths of 500 ft. in colder months.
Swordfish (highly migratory)	Offshore from off Cape Hatteras, North Carolina extending south around peninsular Florida	Same as EFH for species eggs.	Offshore in the central Gulf of Mexico from southern Texas through the Florida Keys and	Offshore in the central Gulf of Mexico from southern Texas to the Florida Panhandle and western Florida Keys.

Mid-Atlantic Species				
Common Name	**Eggs**	**Larvae/YOY**[173]	**Juveniles**	**Adults**
	through the Gulf of Mexico to the U.S./Mexico border from the 200 m isobaths to the EEZ boundary; associated with the Loop Current boundaries in the Gulf and the western edge of the Gulf Stream in the Atlantic.		Atlantic east coast from south Florida to Cape Cod.	Atlantic east coast from southern Florida to the mid-east coast of Florida, and Georgia to Cape Cod.
Tiger Shark (highly migratory)	No EFH egg life stage.	Off Texas, western Louisiana, and the Florida Panhandle in the Gulf of Mexico. In the Atlantic from the mid-east coast of Florida to Virginia.	In the central Gulf of Mexico and off Texas and Louisiana, and from Mississippi through the Florida Keys. Atlantic east coast from Florida to New England.	In the Gulf of Mexico, from Texas to the west coast of Florida, and the Florida Keys. Atlantic east coast from Florida to southern New England.
White Marlin (highly migratory)	No EFH designated.	No EFH designated.	In the central Gulf of Mexico from southern Texas to the Florida Panhandle. Florida Keys to mid-east coast of Florida, and Georgia to Cape Cod.	In the central Gulf of Mexico from southern Texas to the Florida Panhandle. Florida Keys to the mid-east coast of Florida, and South Carolina to Cape Cod.
White Shark (highly migratory)	No EFH egg life stage.	Along the mid- and southern west coast of Florida in the Gulf of Mexico, and along the mid- and northern east coast of Florida, South Carolina, and North Carolina in the Atlantic. Maryland to Cape Cod.	Along the mid- and southern west coast of Florida in the Gulf of Mexico, and along the mid- and northern east coast of Florida, South Carolina, and North Carolina in the Atlantic. Maryland to Cape Cod.	Along the mid- and southern west coast of Florida in the Gulf of Mexico, and along the mid- and northern east coast of Florida, South Carolina, and North Carolina in the Atlantic. Maryland to Cape Cod.
Yellowfin Tuna (highly migratory)	In offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits.	In offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits.	In the central Gulf of Mexico from Florida Panhandle to southern Texas. Mid-east coast of Florida and Georgia to Cape Cod.	In the central Gulf of Mexico from the Florida Panhandle to southern Texas. Mid-east coast of Florida and Georgia to Cape Cod.

Source: (NOAA 2015c)

Table B-2: Essential Fish Habitat for South Atlantic and Gulf of Mexico Species of Florida

South Atlantic and Gulf of Mexico Species	
Species	**Description of EFH**
Red Drum – Gulf of Mexico	All estuaries; Vermilion Bay, Louisiana, to the eastern edge of Mobile Bay, Alabama, out to depths of 25 fathoms; Crystal River, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; and Cape Sable, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council (GMFMC) and the South Atlantic Fishery Management Council (SAFMC) between depths of 5 and 10 fathoms.
Coastal Migratory Pelagics – Atlantic	EFH for coastal migratory pelagic species includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including *Sargassum*. In addition, all coastal inlets, all state-designated nursery habitats of particular importance to coastal migratory pelagics. For cobia, EFH also includes high salinity bays, estuaries, and seagrass habitat. In addition, the Gulf Stream is an EFH because it provides a mechanism to disperse coastal migratory pelagic larvae. For king and Spanish mackerel and cobia EFH occurs in the South Atlantic and Mid-Atlantic Bights.
Reef Fish and Coastal Migratory Pelagics – Gulf of Mexico	All estuaries; the U.S./Mexico border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 100 fathoms.
Corals - Atlantic	EFH for *Antipatharia* (black corals) includes rough, hard, exposed, stable substrate, offshore in high (30-35%) salinity waters in depths exceeding 18 meters (54 feet), not restricted by light penetration on the outer shelf throughout the management area. EFH habitat for octocorals excepting the order Pennatulacea (sea pens and sea pansies) includes rough, hard, exposed, stable substrate in subtidal to outer shelf depths within a wide range of salinity and light penetration throughout the management area. EFH for Pennatulacea (sea pens and sea pansies) includes muddy, silty bottoms in subtidal to outer shelf depths within a wide range of salinity and light penetration.
Corals – Gulf of Mexico	The total distribution of coral species and life stages throughout the Gulf of Mexico including: coral reefs in the North and South Tortugas Ecological Reserves, East and West Flower Garden Banks, McGrail Bank, and the southern portion of Pulley Ridge; hard bottom areas scattered along the pinnacles and banks from Texas to Mississippi, at the shelf edge and at the Florida Middle Grounds, the southwest tip of the Florida reef tract, and predominant patchy hard bottom offshore of Florida from approximately Crystal River south to the Florida Keys.
Golden Crab - Atlantic	EFH for golden crab includes the U.S. Continental Shelf from Chesapeake Bay south through the Florida Straits (and into the Gulf of Mexico). In addition, the Gulf Stream is an EFH because it provides a mechanism to disperse golden crab larvae.
Stone Crab – Gulf of Mexico	All estuaries; the U.S./Mexico border to Sanibel, Florida, from estuarine waters out to depths of 10 fathoms; and from Sanibel, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 15 fathoms.

South Atlantic and Gulf of Mexico Species	
Species	**Description of EFH**
Snapper-Grouper Species - Atlantic	EFH for snapper-grouper species includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (but to at least 2000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including *Sargassum*, required for larval survival and growth up to and including settlement. In addition the Gulf Stream is an EFH because it provides a mechanism to disperse snapper grouper larvae. For specific life stages of estuarine dependent and nearshore snapper-grouper species, EFH includes areas inshore of the 100-foot contour, such as attached macro algae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom.
Spiny Lobster - Atlantic	EFH for spiny lobster includes nearshore shelf/oceanic waters; shallow subtidal bottom; seagrass habitat; unconsolidated bottom (soft sediments); coral and live/hard bottom habitat; sponges; algal communities (*Laurencia*); and mangrove habitat (prop roots). In addition, the Gulf Stream is an EFH because it provides a mechanism to disperse spiny lobster larvae.
Spiny Lobster – Gulf of Mexico	From Tarpon Springs, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; and Cape Sable, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC out to depths of 15 fathoms.
Peneaid Shrimp - Atlantic	EFH includes inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity, and all interconnecting water bodies. Inshore nursery areas include tidal freshwater (palustrine), estuarine, and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine, and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and intertidal non-vegetated flats. This applies from North Carolina through the Florida Keys.
Rock Shrimp - Atlantic	EFH consists of offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. This applies for all areas from North Carolina through the Florida Keys. In addition the Gulf Stream is an EFH because it provides a mechanism to disperse rock shrimp larvae.
Royal Red Shrimp - Atlantic	EFH includes the upper regions of the continental slope from 180 meters (590 feet) to about 730 meters (2,395 feet), with concentrations found at depths of between 250 meters (820 feet) and 475 meters (1,558 feet) over blue/black mud, sand, muddy sand, or white calcareous mud. In addition the Gulf Stream is an EFH because it provides a mechanism to disperse royal red shrimp larvae.
Shrimp – Gulf of Mexico	All estuaries; the U.S./Mexico border to Fort Walton Beach, Florida, from estuarine waters out to depths of 100 fathoms; Grand Isle, Louisiana, to Pensacola Bay, Florida, between depths of 100 and 325 fathoms; Pensacola Bay, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida, to Naples, Florida, between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.
Dolphin/Wahoo - Atlantic	EFH for dolphin and wahoo includes the Gulf Stream, Charleston Gyre, Florida Current, and pelagic *Sargassum*.

Source: (NOAA 2015c)

Table B-3: FNAI S1 Ranked Terrestrial Communities of Concern in Florida

Vegetative Community Type	EPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Keys Cactus Barren	Southern Florida Coastal Plain	**Everglades and Florida Keys**	Occurs as small patches or larger areas of several acres of low-growing plants, including succulents, with scattered shrubs and occasionally stunted trees. Found over limestone with thin soil and/or leaf litter layer. Characteristic species include three-spined pricklypear (*Opuntia triacantha*), erect pricklypear (*Opuntia stricta*), barbed wire cactus (*Acanthocereus tetragonus*), Yucatan fly mallow (*Cienfuegosia yucatanensis*), Florida Keys indigo (*Indigofera mucronata* var. *keyensis*), skyblue clustervine (*Jacquemontia pentanthos*), and dwarf bindweed (*Evolvulus convolvuloides*).	This community is found only in the Florida Keys and is currently documented at only six sites.
Pine Rockland	Southern Florida Coastal Plain	**Everglades and Florida Keys**	Open tree canopy dominated by South Florida slash pines with a patchy understory of tropical and temperate shrubs, and a perennial herbaceous layer. Limestone outcrops are common in this fire-maintained community. Characteristic species include South Florida slash pine, Christmas berry (*Crossopetalum ilicifolium*), maidenhair pineland fern (*Anemia adiantifolia*), Florida silver palm (*Coccothrinax argentata*), and Florida white-top sedge (*Rhynchospora floridensis*).	This community is found along the Miami Rock Ridge (which extends from Miami into the upper Florida Keys), the lower Florida Keys, and in Big Cypress National Preserve. Similar pinelands are found in Bahamas and the Turks and Caicos.

Vegetative Community Type	EPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Slope Forest	Southeastern Plains	Panhandle	Closed canopy upland hardwood forests found on steep slopes, bluffs, and sheltered ravines in the Apalachicola River drainage. Characteristic species include American beech (*Fagus grandifolia*), Florida torreya (*Torreya taxifolia*), Florida yew (*Taxus floridana*), Ashe's magnolia (*Magnolia ashei*), fringed campion (*Silene polypetala*), eastern leatherwood (*Dirca palustris*), Shumard's oak (*Quercus shumardii*), and Florida maple (*Acer saccharum* ssp. *floridanum*).	In Florida, this community is found only in Gadsden and Liberty Counties along the eastern side of the Apalachicola River; the community then extends into southern Georgia.
Upland Glade	Southeastern Plains	Panhandle	Primarily an herbaceous community with some patchy woody vegetation found on thin soils on limestone outcrops within forested areas. Community is small (found in patches approximately 0.1 to 2 acres). Characteristic species include black bogrush (*Schoenus nigricans*), poverty dropseed (*Sporobolus vaginiflorus*), diamondflowers (*Stenaria nigricans*), hairawn muhly (*Muhlenbergia capillaris*), Boykin's polygala (*Polygala boykinii*), and red cedar (*Juniperus virginiana*).	In Florida, this community is found only in clusters in Jackson and Gadsden Counties; the community is also found in Decatur County, Georgia.

Sources: (Griffith, 2007) (FNAI, 2010a)

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
APE	Area of Potential Effect
AIRFA	American Indian Religious Freedom Act
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BTOP	Broadband Technology Opportunity Program
CAA	Clean Air Act
CCMP	Comprehensive Conservation and Management Plan
CCR	Consumer Confidence Report
CDC	Centers for Disease Control
CEEJ	Center for Environmental Equity and Justice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFA	Controlled Firing Areas
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	Methane
CIMC	Cleanups in My Community
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRS	Community Rating System
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
DHR	Florida Division of Historical Resources
DISDI	Defense Installations Spatial Data Infrastructure
DMS	Florida Department of Management Services
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	Environmental Resource Permit
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
FAA	Federal Aviation Administration

Acronym	Definition
FAC	Florida Administrative Code
FAR	Federal Aviation Regulations
FCC	Federal Communications Commission
FDACS	Florida Department of Agriculture and Consumer Services
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FFWCC	Florida Fish and Wildlife Conservation Commission
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLDEP	Florida Department of Environmental Protection
FLDOH	Florida Department of Public Health
FLL	Fort Lauderdale International Airport
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FNAI	Florida Natural Areas Inventory
FPC	Florida Ports Council
FPSC	Florida Public Service Commission
FRBA	Florida Rural Broadband Alliance
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FTA	Federal Transit Authority
FWC	Florida Fish and Wildlife Conservation Commission
GAO	Government Accountability Office
GAP	Gap Analysis Program
GEMS	Gulf Ecological Management Sites
GHG	Greenhouse Gas
GIO	Geospatial Information Officer
GMFMC	Gulf of Mexico Fishery Management Council
GPO	Government Publishing Office
HAP	Hazardous Air Pollutants
HAPC	Habitat Areas of Particular Concern
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Areas
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
JAX	Jacksonville International
LATF	Land Acquisition Trust Fund
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LMR	Land Mobile Radio
LRR	Land Resource Region
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MCO	Orlando International Airport
MHI	Median Household Income
MIA	Miami International Airport
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MOA	Military Operation Areas

Acronym	Definition
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MYA	Million Years Ago
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NCA	National Conservation Areas
NCED	National Conservation Easement Database
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserves
NFBA	North Florida Broadband Authority
NFIP	National Flood Insurance Program
NHA	National Heritage Area
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NNL	National Natural Landmarks
NOTAM	Notices To Airmen
NO_X	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NST	National Scenic Trail
NTIA	National Telecommunications and Information Administration
NTFI	National Task Force On Interoperability
NWI	National Wetlands Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuge
NWS	National Weather Service
NWSRS	National Wild and Scenic Rivers System
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
ONA	Outstanding Natural Area
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PBI	Palm Beach International
PEM	Palustrine emergent wetlands
PFO	Palustrine forested wetlands
PGA	Peak Ground Acceleration
POP	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSCR	Public Safety Communications Research Program

Acronym	Definition
PSD	Prevention of Significant Deterioration
PSS	Palustrine scrub-shrub wetlands
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RSW	Southwest Florida International
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF_6	Sulfur Hexafluoride
SFWMD	South Florida Water Management District
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SO_X	Oxides of Sulfur
SPL	Sound Pressure Level
SSA	Sole Source Aquifers
SUA	Special Use Airspace
SWEMS	Statewide Emergency Mobile System
SWPP	Stormwater Pollution Prevention Plan
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
TPA	Tampa International Airport
TPY	Tons Per Year
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UAS	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USEPA	United States Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
WCA	Water Conservation Area
WEA	Wildlife Environmental Area
WMA	Wildlife Management Area
WMD	Water Management District
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WQARF	Water Quality Assurance Revolving Fund
WWI	World War I
WWII	World War II

REFERENCES

The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was being written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

40 CFR 230.3(t). (1993, August 25). *Clean Water Act-Guidelines for Specification of Disposal Sites for Dredged or Fill Material*. Retrieved April 6, 2015, from http://www.ecfr.gov/cgi-bin/text-idx?SID=7977290449ab243f2865159951305a77&node=40:25.0.1.3.24&rgn=div5

Adirondack Park Agency. (2013, August 20). *Freshwater Wetlands.* Retrieved March 20, 2015, from Agency Regulations: http://www.apa.ny.gov/Documents/Flyers/FreshwaterWetlands.pdf

Advisory Council on Historic Preservation. (2004, August 5). *36 CFR Part 800 - Protection of Historic Properties.* Retrieved July 21, 2015, from Advisory Council on Historic Preservation: http://www.achp.gov/regs-rev04.pdf

American Trails. (2015a, August 14). *National Trails Training Partnership*. Retrieved September 15, 2015, from http://www.americantrails.org/resources/feds/NatTrSysOverview.html

American Trails. (2015b). *Florida Trail Resources*. Retrieved October 5, 2015, from http://americantrails.org/resources/statetrails/FLstate.html

Amtrak. (2015a). *Auto Train*. Retrieved August 26, 2015, from http://www.amtrak.com/auto-train

Amtrak. (2015b). *Amtrak - Southern Train Routes*. Retrieved August 2015, from Soils: https://www.amtrak.com/south-train-routes

Amtrak. (2015c, April 6). *Amtrak System Timetable.* Retrieved from Amtrak: https://www.amtrak.com/ccurl/294/1015/Amtrak-System-Timetable-Winter-Spring-2016-rev,0.pdf

Balshe, W. (2011). *Power System Considerations for Cell Tower Applications.* Cummins Power Generation. Retrieved from https://www.cumminspower.com/www/literature/technicalpapers/PT-9019-Cell-Tower-Applications-en.pdf

Bense, J. A. (1996). Overview of the Mississippian Stage in the Southeastern United States. *Revista de Arqueología Americana, 10*, 53-71. Retrieved October 2015, from http://www.jstor.org/stable/27768367

Berven, K., & Grudzien, T. (1990). Dispersal in the wood frog (Rana sylvatica): implications for genetic population structure. *Evolution, Volume 44*(Issue 8), 2047-2056. Retrieved from http://www.jstor.org/stable/2409614?seq=1#page_scan_tab_contents

BLM. (1984). *Manual 8400 - Visual Resource Management.* Washington: Department of the Interior, Bureau of Land Management.

BLM. (2005). *Land Use Planning Handbook.* BLM Handbook H-1601-1. Retrieved March 2016, from http://www.blm.gov/wo/st/en/prog/planning/nepa/webguide/document_pages/land_use_planning.html

BLM. (2008). *Reasonably Foreseeable Development Scenario for Fluid Minerals.* doi:http://www.blm.gov/style/medialib/blm/es/jackson_field_office/planning/planning_pdf_florida.Par.65103.File.dat/Florida_RFDS_R1.pdf

BLM. (2012, June 28). *VRM System*. Retrieved October 7, 2015, from http://www.blm.gov/wo/st/en/prog/Recreation/recreation_national/RMS/2.html

BLM. (2014, 08). *DRECP Noise and Vibration*. Retrieved 07 22, 2015, from http://www.blm.gov/style/medialib/blm/ca/pdf/pa/energy/drecp/draft_drecp.Par.37401.File.dat/III.21%20Noise%20and%20Vibration.pdf

BLM. (2015a, August 24). *National Conservation Lands: Jupiter Inlet Lighthouse Outstanding Natural Area*. Retrieved October 26, 2015, from http://www.blm.gov/es/st/en/fo/Jackson_Home_Page/jupiter_ONA.html

BLM. (2015b). *Federal Land Policy and Management Act*. Retrieved October 7, 2015, from http://www.blm.gov/flpma/

BLS. (2013a). *State Occupational Injuries, Illnesses, and Fatalities.* Retrieved September 4, 2015, from http://www.bls.gov/iif/oshwc/osh/os/pr136ct.pdf

BLS. (2013b). *Fatal occupational injuries to private sector wage and salary workers, government workers, and self-employed workers by industry, all United States, 2013.* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/cfoi/cftb0279.pdf

BLS. (2014a, December 4). *Table 1. Incidence rates of nonfatal occupational injuries and illnesses by case type and ownership, selected industries, 2013*. Retrieved September 4, 2015, from http://www.bls.gov/news.release/osh.t01.htm

BLS. (2014b). *Table A-5. Fatal occupational injuries by occupation and event or exposure, all United States, 2014.* Retrieved September 29, 2015, from 2014 Census of Fatal Occupational Injuries (preliminary data): http://www.bls.gov/iif/oshwc/cfoi/cftb0290.pdf

BLS. (2015a, May). *U.S. Bureau of Labor Statistics*. Retrieved from May 2015 State Occupational Employment and Wage Estimates Florida: http://www.bls.gov/oes/current/oes_fl.htm

BLS. (2015b). *Local Area Unemployment Statistics, Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages.* State Data, Annual Average Series, Employment status of the civilian noninstitutional population, annual averages, file staadata.zip. Retrieved April 2015, from http://www.bls.gov/lau/rdscnp16.htm

BLS. (2015c, March 25). *May 2014 State Occupational Employment and Wage Estimates, Florida.* Retrieved October 1, 2015, from Occupational Employment Statistics: http://www.bls.gov/oes/current/oes_fl.htm#49-0000

BLS. (2015d, March 25). *Occupational Employment and Wages, May 2014: 49-9052 Telecommunications Line Installers and Repairers.* Retrieved October 1, 2015, from http://www.bls.gov/oes/current/oes499052.htm

BLS. (2015e, April 22). *State Occupational Injuries, Illnesses, and Fatalities.* Retrieved October 1, 2015, from http://www.bls.gov/iif/state_archive.htm#FL

BLS. (2015f, September 21). *Census of Fatal Occupational Injuries (2011 forward)*. Retrieved September 18, 2015, from http://data.bls.gov/pdq/SurveyOutputServlet;jsessionid=D50AB7BE7C7731D5A8549E2E0212D1CD.tc_instance4

BLS. (2015g, November 19). *Schedule of upcoming releases and access to archived news releases*. Retrieved February 16, 2016, from Injuries, Illnesses, and Fatalities: http://www.bls.gov/iif/osh_nwrl.htm

BLS. (2016, March 30). *Telecommunications: NAICS 517*. Retrieved from Industries at a Glance: http://www.bls.gov/iag/tgs/iag517.htm

Bond, S., Sims, S., & Dent, P. (Eds.). (2013). *Towers, Turbines, and Transmission Lines: Impacts on Property Value.* Chichester, West Sussex, United Kingdom: Wiley-Blackwell.

Bureau of Historic Preservation. (2012). *Preserving Florida's Heritage: More Than Orange Marmalade, 2012-2016.* Florida Department of State, Division of Historical Resources. Tallahassee: Bureau of Historic Preservation, Division of Historical Resources, Florida Department of State. Retrieved October 2015, from https://ia601407.us.archive.org/10/items/62683_FDS_84Pg_Publication/62683_FDS_84Pg_Publication.pdf

Calhoun, A., & DeMaynadier, P. (2007). Science and conservation of vernal pools in northeastern North America: ecology and conservation of seasonal wetlands in northeastern North America. *CRC Press LLC.* Retrieved from http://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/Ch12_ScienceConservationofVernalPools.pdf

Carr, C., & Sears, D. W. (1985). Toward Analysis of the Exchange of Meteorotic Iron in the Middle Woodland. *Southeastern Archaeology, 4*(2), 79-92. Retrieved October 2015, from http://www.jstor.org/stable/40712805

Carr, R. S. (2012). *Digging Miami.* Gainesville: University Press of Florida. Retrieved August 8, 2016

CDC. (1992, September 18). *Rapid Health Needs Assessment Following Hurricane Andrew -- Florida and Louisiana, 1992.* Retrieved October 2, 2015, from http://www.cdc.gov/mmwr/preview/mmwrhtml/00017631.htm

CDC. (2015, November 30). *CDC WONDER: Underlying Cause of Death, 1999-2013 Results.* Retrieved November 30, 2015, from http://wonder.cdc.gov/

CEC. (2011, April). *North American Terrestrial Ecoregions - Level III.* Retrieved from USEPA Ecoregions of North America: ftp://ftp.epa.gov/wed/ecoregions/pubs/NA_TerrestrialEcoregionsLevel3_Final-2june11_CEC.pdf

Center for Climate Change Strategies. (2008). *Final Florida Greenhouse Gas Inventory and Reference Case Projections 1990-2025.* Retrieved 10 5, 2015, from file:///C:/Users/578245/Downloads/FL%20Final%20I&F%20Report%20(2).pdf

CEQ. (1997, December). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Retrieved April 2015, from http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-EJGuidance.pdf

Charlotte Harbor National Estuary Program . (2013). *Comprehensive Conservation and Management Plan*. Retrieved August 28, 2015, from http://www.chnep.org/CCMP/CCMP2013.pdf

CIO Council. (2015). *Data Center Consolidation and Optimization*. Retrieved from https://cio.gov/drivingvalue/data-center-consolidation/

City of Lincoln. (2015). *What are Saline Wetlands?* Retrieved July 2015, from http://lincoln.ne.gov/city/parks/parksfacilities/wetlands/wetlandsinfo.htm

Coladonato, M. (1992). *Index of Species Information: Cyrilla racemiflora*. Retrieved from Fire Effects Information System: http://www.fs.fed.us/database/feis/plants/shrub/cyrrac/all.html

Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T. (1979). *Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31*. Retrieved April 4, 2015, from http://www.fws.gov/wetlands/Documents/classwet/index.html

CSC. (2007, March). Retrieved from Telecommunications Facilities: An Illustrated Primer on the Siting of Facilities within Connecticut and Throughout the Nation: http://www.ct.gov/csc/lib/csc/csc_tower_3_07.pdf

Daytona Beach Area CVB. (2015). *Daytona Beach*. Retrieved August 2015, from http://www.daytonabeach.com/

Daytona International Speedway. (2015). *Daytona International Speedway*. Retrieved August 2015, from http://www.daytonainternationalspeedway.com/?homepage=true

DEP. (2000). *Florida's Statewide Comprehensive Outdoor Recreation Plan*. Retrieved from http://www.dep.state.fl.us/parks/planning/forms/OutdoorRecreationinFlorida2000.pdf

DEP. (2010). *Loxahatchee River National Wild and Scenic River Managment Plan*. Retrieved August 8, 2015, from http://www.rivers.gov/documents/plans/loxahatchee-plan.pdf

DEP. (2011a). *Myakka River Wild and Scenic Management Plan*. Retrieved August 08, 2015, from http://www.myakkarivermanagement.org/Files/MWSRMS%20Final/MYAKKA%20WILD%20AND%20SCENIC%20RIVER%20MANAGEMENT%20PLAN%20-Final.pdf

DEP. (2011b). *Overview of the Wetland and Other Surface Water Regulatory and Propreitary Programs in Florida*. Retrieved May 2015, from http://www.dep.state.fl.us/water/wetlands/docs/erp/overview.pdf

DEP. (2012a). *Salt Marsh Restoration*. Retrieved October 19, 2015, from http://www.dep.state.fl.us/northwest/ecosys/section/restoresaltmarsh.htm

DEP. (2012b, March 28). *Stationary Sources - Preconstrution Review: Chapter 62-212.* Retrieved October 5, 2015, from http://www.dep.state.fl.us/air/rules/fac/62-212.pdf

DEP. (2012c). *Air Monitoring Report.* Retrieved October 5, 2015, from http://www.dep.state.fl.us/air/air_quality/techrpt/AMR2012.pdf

DEP. (2013, November 13). *State Funded Cleanup Program.* Retrieved from http://www.dep.state.fl.us/waste/categories/wc/pages/cleanup/pages/statesites.htm

DEP. (2014a). *Florida Geological Survey - Hazards and Earthquakes*. Retrieved March 2015, from http://www.dep.state.fl.us/geology/geologictopics/hazards/tsunamis.htm

DEP. (2014b). *Florida Geological Survey: Hazards - Landslides*. Retrieved March 2015, from http://www.dep.state.fl.us/geology/geologictopics/hazards/landslides.htm

DEP. (2014c). *Florida Coastal Management Program Guide*. Retrieved July 28, 2015, from http://www.dep.state.fl.us/cmp/publications/FCMP_Program_Guide_2014.pdf

DEP. (2014d). *Florida's Gulf Ecological Management Sites*. Retrieved August 12, 2015, from http://www.dep.state.fl.us/coastal/programs/gems.htm

DEP. (2014e, June 4). *Water Management Districts*. Retrieved October 5, 2015, from http://dep.state.fl.us/secretary/watman/default.htm

DEP. (2014f, August 25). *Stationary Sources - General Requirements: Chapter 62-210.* Retrieved October 5, 2015, from http://www.dep.state.fl.us/air/rules/fac/62-210.pdf

DEP. (2014g). *Florida Geological Survey -- Frequently Asked Questions*. Retrieved March 2015, from http://dep.state.fl.us/geology/contactus/faq.htm#14

DEP. (2014h). *Integrated Water Quality Assessment for Florida*. Retrieved August 12, 2015, from http://www.dep.state.fl.us/water/docs/2014_integrated_report.pdf

DEP. (2015a, September). *Source & Drinking Water Program*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/drinkingwater/

DEP. (2015aa, August 13). *Division of Waste Management.* Retrieved from http://www.dep.state.fl.us/waste/

DEP. (2015ab, June 30). *Brownfields Redevelopment Program.* Retrieved from http://www.dep.state.fl.us/waste/categories/brownfields/

DEP. (2015b, September). *Consumer Confidence Reports*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/drinkingwater/ccr.htm

DEP. (2015c, September). *Ground Water Program*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/groundwater/index.htm

DEP. (2015d, September). *General Facts and Statistics about Wastewater in Florida*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/wastewater/facts.htm

DEP. (2015e, September). *Wastewater Program*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/wastewater/index.htm

DEP. (2015f, September). *Florida's Reuse Activities*. Retrieved September 2015, from Florida Department of Environmental Protection: http://www.dep.state.fl.us/water/reuse/activity.htm

DEP. (2015g, September). *Solid Waste Main Page*. Retrieved September 2015, from Florida Department of Energy: http://www.dep.state.fl.us/waste/categories/solid_waste/

DEP. (2015h, September). *Florida Department of Environmental Protection Water Assurance Compliance System Solid Waste Facility Inventory Report*. Retrieved September 2015, from Florida Department of Environmental Protection: https://fldeploc.dep.state.fl.us/www_wacs/Reports/SW_Facility_Inventory_res1.asp

DEP. (2015i, September). *Florida Municipal Solid Waste Collected and Recycled (2014).* Retrieved September 2015, from Florida Department of Environmental Protection: ftp://ftp.dep.state.fl.us/pub/reports/Recycling/Reports/2014AnnualReport/MSW-Composition_2014.pdf

DEP. (2015j, September). *Florida Municipal Solid Waste Management (2014)*. Retrieved September 2015, from Florida Department of Environmental Protection: ftp://ftp.dep.state.fl.us/pub/reports/Recycling/Reports/2014AnnualReport/MSW-Management_2014.pdf

DEP. (2015k, September). *MSW Collected by Generator Type in Florida (2014)*. Retrieved September 2015, from Florida Department of Environmental Protection: ftp://ftp.dep.state.fl.us/pub/reports/Recycling/Reports/2014AnnualReport/MSW-Generators_2014.pdf

DEP. (2015l, April 2). *Fossils*. Retrieved from Florida Geological Survey - Geology Topics: http://www.dep.state.fl.us/geology/geologictopics/fossil.htm

DEP. (2015m). *Watershed Management*. Retrieved July 28, 2015, from http://www.dep.state.fl.us/water/watersheds/

DEP. (2015n). *Factsheet about Outstanding Florida Waters*. Retrieved August 7, 2015, from http://www.dep.state.fl.us/water/wqssp/ofwfs.htm

DEP. (2015o). *Water Quality Report Cards*. Retrieved August 21, 2015, from http://www.dep.state.fl.us/water/monitoring/report-cards.htm

DEP. (2015p). *Map Direct: Status Report Card*. Retrieved August 21, 2015, from http://ca.dep.state.fl.us/mapdirect/?focus=watermonrepcard

DEP. (2015q). *Trends in Selected Water Quality Indicators at Surface Water Stations (Adjusted for River Flow)*. Retrieved August 21, 2015, from http://publicfiles.dep.state.fl.us/DEAR/Watershed%20Monitoring/Report-Card/2014ir-sw-trend/SW_Trend_Tables.pdf

DEP. (2015r). *Federal/State Wetland Delineation vs. Jurisdiction*. Retrieved May 2015, from http://www.dep.state.fl.us/water/wetlands/delineation/docs/delvjur.pdf

DEP. (2015s, February). *What are Mangroves?* Retrieved May 2015, from Mangroves "Walking Trees": http://www.dep.state.fl.us/coastal/habitats/mangroves.htm

DEP. (2015t, January 27). *Mangroves are a Valuable Coastal Resource*. Retrieved October 19, 2015, from http://www.dep.state.fl.us/central/Home/SLERP/Mangroves/mangroves.htm

DEP. (2015u). *Florida State Owned Lands and Records Information System*. Retrieved October 2015, from http://www.dep.state.fl.us/lands/fl_solaris.htm

DEP. (2015v). *Greenways and Trails*. Retrieved August 2015, from http://www.dep.state.fl.us/gwt/

DEP. (2015w). *Florida Circumnavigational Saltwater Paddling Trail*. Retrieved August 2015, from http://www.dep.state.fl.us/gwt/paddling/saltwater.htm

DEP. (2015x, April 6). *About Us*. Retrieved October 21, 2015, from http://dep.state.fl.us/lands/about.htm

DEP. (2015y, January 14). *Air Pollution Control - General Provisions: Chapter 62-204.* Retrieved October 5, 2015, from http://www.dep.state.fl.us/air/rules/fac/62-204.pdf

DEP. (2015z, May). *Annual Air Monitoring Network Plan.* Retrieved October 5, 2015, from http://www.dep.state.fl.us/air/air_quality/techrpt/AMP-2015.pdf

Department of Transportation. (2015a). *Federal Railroad Administration Horn Noise FAQ*. Retrieved 07 22, 2015, from https://www.fra.dot.gov/Page/P0599

Department of Transportation. (2015b). *National Transportation Atlas Database*. Retrieved July 2015, from Bureau of Transportation Statistics National Transportation Atlas Database: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/index.html

Detroit Publishing Company. (1880). Ponce de Leon [Hotel]. *Library of Congress Prints and Photographs Online Collection*. St. Augustine, Florida: Library of Congress. Retrieved October 2015, from http://www.loc.gov/resource/det.4a26940/

Di Gregorio, A., & Jansen, L. J. (1998). *Land Cover Classification System (LCCS): Classification Concepts and User Manual.* Rome: Food and Agriculture Organization of the United Nations.

Diesel Service & Supply. (2016, June). *Approximate Diesel Fuel Consumption Chart*. Retrieved from http://www.dieselserviceandsupply.com/Diesel_Fuel_Consumption.aspx

DoD. (2014). *Base Structure Report - Fiscal Year 2014 Baseline; A Summary of the Real Property Inventory.* Retrieved September 2015, from http://www.acq.osd.mil/ie/download/bsr/Base%20Structure%20Report%20FY14.pdf

DOE. (2015). *Climate Changes and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions.* Washington, DC: Department of Energy.

eBird. (2015a). *eBird Range Map--Bald Eagle*. Retrieved from http://ebird.org/ebird/map/baleag?bmo=1&emo=12&byr=2011&eyr=2015&__hstc=75100365.64b7254677ac8cc5c8f21aa17c0b9689.1442877327577.1442877327577.1442877327577.1&__hssc=75100365.4.1442877327577&__hsfp=3470679313#_ga=1.21938685.790432658.1442877326

eBird. (2015b). *eBird Range Map--Golden Eagle*. Retrieved from http://ebird.org/ebird/map/goleag?bmo=1&emo=12&byr=2011&eyr=2015#_ga=1.21938685.790432658.1442877326

Edinger, G. J., Evans, D. J., Gebauer, S., Howard, T. G., Hunt, D. M., & Olivero, A. M. (2014, March). *Ecological Communities of New York State.* Retrieved March 19, 2015, from A revised and expanded edition of Carol Reschke's Ecological Communities of New York State.: http://www.dec.ny.gov/animals/97703.html

EIA. (2013). *Florida State Profile and Energy Estimates*. Retrieved March 2015, from http://www.eia.gov/state/analysis.cfm?sid=FL

EIA. (2015a, October). *Electricity*. Retrieved November 2015, from U.S. Energy Information Administration: http://www.eia.gov/electricity/data/state/

EIA. (2015b, July 7). *How much carbon dioxide is produced by burning gasoline and diesel fuel?* Retrieved September 21, 2015, from http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11

EIA. (2015c). *Florida -- Profile Overview*. Retrieved October 2015, from http://www.eia.gov/state/?sid=FL

EIA. (2015d). *Greenhouse Gas Emissions Overview*. Retrieved 07 28, 2015, from Emissions of Greenhouse Gases in the United States: http://www.eia.gov/environment/emissions/ghg_report/ghg_overview.cfm

EIA. (2015e, October 26). *State CO2 Emissions - 1980 to 2013*. Retrieved April 26, 2016, from http://www.eia.gov/environment/emissions/state/

EIA. (2015f, September). *Electricity Data Browser- Florida*. Retrieved September 2015, from U.S. Energy Information Administration: http://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vtvo&geo=000001&sec=g&linechart=ELEC.PRICE.NY-RES.A~ELEC.PRICE.NY-COM.A~ELEC.PRICE.NY-IND.A~ELEC.PRICE.NY-TRA.A~ELEC.PRICE.NY-OTH.A&freq=A&start=2001&end=2014&ctype=linechart&ltype=pin&

EIA. (2015g, October 26). *State-Level Energy-Related Carbon Dioxide Emissions 2000-2013*. Retrieved April 26, 2016, from http://www.eia.gov/environment/emissions/state/analysis/

EIA. (2015h, October 26). *State CO2 Emissions - 1980 to 2013*. Retrieved April 26, 2016, from http://www.eia.gov/environment/emissions/state/

EIA. (2015i, May 21). *Florida - State Profile and Energy Estimates*. Retrieved October 2, 2012, from http://199.36.140.204/state/?sid=FL

EIA. (2016). *Glossary - Electricity*. Retrieved from U.S. Energy Information Administration: https://www.eia.gov/tools/glossary/?id=electricity

Executive Office of the President. (1994, February). *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.* Retrieved April 2015, from 59 Federal Register 7629: https://federalregister.gov/a/94-3685

FAA. (2007). *Hearing and Noise in Aviation*. Retrieved 07 22, 2015, from https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

FAA. (2008). *Chapter 14 Airspace.* Retrieved June 2015, from Pilot's Handbook of Aeronautical Knowledge: http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/phak%20-%20chapter%2014.pdf

FAA. (2012a). *Advisory Circular AC 36-3H.* Retrieved 07 22, 2015, from http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC36-3H%20Chg%201.pdf

FAA. (2012b). *Evaluation for new obstruction lighting techniques to reduce avian fatalities.* Retrieved from http://www.tc.faa.gov/its/worldpac/techrpt/tctn12-9.pdf

FAA. (2013). *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap.* Washington D.C.: U.S. Department of Transportation Federal Aviation Administration.

FAA. (2014a, January). *Federal Aviation Administration, Air Traffic Organization*. Retrieved June 2015, from http://www.faa.gov/about/office_org/headquarters_offices/ato/

FAA. (2014b, August 6). *FAA Air Traffic Organization Policy, JO 7400.9Y, Airspace Designations and Reporting Points*. (F. A. U.S. Department of Transportation, Producer) Retrieved July 2015, from FAA, Regulations & Policies, Orders & Notices: http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.list/parentTopicID/10

FAA. (2015a, June 25). *Airport Data and Contact Information*. Retrieved July 10, 2015, from http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015b, September). *Passenger Boarding and All-Cargo Data*. Retrieved September 15, 2015, from http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/?year=2014

FAA. (2015c, March). *Flight Standards District Offices (FSDO)*. Retrieved June 2015, from http://www.faa.gov/about/office_org/field_offices/fsdo/

FAA. (2015d). *Aeronautical Information Manual*. Retrieved August 2015, from http://www.faa.gov/air_traffic/publications/media/aim.pdf

FAA. (2015e). *Obstruction Evaluation / Airport Airspace Analysis (OE/AAA)*. Retrieved July 2015, from Federal Aviation Administration: https://oeaaa.faa.gov/oeaaa/external/portal.jsp

FAA. (2015f). *Air Traffic Organization Policy Order JO 7400.8Y, Subject: Special Use Airspace.* Retrieved July 2015, from http://www.faa.gov/documentlibrary/media/order/7400_8y_2016.pdf

FAA. (2015g, August 05). *FAA Pilot Safety Brochure - Hearing and Noise in Aviation.* Retrieved 08 05, 2015, from FAA.gov: https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

FAA. (2015h, June 15). *Airport Data and Contact Information*. Retrieved July 10, 2015, from http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015i). *Aviation System Performance Metrics (ASPM) Database*. Retrieved 07 22, 2015, from https://aspm.faa.gov/apm/sys/AnalysisAP.asp

FAC, FAR. (2014). *5B-57.007: Noxious Weed List - Florida Administrative Rules, Law, Code, Register.* Retrieved from https://www.flrules.org/gateway/ruleNo.asp?id=5B-57.007

FCC. (2000, August). *Deployment of Advanced Telecommunications Capability: Second Report.* Retrieved Nov 16, 2015, from https://transition.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00290.pdf

FCC. (2012, March 13). *Final Programmatic Environmental Assessment for the Antenna Structure Registration Program.* Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-312921A1.pdf

FCC. (2013). *Universal Service Monitoring Report.* Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-330829A1.pdf

FCC. (2014a). *Internet Access Services: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau. Federal Communications Commission. Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-329973A1.pdf

FCC. (2014b). *Local Telephone Competition: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau. Retrieved from https://apps.fcc.gov/edocs_public/attachmatch/DOC-329975A1.pdf

FCC. (2015a). *Master PSAP Registry, V 2.0.* PSAP Registry Data Report. Retrieved from https://www.fcc.gov/general/9-1-1-master-psap-registry

FCC. (2015b, June 17). *Antenna Structure Registration*. Retrieved June 17, 2015, from Federal Communications Commission: http://wireless2.fcc.gov/UlsApp/AsrSearch/asrRegistrationSearch.jsp

FCC. (2016a, March). *National Broadband Plan Chapter 16 Public Safety*. Retrieved March 29, 2016, from Broadband.gov: http://www.broadband.gov/plan/16-public-safety/

FCC. (2016b, February 1). *Tower and Antenna Siting*. Retrieved February 10, 2016, from https://www.fcc.gov/general/tower-and-antenna-siting

FCC. (2016c, June). *Detail - Microwave*. Retrieved from Application Search Help: http://wireless2.fcc.gov/helpfiles/applicationSearch/ad_microwave.html

FDACS. (2008). *Aquatic Plant Importation, Transportation, and Non-Nursery Cultivation, Possession and Collection (FAC 5B-64).* Retrieved from https://www.flrules.org/gateway/ChapterHome.asp?Chapter=5B-64

FDACS. (2015). *Invasive non-native plants - Florida*. Retrieved from http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Forest-Health/Invasive-Non-Native-Plants

FDOS. (2013). *Introduction or release of plant pests, noxious weeds, arthropods, and biological control agents*. Retrieved from https://www.flrules.org/gateway/ChapterHome.asp?Chapter=5b-57

FDOT. (2009, December). *The Florida Rail System Plan: Policy Element*. Retrieved September 15, 2015, from http://www.dot.state.fl.us/rail/PlanDevel/Documents/2009PolicyElementoftheRailSystemPlan-webfinal.pdf

FDOT. (2010). *Rail System Plan - 2010 Investment Element.* Tallahassee: Florida Department of Transportation.

FDOT. (2014). *2014 Florida Transit Handbook*. Retrieved September 15, 2015, from http://www.dot.state.fl.us/transit/Pages/2014FloridaTransitHandbook.pdf

FDOT. (2015a, September). *About FDOT*. Retrieved September 15, 2015, from http://www.dot.state.fl.us/agencyresources/aboutFDOT.shtm

FDOT. (2015b, September). *Florida's Transportation System by the Numbers*. Retrieved September 15, 2015, from http://www.dot.state.fl.us/intermodal/system/

FDOT. (2015c, September). *Scenic Highways*. Retrieved September 15, 2015, from http://www.dot.state.fl.us/projectmanagementoffice/highwaybeautification/scenichighways.shtm

FDOT. (2015d, September). *Seaport Office*. Retrieved September 2015, from Florida Department of Transportation: http://www.dot.state.fl.us/seaport/seamap.shtm

FDOT. (2015e). *FDOT, Aviation and Spaceports Office*. Retrieved September 2015, from http://www.dot.state.fl.us/aviation/mission.shtm

FDOT. (2015f). *FDOT, Aviation and Spaceports Office, Airport and Airspace Protection*. Retrieved September 2015, from http://www.dot.state.fl.us/aviation/compland.shtm

FDOT. (2015g). *Florida Department of Transportation Research.* Retrieved from Development of a Geographic Information System (GIS) Tool for the Preliminary Assessment of the Effects of Predicted Sea Level and Tidal Change on Transportation Infrastructure: http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_PL/FDOT-BDK75-977-63-sum.pdf

FDOT. (2016, July). *Seaport System*. Retrieved from Florida Department of Transportation: http://www.dot.state.fl.us/seaport/seamap.shtm

Federal Mining Dialogue. (2015a, January 6). *Abandoned Mine Lands Portal - Staying Safe*. Retrieved September 29, 2015, from http://www.abandonedmines.gov/ss.html

FEMA. (2000). *44 CFR Section 59.1 of the National Flood Insurance Program (NFIP) Regulations: Definitions of NFIP Terms.* Retrieved May 2015, from http://www.fema.gov/media-library/assets/documents/12437?id=3064

FEMA. (2010, March). *Guidelines for Estimation of Percolation losses for NFIP Studies.* Retrieved August 6, 2015, from FEMA: http://www.fema.gov/media-library-data/20130726-1731-25045-9495/dl_perc.pdf

FEMA. (2013). *Unit 3: NFIP Flood Studies and Maps*. Retrieved May 2015, from http://www.fema.gov/media-library-data/20130726-1539-20490-0241/nfip_sg_unit_3.pdf

FEMA. (2014a, May). *Chapter 8: Floodplain Natural Resources and Functions*. Retrieved May 2015, from https://training.fema.gov/hiedu/docs/fmc/chapter%208%20-%20floodplain%20natural%20resources%20and%20functions.pdf

FEMA. (2014b, May). *Chapter 2: Types of Floods and Floodplains*. Retrieved May 2015, from http://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf

FEMA. (2014c, May). *The National Flood Insurance Program Community Status Book.* Retrieved May 2015, from http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

FEMA. (2014d, May). *Community Rating System.* Retrieved May 2015, from http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf

FEMA. (2015, April). *Floodplain Management Fact Sheet*. Retrieved May 2015, from https://www.fema.gov/floodplain-management-fact-sheet

Fenneman, N. (1916). *Physiographic subdivision of the United States.* Retrieved from http://www.jstor.org/stable/83422

FFWCC. (2013). *A Species Action Plan for the Rim Rock Crowned Snake.* http://myfwc.com/media/2738843/Rim-Rock-Crowned-Snake-Species-Action-Plan-Final-Draft.pdf.

FGDC. (2013, August). *Classification of Wetlands and Deepwater Habitats of the United States.* Retrieved April 17, 2015, from FGDC Subcommittee on Wetlands Data: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/wetlands/nvcs-2013

FHWA. (2009, October). *Advances in Wildlife Crossing Technologies*. Retrieved July 12, 2016, from Public Roads: http://www.fhwa.dot.gov/publications/publicroads/09septoct/03.cfm

FHWA. (2011). *Highway Traffic and Construction Noise.* Retrieved 07 27, 2015, from fhwa.dot.gov: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/probresp.cfm#appendix

FHWA. (2012, September 14). *Briefing Room / Press Releases*. Retrieved August 31, 2015, from http://www.fhwa.dot.gov/pressroom/fhwa0227.cfm

FHWA. (2013, September 3). *National Scenic Byways Program - Intrinsic Qualities: Identification and Distinctions*. Retrieved May 2016, from http://www.fhwa.dot.gov/hep/scenic_byways/byway_quality/analysis/iq_identification.cfm

FHWA. (2014, October 21). *Public Road Length*. Retrieved September 9, 2015, from http://www.fhwa.dot.gov/policyinformation/statistics/2013/hm10.cfm

FHWA. (2015a, May 28). *Bridges by State and County 2014*. Retrieved September 15, 2015, from http://www.fhwa.dot.gov/bridge/nbi/no10/county14.cfm#fl

FHWA. (2015b). *Route Log and Finder List*. Retrieved July 1, 2015, from Federal Highway Administration: http://www.fhwa.dot.gov/reports/routefinder/#s09

FHWA. (2015c, November). *Florida*. Retrieved November 3, 2015, from http://www.fhwa.dot.gov/byways/states/FL

FHWA. (2015d). *America's Byways*. Retrieved June 2015, from http://www.fhwa.dot.gov/byways/

FHWA. (2015e). *America's Byways: Florida*. Retrieved October 4, 2015, from http://www.fhwa.dot.gov/byways/states/FL

FHWA. (2015f, May). *Highway Traffic Noise*. Retrieved 07 22, 2015, from http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm

Fiber Optic Association. (2010). *Guide to Fiber Optics & Premises Cabling*. Retrieved September 21, 2015, from Safety in Fiber Optic Installations: http://www.thefoa.org/tech/safety.htm

FLDEP. (2008). *Final Florida Greenhouse Gas Inventory and Reference Case Projections 1990-2025.* Retrieved 10 5, 2015, from https://www.dep.state.fl.us/air/about_air/climate/FLGHG%20Inventory_1990thru2007.doc

FLDOH. (2015). *Hazardous Waste Site Health Risk Assessment Program*. Retrieved October 1, 2015, from http://www.floridahealth.gov/environmental-health/hazardous-waste-sites/index.html

Fletcher, W. L. (2012). *Tropical Connections: South Florida's marine environment.* IAN Press. Retrieved from http://www.aoml.noaa.gov/outreach/floridaseagrant/pdf_files/TropicalConnections_5SpeciesSeaTurtles_KruczynskiFletcher.pdf

FLL. (2015a, September). *About Us*. Retrieved September 15, 2015, from http://www.broward.org/Airport/About/Pages/Default.aspx

FLL. (2015b, September 4). *Monthly Statistics*. Retrieved September 15, 2015, from http://www.broward.org/Airport/About/Documents/Monthlyfllstatsjuly2015.pdf

Florida Department of Agriculture and Consumer Service. (2013). *Withlacoochee State Forest*. Retrieved August 2015, from http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/State-Forests/Withlacoochee-State-Forest

Florida Department of Agriculture and Consumer Services. (2015a). *State Forests*. Retrieved October 5, 2015, from http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/State-Forests

Florida Department of Agriculture and Consumer Services. (2015b). *Peace River State Forest*. Retrieved October 5, 2015, from http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/State-Forests/Picayune-Strand-State-Forest

Florida Department of Economic Opportunity. (2015). *Community Planning*. Retrieved October 2015, from http://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents

Florida Department of Management Services. (2015). *2015 Law Enforcement Communications Plan.* Florida DMS. Retrieved from http://www.dms.myflorida.com/content/download/117099/643843/Law_enf_comm_Plan_final.pdf

Florida Department of State. (2015a). *A Brief History*. Retrieved September 15, 2015, from http://dos.myflorida.com/florida-facts/florida-history/a-brief-history/

Florida Department of State. (2015b). *Prehistoric Native People*. Retrieved October 2015, from http://dos.myflorida.com/florida-facts/florida-history/prehistoric-native-people/

Florida Department of State. (2015c, October). *Florida History*. Retrieved October 2015, from My Florida: http://dos.myflorida.com/florida-facts/florida-history/

Florida Division of Emergency Management. (2013). *Section 3.0 State Risk Assessment.* Retrieved from 2013 State of Florida Enhanced Hazard Mitigation Plan: http://www.floridadisaster.org/Mitigation/State/documents/2013stateplan/Section%203%20State%20Risk%20Assessment%20FINAL.pdf

Florida Division of Historical Resources. (2015a). *Florida's Comprehensive Historic Preservation Plan 2012–2016.* Retrieved September 2015, from http://info.flheritage.com/comprehensive-plan/

Florida Division of Historical Resources. (2015b). *Florida Master Site FIle*. Retrieved October 6, 2015, from http://dos.myflorida.com/historical/preservation/master-site-file/

Florida Legislature. (2015a). *Online Sunshine, The 1998 Florida Statutes*. Retrieved October 6, 2015, from http://www.leg.state.fl.us/STATUTES/index.cfm?StatuteYear=1998&Tab=statutes&Submenu=1

Florida Legislature. (2015b). *Online Sunshine, The 2015 Florida Statutes*. Retrieved October 6, 2015, from http://www.leg.state.fl.us/STATUTES/

Florida Museum of Natural History. (2015). *Amphicyon longiramus*. Retrieved April 2015, from Vertebrate Fossil Species of Florida: http://www.flmnh.ufl.edu/florida-vertebrate-fossils/species/amphicyon-longiramus/

Florida Oceans and Coastal Council. (2010, December). *Climate Change and Sea Level Rise in Florida*. Retrieved November 2015, from http://www.dep.state.fl.us/oceanscouncil/reports/climate_change_and_sea_level_rise.pdf

Florida Scenic Highway. (2015). *Stories from the Road*. Retrieved October 4, 2015, from http://floridascenichighways.com/stories-from-the-road/

Florida State Parks. (2015a). *Welcome to Perdido Key State Park*. Retrieved August 2015, from https://www.floridastateparks.org/park/perdido-key

Florida State Parks. (2015b). *Welcome to Letchworth Mounds*. Retrieved August 2015, from https://www.floridastateparks.org/park/Letchworth

Florida State Parks. (2015c). *Welcome to Lake Jackson Mounds Archaeological State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/Lake-Jackson

Florida State Parks. (2015d). *Welcome to Little Talbot Island State Park.* Retrieved August 2015, from https://www.floridastateparks.org/parks/little-talbot-island-state-park

Florida State Parks. (2015e). *Welcome to Anastasia State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/anastasia

Florida State Parks. (2015f). *Welcome to General James A. Van Fleet State Trail*. Retrieved August 2015, from https://www.floridastateparks.org/trail/Van-Fleet

Florida State Parks. (2015g). *Welcome to North Peninsula State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/north-peninsula

Florida State Parks. (2015h). *Welcome to Washington Oaks Gardens State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/Washington-Oaks

Florida State Parks. (2015i). *Welcome to Avalon State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/Avalon

Florida State Parks. (2015j). *Welcome to Fort Pierce Inlet State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/Fort-Pierce-Inlet

Florida State Parks. (2015k). *Welcome to Lovers Key State Park*. Retrieved August 2015, from https://www.floridastateparks.org/park/Lovers-Key

Florida State Parks. (2015l). *Welcome to Delnor-Wiggins Pass State Park.* Retrieved August 2015, from https://www.floridastateparks.org/park/Delnor-Wiggins

Florida State Parks. (2015m). *Home Page.* Retrieved October 5, 2015, from https://floridastateparks.org/

Florida State Parks. (2015n). *Welcome to Florida Caverns State Park*. Retrieved October 4, 2015, from https://www.floridastateparks.org/park/Florida-Caverns

Florida State Parks. (2015o). *Main Florida State Parks Map*. Retrieved October 5, 2015, from https://floridastateparks.org/interactive-map

Florida State Parks. (2015p). *Activities*. Retrieved October 5, 2015, from https://floridastateparks.org/things-to-do/activities

Florida State Parks. (2015q). *Guide to Designated State Greenway and Trails*. Retrieved October 5, 2015, from https://floridastateparks.org/things-to-do/state-trails

FNAI. (2000a). *Carter's small-flowered flax.* Retrieved from http://www.fnai.org/FieldGuide/pdf/Linum_carteri.pdf

FNAI. (2000b). *Miccosukee gooseberry.* Retrieved from http://www.fnai.org/FieldGuide/pdf/Ribes_echinellum.pdf

FNAI. (2000c). *Fact sheet fragrant prickly-apple.* Retrieved from http://www.fnai.org/FieldGuide/pdf/Harrisia_fragrans.PDF

FNAI. (2001a). *Southeastern beach mouse - Field guide to the rare animals of Florida.* Retrieved from http://myfwc.com/media/2211905/Southeastern-beach-mouse.pdf

FNAI. (2001b). *Field guide - Choctawhatchee beach mouse.* Retrieved from http://myfwc.com/media/2211827/Choctawhatchee-beach-mouse.pdf

FNAI. (2010a). *Guide to the natural communities of Florida: 2010 edition.* Retrieved from http://fnai.org/natcom_accounts.cfm

FNAI. (2010b). *Pine rockland.* Retrieved from http://fnai.org/PDF/NC/Pine_Rockland_Final_2010.pdf

FNAI. (2010c). *Natural communities guide*. Retrieved from http://fnai.org/naturalcommguide.cfm

FNAI. (2010d). *Guide to the Natural Communities of Florida - Scrubby Flatwoods.* Retrieved from http://fnai.org/PDF/NC/Shrub_Bog_Final_2010.pdf

FNAI. (2015). *Explanations & definitions of rank and status*. Retrieved from http://fnai.org/ranks.cfm

FOA. (1994). *Chapter 6 - Causes of land degradation.* Retrieved from Land degradation in south Asia: Its severity, causes and effects upon the people: http://www.fao.org/docrep/v4360e/V4360E00.htm#Contents

FPC. (2015a, September). *Florida Ports Council*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/about/florida-ports-council/

FPC. (2015b, September). *Seaports*. Retrieved September 2015, from Florida Port Council: http://flaports.org/seaports/

FPC. (2015c, September). *Port Tampa Bay*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-tampa-bay/

FPC. (2015d, September). *Port of Key West*. Retrieved September 2015, from Florida Ports Commission: http://flaports.org/ports/port-of-key-west/

FPC. (2015e, September). *Port Miami*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/portmiami/

FPC. (2015f, September). *Port Everglades*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-everglades/

FPC. (2015g, September). *Port of Palm Beach*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-of-palm-beach/

FPC. (2015h, September). *Port of Fort Pierce*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-of-fort-pierce/

FPC. (2015i, September). *Port Canaveral*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-canaveral/

FPC. (2015j, September). *Port of Jacksonville*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-of-jacksonville/

FPC. (2015k, September). *Port of Fernandina*. Retrieved September 2015, from Florida Ports Council: http://flaports.org/ports/port-of-fernandina/

FPSC. (2015a, September). *Overview and Key Facts*. Retrieved September 2015, from Florida Public Service Commission: http://www.psc.state.fl.us/AboutPSC/Overview

FPSC. (2015b, September). *Company Annual Reports*. Retrieved September 2015, from Florida Public Service Commission: http://www.psc.state.fl.us/UtilityRegulation/AnnualReport

FPSC. (2015c, September). *Introduction for Utilities*. Retrieved September 2015, from Florida Public Service Commission: http://www.psc.state.fl.us/WaterWasteWater/UtilityIntroduction

FPSC. (2015d, September). *Master Commission Directory*. Retrieved September 2015, from Florida Public Service Commission: http://www.psc.state.fl.us/UtilityRegulation/CompaniesRegulatedByPSC

FPSC. (2015e, September). *Master Commission Directory*. Retrieved September 2015, from Florida Public Service Commission: http://www.psc.state.fl.us/UtilityRegulation/CompaniesRegulatedByPSC

FRBA. (2014). *Annual Performance Progress Report For Broadband Infrastructure Projects.* Project Performance. Retrieved from http://www2.ntia.doc.gov/files/grantees/nt10bix5570122_apr2013.pdf

Friends of Mission San Luis, Inc. (2015, October). *History and Archaeology of Mission San Luis*. (I. Friends of Mission San Luis, Editor) Retrieved October 2015, from Mission San Luis: http://www.missionsanluis.org/research/history.cfm

Friends of the Wekiva River, Inc. (2011). *Wekiva River*. Retrieved October 5, 2015, from http://www.friendsofwekiva.org/river.html

FTA. (2006). *Transit Noise and Vibration Impact Assessment.* FTA.

FWC. (1987). *Recovery plan Perdido Key beach mouse.* Retrieved from http://myfwc.com/media/2211884/Perdido-Key-beach-mouse.pdf

FWC. (2012a). *Florida's State Wildlife Action Plan.* Retrieved May 2015, from http://myfwc.com/conservation/special-initiatives/fwli/action-plan/

FWC. (2012b). *Florida's State Wildlife Action Plan.* Tech. rep., Florida Fish and Wildlife Conservation Commission. Retrieved from http://myfwc.com/media/2663010/StateWildlifeActionPlan.pdf

FWC. (2015a). *Florida Wetlands*. Retrieved May 2015, from Wetland Habitat Conservation: http://myfwc.com/conservation/freshwater/wetland-habitat/

FWC. (2015b). *Enjoying your Wildlife Management Areas*. Retrieved May 2015, from Wildlife Viewing: http://myfwc.com/viewing/recreation/

FWC. (2015c). *Hunting by species*. Retrieved from http://myfwc.com/hunting/regulations/nongame/

FWC. (2015d). *Birds*. Retrieved from http://myfwc.com/wildlifehabitats/profiles/birds/

FWC. (2015e). *Nongame wildlife*. Retrieved from http://myfwc.com/hunting/regulations/nongame/

FWC. (2015f). *Methods of taking freshwater fish*. Retrieved from http://myfwc.com/fishing/freshwater/regulations/taking-fish/

FWC. (2015g). *Fast facts*. Retrieved from http://myfwc.com/about/overview

FWC. (2015h). *Florida recreational saltwater fishing regulations quickchart.* Retrieved from http://myfwc.com/media/3812053/Quickchart.pdf

FWC. (2015i). *Florida's freshwater mussels and clams*. Retrieved from http://myfwc.com/research/freshwater/species-assessments/mollusks/brochure/

FWC. (2015j). *Recreational harvest of marine life (aquarium) species*. Retrieved from http://myfwc.com/fishing/saltwater/recreational/aquarium-species/

FWC. (2015k). *Dolphin (Tursiops truncatus)*. Retrieved from http://myfwc.com/wildlifehabitats/profiles/mammals/aquatic/dolphin

FWC. (2015l). *Manatee (Trichechus manatus)*. Retrieved from http://myfwc.com/wildlifehabitats/profiles/mammals/aquatic/manatee/

FWC. (2015m). *North Atlantic right whale*. Retrieved from http://myfwc.com/wildlifehabitats/profiles/mammals/aquatic/north-atlantic-right-whale/

FWC. (2015n). *Florida's sea turtles*. Retrieved from http://myfwc.com/research/wildlife/sea-turtles/fl-sea-turtles/

FWC. (2015o). *Anastasia Island beach mouse*. Retrieved from http://myfwc.com/wildlifehabitats/imperiled/profiles/mammals/anastasia-island-beach-mouse/

FWC. (2015p). *Choctawhatchee beach mouse*. Retrieved from http://myfwc.com/wildlifehabitats/imperiled/profiles/mammals/choctawhatchee-beach-mouse/

FWC. (2015q). *Key Largo cotton mouse*. Retrieved from http://myfwc.com/wildlifehabitats/imperiled/profiles/mammals/key-largo-cotton-mouse/

FWC. (2015r). *Nonnatives - European Starling*. Retrieved from http://myfwc.com/wildlifehabitats/nonnatives/birds/european-starling/

FWC. (2015s). *Fact sheet blue-tail mole skink.* Retrieved from http://myfwc.com/media/2212129/bluetail-mole-skink.pdf

FWC. (2015t). *Miami blue butterfly*. Retrieved from http://myfwc.com/media/2211670/Miami-Blue-Butterfly.pdf

FWC. (2015u). *Schaus swallowtail butterfly.* Retrieved from http://myfwc.com/media/2211691/Schaus-Swallowtail-Butterfly.pdf

FWC. (2015v). *What are Wildlife Management Areas?* Retrieved October 5, 2015, from http://myfwc.com/viewing/recreation/wmas/

FWC. (2015w). *WMA Brochures.* Retrieved from Florida Fish and Wildlife Conservation Commission: http://myfwc.com/hunting/wma-brochures

FWC. (2015x). *Aquatic Mammals.* Retrieved from http://myfwc.com/wildlifehabitats/profiles/mammals/aquatic/

FWC. (2016a). *Red Wolf*. Retrieved from Listed Mammals: http://myfwc.com/wildlifehabitats/imperiled/profiles/mammals/red-wolf/

FWC. (2016b). *Alligator snapping turtle*. Retrieved from Reptiles: http://myfwc.com/wildlifehabitats/imperiled/profiles/reptiles/alligator-snapping-turtle/

GAO. (2013). *Data Center Consolidation: Strengthened Oversight Needed to Achieve Billions of Dollars in Savings*. Retrieved from http://www.gao.gov/products/GAO-13-627T

Gehring, J., Kerlinger, P., & Manville, A. M. (2011). The Role of Tower Height and Guy Wires on Avian Collisions with Communication Towers. *The Journal of Wildlife Management*, 848-855. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/jwmg.99/abstract.

Georgia, University of. (2016). *Parts of a grass plant*. Retrieved from http://www.commodities.caes.uga.edu/turfgrass/georgiaturf/Turfgras/1130_DiagramParts.htm

Gilliland, M. S. (1989). *Key Marco's Buried Treasure: Archaeology and Adventure in the Nineteenth Century*. Gainesville: University of Florida Press. Retrieved August 8, 2016, from 2805

Gladwin, W. J. (1992). *Men, Salt, Cattle and battle: The Civil War in Florida (November 1860-July 1865).* Newport: Naval War College. Retrieved August 8, 2016, from http://www.dtic.mil/dtic/tr/fulltext/u2/a255006.pdf

GLOBE SCRC. (2015). *Globe Student Climate Research Campaign*. Retrieved from http://www.globe.gov/web/scrc/overview

GPO. (2010, April 5). *Title 40 Code of Federal Regulations Part 93.153*. Retrieved July 20, 2015, from http://www.ecfr.gov/cgi-bin/text-

idx?SID=2028b268447f0bf79b396678569dac85&mc=true&node=se40.20.93_1153&rgn=div8

GPO. (2011). *Title 7, Agriculture, Chapter 104 - Plant Protection*. Retrieved from https://www.gpo.gov/fdsys/pkg/USCODE-2011-title7/pdf/USCODE-2011-title7-chap104.pdf

GPO. (2015, June). *Electronic Code of Federal Regulations.* Retrieved June 2015, from U.S. Government Publishing Office: http://www.ecfr.gov/cgi-bin/text-idx?SID=6095c0db6bb5edb10c850334725dae34&mc=true&tpl=/ecfrbrowse/Title36/36tab_02.tpl

Greater Miami CVB. (2015). *2014 Visitor Industry Overview.* Retrieved August 2015, from Research and Statistics: http://www.miamiandbeaches.com/~/media/files/gmcvb/partners/research%20statistics/annual_report_2014

Greater Orlando Aviation Authority. (2014, December). *Traffic Summary Report.* Retrieved July 2016, from https://orlandoairports.net/site/uploads/2016/03/trfc201412.pdf

Griffin, M. (2015). *Florida's Climate the COCORAHS State Climate Series.* Retrieved from Florida State Climatologists: http://www.cocorahs.org/Media/docs/ClimateSum_FL.pdf

Griffith, G. (2007). *Descriptions of Level III and level IV ecoregions in Florida.* Tech. rep., U.S. Environmental Protection Agency, Corvallis, Oregon.

Haag, K. H., & Lee, T. M. (2010). *Hydrology and Ecology of Freshwater Wetlands in Central Florida - A Primer.* Retrieved May 2015, from http://pubs.usgs.gov/circ/1342/pdf/C1342_report_11x17.pdf

Halligan et al. (2016, May 13). *Pre-Clovis occupation 14,550 years ago at the Page-Ladson site, Florida, and the peopling of the Americas*. Retrieved from Science Advances: http://advances.sciencemag.org/content/2/5/e1600375.full

Handley, L., Spear, K., Baumstark, R., Moyer, R., & Thatcher, C. (2010). *Statewide Summary for Florida.* Retrieved October 2015, from Introduction to Emergent Wetlands Status and Trends in the Northern Gulf of Mexico: 1950-2010: http://gom.usgs.gov/documents/Chapter_L_StateSumFL.pdf

Hardin, S. (2007). Managing non-native wildlife in Florida: State perspective, policy, and practice. *Managing Vertebrate Invasive Species: Proceedings of an International Symposium.* For Collins, CO. Retrieved from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1013&context=nwrcinvasive

Harris / SLERS. (2015, October 6). *Florida's Statewide Law Enforcement Radio System.* Retrieved October 6, 2015, from Harris Corp.: http://pspc.harris.com/slers/

Hatton, H. (1987). *Topical Splendor: An Architectural History of Florida.* New York: Alfred A. Knopf.

Highsmith, Carol M. (1980a). St. Marks Light, at the mouth of the St. Marks River in the Apalachee Bay on Florida's panhandle. *Library of Congress Prints and Photographs Online Collection*. St. Marks, Florida: Library of Congress. Retrieved October 2015, from http://www.loc.gov/resource/highsm.14792/

Highsmith, Carol M. (1980b). Historic Capitol, Tallahassee, Florida. *Library of Congress Prints and Photographs Online Collection*. Tallahassee, Florida: Library of Congress. Retrieved October 2015, from http://www.loc.gov/resource/highsm.12207/

Hill, D., Hockin, D., Price, D., Tucker, G., Morris, R., & Treweek, J. (1997). Bird Disturbance: Improving the Quality and Utility of Disturbance Research. *Journal of Applied Ecology*, 34(2): 275-288.

Historic American Buildings Survey. (1933). General View - Marjorie Kinnan Rawlings House, State Route 325 Vicinity, Cross Creek, Alachua County, FL. *Library of Congress Prints and Photographs Online Collection*. Cross Creek, Florida: Library of Congress. Retrieved October 2015, from http://www.loc.gov/resource/hhh.fl0158.photos/?sp=2

Hostetler, M., Mazzotti, F., & Taylor, A. (2013). *Blue land crab (Cardisoma guanhumi).* Tech. rep., University of Florida, Institute of Food & Agricultural Sciences Extension. Retrieved from http://edis.ifas.ufl.edu/pdffiles/UW/UW01300.pdf

HydroDynamics Incorporated. (2007). *Erosion and Sediment Control Designer and Reviewer Manual.* Parker, CO.

Idaho State University. (2000). *Environmental Geology*. Retrieved March 20, 2016, from http://geology.isu.edu/wapi/EnvGeo/EG4_mass_wasting/EG_module_4.htm

IFC. (2007, April 30). *Environmental, Health, and Safety Guidelines for Telecommunications*. Retrieved from http://www.ifc.org/wps/wcm/connect/0985310048855454b254f26a6515bb18/Final+-+Telecommunications.pdf?MOD=AJPERES&id=1323152343828

ILDNR. (2015). *Critical Resource Waters*. Retrieved July 2015, from http://dnr.state.il.us/wetlands/gis/criticalwaters.htm

Indian River Lagoon National Estuary Program. (2008). *Indian River Lagoon Comprehensive Conservation Management Plan Update*. Retrieved August 28, 2015, from http://floridaswater.com/indianriverlagoon/pdfs/CCMP_Update_2008_Final.pdf

Institute of Maritime History. (2015, August). *Rainsford Island Archaeological Survey*. Retrieved August 2015, from http://www.maritimehistory.org/content/rainsford-island-archaeological-survey

Iowa State University. (2016). *Longevity of Perennials*. Retrieved from Horticulture & Home Pest News: http://www.ipm.iastate.edu/ipm/hortnews/2006/2-22/perennials.html

IPCC. (2007). *Climate Change 2007: Synthesis Report.* Retrieved 2015, from Intergovernmental Panel on Climate Change: www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg1/

ITU-T. (2012). *Series L: Construction, Installation and Protection of Cables and Other Elements of Outside Plant.* International Telecommunication Union, Telecommunication Standardization Sector of ITU, Geneva. Retrieved from https://www.itu.int/rec/T-REC-L/en

Jaxport. (2015a, September). *Intermodal*. Retrieved September 2015, from Jaxport: http://www.jaxport.com/cargo/logistics-resources/intermodal

Jaxport. (2015b, September). *Cruise FAQ*. Retrieved September 2015, from Jaxport: http://www.jaxport.com/cruise/cruise-faq

Karim, A., & Main, M. B. (2004, December). *Tropical Hardwood Hammocks in Florida*. Retrieved from University of Florida IFAS Extension: http://edis.ifas.ufl.edu/uw206

Kelly, J. A., Tykot, R. H., & Milanich, J. T. (2006). *Histories of Maize: Multidisciplinary Approaches to the Prehistory, Linguistics, Biogeography, Domestication, and Evolution of Maize.* Burlington, MA: Academic Press. Retrieved August 8, 2016, from http://luna.cas.usf.edu/~rtykot/18%20Kelly%20et%20al.pdf

Kennedy Space Center. (2015). *Kennedy Space Center Visitor Complex*. Retrieved August 2015, from https://www.kennedyspacecenter.com/

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). *World Map of the Koppen-Geiger Climate Classification Updated.* Global Precipitation Climatology Centre. Ofenbach: Deutscher Wetterdienst. Retrieved June 2015, from http://koeppen-geiger.vu-wien.ac.at/pdf/Paper_2006.pdf

Krysko, K., Enge, K., & Moler, P. (2011). *Atlas of amphibians and reptiles in Florida.* Final {Report}, Florida Fish and Wildlife Conservation Commission, Tallahassee, FL. Retrieved from http://www.flmnh.ufl.edu/files/1513/9655/3772/herps_atlas_low.pdf

LandScope America. (2015). *Endemic vertebrate animals list*. Retrieved from http://www.landscope.org/florida/plants-animals/lists/Endemic%20Vertebrate%20Animals/Endemic%20Vertebrate%20Animals%20List

Loxahatchee River District. (2015a). *General Information: About the River*. Retrieved October 5, 2015, from https://www.loxahatcheeriver.org/about_the_river.php

Loxahatchee River District. (2015b). *General Information: Latest News*. Retrieved October 5, 2015, from https://www.loxahatcheeriver.org/read_press_release.php?pr=118

Lynskey, K. (2015, September). *Port Miami.* Retrieved July 2016, from Port Miami: http://aapa.files.cms-plus.com/PDFs/01-8-28-14_AAPA_Argentina_Deputy_Director_Kevin_Lynskey_Presentation_OK.pdf

MacNeil, F. S. (1949). *Pleistocene Shore Lines in Florida and Georgia.* Retrieved April 2015, from http://pubs.usgs.gov/pp/0221f/report.pdf

Maps of World.com. (2016). *Florida Rivers Map.* Retrieved from Maps of World: http://www.mapsofworld.com/usa/states/florida/florida-river-map.html

MCO. (2015, September). *About Us*. Retrieved September 15, 2015, from http://www.orlandoairports.net/about.htm

Merriam Webster Dictionary. (2015a). *Airspace*. Retrieved June 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/airspace

Merriam Webster Dictionary. (2015b). *Sea Level*. Retrieved July 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/sea%20level

MIA. (2015, September). *About Us*. Retrieved September 15, 2015, from http://www.miami-airport.com/about_us.asp

Miami-Dade County. (2014, December). *Ridership Technical Report*. Retrieved September 15, 2015, from http://www.miamidade.gov/transit/library/rtr/2014-12-Ridership-Technical-Report.pdf

Miami-Dade County. (2015a). *Metrorail*. Retrieved September 15, 2015, from http://www.miamidade.gov/transit/metrorail.asp

Miami-Dade County. (2015b, September). *Metrorail Stations*. Retrieved September 15, 2015, from http://www.miamidade.gov/transit/metrorail-stations.asp

Miami-Dade County. (2015c, September). *Cruise Facts*. Retrieved September 2015, from PortMiami: http://www.miamidade.gov/portmiami/cruise-facts.asp

Miami-Dade County. (2015d, September). *On-dock Rail*. Retrieved September 2015, from PortMiami: http://www.miamidade.gov/portmiami/portmiami-fec-connection.asp

Milanich, J. T. (1995). Recent Archaeological Research in Florida. *Archaeology of Eastern North America, 23*, 97-118. Retrieved May 2015, from http://www.jstor.org/stable/40914394

Mitchell. (2014). Future climate and fire interactions in the South Eastern region of the United States. *Forest Ecology and Management*, 316-326.

Myakka River Management Coordinating Council. (2015). *Myakka River Wild and Scenic Management Plan.* Retrieved October 5, 2015, from Myakka River Management Coordinating Council: http://www.myakkarivermanagement.org/MRWSMP.html

NAS. (2011). *National Audubon Society*. Retrieved from http://netapp.audubon.org/IBA/State/US-FL

NASA. (2013, July). *Final Environmental Impact Statement: Sounding Rockets Program at Poker Flat Research Range.* Retrieved July 1, 2016, from http://netspublic.grc.nasa.gov/main/NASA%20SRP%20at%20PFRR%20FEIS%20Volume%20I.pdf

National Association of State Aviation Officials [NASAO]. (2015). *Resources NASAO National Association of State Aviation Officials*. Retrieved July 2015, from NASAO National Association of State Aviation Officials: http://www.nasao.org/Resources.aspx

National Geographic. (2016). *First Americans.* Retrieved August 7, 2016, from National Geographic: http://news.nationalgeographic.com/2016/05/160513-first-americans-clovis-mastodon-florida-page-ladson/

National Institutes of Health. (2015a, June). *What is TOXMAP?* Retrieved from http://toxmap.nlm.nih.gov/toxmap/faq/2009/08/what-is-toxmap.html

National Wild and Scenic Rivers System. (2015). *Florida*. Retrieved October 5, 2015, from http://www.rivers.gov/florida.php

National Wildlife Federation. (2015). *Ecoregions*. Retrieved from http://www.nwf.org/Wildlife/Wildlife-Conservation/Ecoregions.aspx

NatureServe. (2009, February 2). *Ptychobranchus jonesi (van der Schalie, 1934), Southern Kidneyshell*. (NatureServe) Retrieved July 22, 2016, from http://explorer.natureserve.org/servlet/NatureServe?searchName=Ptychobranchus+jonesi

NCED. (2015). *State of Florida and All Easements*. Retrieved August 3, 2015, from National Conservation Easement Database: http://conservationeasement.us/reports/easements

NERRS. (2011). *National Estuarine Research Reserve System Strategic Plan*. Retrieved July 15, 2015, from http://coast.noaa.gov/data/docs/nerrs/StrategicPlan2011.pdf

New College of Florida. (2015, October). *A College Ahead of Its Time*. Retrieved October 2015, from New College of Florida: https://www.ncf.edu/history

New Hampshire Department of Environmental Services. (2014). *Geologic Mapping Program.* Retrieved August 2015, from http://des.nh.gov/organization/commissioner/gsu/gmp/categories/overview.htm

NFBA. (2014). *Annual Performance Progress Report For Broadband Infrastructure Projects.* Annual Performance Report. Retrieved from http://www2.ntia.doc.gov/files/grantees/nt10bix5570105_apr2014.pdf

NIST. (2015, March). *Nationwide Public Safety Broadband Network Deployment: Network Parameter Sensitivity Analysis.* U.S. Department of Commerce. National Institute of Standards and Technology (NIST), Wireless Networks Division, Communications Technology Laboratory. Retrieved from http://nvlpubs.nist.gov/nistpubs/ir/2015/NIST.IR.8039.pdf

NMFS. (2000). *Critical habitat Johnson's seagrass.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/fr/fr65-17786.pdf

NMFS. (2009). *Critical habitat for smalltooth sawfish*. Retrieved from https://www.federalregister.gov/articles/2009/09/02/E9-21186/endangered-and-threatened-species-critical-habitat-for-the-endangered-distinct-population-segment-of#h-37

NMFS. (2014). *Critical Habitat Loggerhead Sea Turtle.* Retrieved from https://www.federalregister.gov/articles/2014/07/10/2014-15748/endangered-and-threatened-species-critical-habitat-for-the-northwest-atlantic-ocean-loggerhead-sea

NOAA. (2010). *Essential fish habitat conservation mandate (Gulf of Mexico region).* Retrieved from http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_fisheries/generic/documents/pdfs/2013/gom_efh_guide_2010.pdf

NOAA. (2012). *Fisheries Economics of the United States*. Retrieved October 23, 2015, from https://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/FEUS2012.pdf

NOAA. (2013). *Johnson's seagrass (Halophila johnsonii)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/plants/johnsonsseagrass.htm

NOAA. (2014a). *Hawksbill Turtle (Eretmochelys imbricata).* Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm

NOAA. (2014b). *Loggerhead turtle (Caretta caretta)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html

NOAA. (2014c). *Smalltooth sawfish (Pristis pectinata)*. Retrieved from http://www.fisheries.noaa.gov/pr/species/fish/smalltooth-sawfish.html

NOAA. (2014d). *Elkhorn coral (Acropora palmata)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

NOAA. (2014e). *Staghorn coral (Acropora cervicornis).* Retrieved from http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

NOAA. (2014f, January 29). *What is a slough?* Retrieved July 17, 2015, from http://oceanservice.noaa.gov/facts/slough.html

NOAA. (2014g). *Hurricane Research Division*. Retrieved September 3, 2015, from The Synoptic Flow era: http://www.aoml.noaa.gov/hrd/Storm_pages/andrew1992/

NOAA. (2014h). *Draft Recovery Plan Elkhorn Coral and Staghorn Coral.* Retrieved from http://www.nmfs.noaa.gov/pr/recovery/plans/elkhorn_staghorn_corals_draft2014.pdf

NOAA. (2015a). *Guana Tolomato Matanzas National Estuarine Research Reserve*. Retrieved August 7, 2015, from http://nerrs.noaa.gov/reserves/gtm.html

NOAA. (2015b). *Rookery Bay National Estuarine Research Reserve*. Retrieved August 7, 2015, from http://nerrs.noaa.gov/reserves/rookery-bay.html

NOAA. (2015c). *Apalachicola Bay National Estuarine Research Reserve*. Retrieved August 12, 2015, from http://nerrs.noaa.gov/reserves/apalachicola-bay.html

NOAA. (2015d). *Guide to essential fish habitat descriptions*. Retrieved from http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm

NOAA. (2015e). *Essential fish habitat mapper*. Retrieved from http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html

NOAA. (2015f). *In 2014, there were 26 lightning fatalities: 6 in Florida, 3 in Wisconsin, 2 in Arizona, Arkansas, Colorado, Georgia and Massachusetts*. Retrieved October 22, 2015, from National Weather Service: http://www.lightningsafety.noaa.gov/fatalities/fatalities14.shtml

NOAA. (2015g). *Kemp's Ridley turtle (Lepidochelys kempii)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.html

NOAA. (2015h). *Leatherback turtle (Dermochelys coriacea)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm

NOAA. (2015i). *National Oceanic and Atmospheric Administration*. Retrieved from National Centers of Environmental Information: http://www.ncdc.noaa.gov/cag/time-series/us

NOAA. (2015j). *State Climate Extremes Committee*. (N. O. Administration, Producer) Retrieved 2015, from National Climatic Data Center: http://www.ncdc.noaa.gov/extremes/scec/records

NOAA. (2015k). *National Oceanic and Atmospheric Administration*. Retrieved from Data Tools: 1981 - 2010 Normals: http://www.ncdc.noaa.gov/cdo-web/datatools/normals

NOAA. (2016a). *Final Rule to List Eleven Distinct Population Segments of the Green Sea Turtle as Endangered and Threatened*. Retrieved from Federal Register: https://www.federalregister.gov/articles/2016/04/06/2016-07587/endangered-and-threatened-wildlife-and-plants-final-rule-to-list-eleven-distinct-population-segments

NOAA. (2016b). *Fact Sheet Green Turtle* . Retrieved from NOAA: http://www.nmfs.noaa.gov/pr/species/turtles/green.html

NOAA; USGS; SERPD; and USACE. (2012). *Global Sea Level Rise Scenarios for the.* MD: Silver Springs.

NPS. (1995, July 12). *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes.* Retrieved September 4, 2015, from National Park Service: http://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm

NPS. (2000). *Geologic Glossary.* Retrieved August 2015, from https://www.nature.nps.gov/geology/usgsnps/misc/glossaryDtoI.html#G

NPS. (2005). *Canaveral National Seashore*. Retrieved from http://www.nature.nps.gov/geology/parks/cana/

NPS. (2011, May 19). *Connecting with Native Americans*. Retrieved April 12, 2015, from http://www.nps.gov/history/tribes/Heritage_Areas.htm

NPS. (2012a). *Florida*. Retrieved May 2015, from National Natural Landmarks Program: http://www.nature.nps.gov/nnl/state.cfm?State=FL

NPS. (2012b, July 17). *The National Trails System Act*. Retrieved April 12, 2015, from http://nature.nps.gov/nnl/index.cfm

NPS. (2012c, June 28). *National Natural Landmarks Program: Florida*. Retrieved October 5, 2015, from http://www.nature.nps.gov/nnl/state.cfm?State=FL

NPS. (2013, December 10). *Geologic Hazards*. Retrieved September 1, 2015, from Geologic, Energy, and Mineral Resources: http://www.nature.nps.gov/geology/hazards/

NPS. (2014a). *National Reports.* Retrieved from NPS Stats: irma.nps.gov/Stats/Reports/National

NPS. (2014b, June 20). *Prohibition of Unmanned Aircraft in National Parks*. Retrieved June 2015, from https://www.nps.gov/gaar/learn/news/prohibition-of-unmanned-aircraft-in-national-parks.htm

NPS. (2014c, October 22). *National Natural Landmarks Program*. Retrieved April 21, 2015, from http://nature.nps.gov/nnl/index.cfm

NPS. (2014d, September). *Florida*. Retrieved July 2015, from http://www.nps.gov/state/FL/index.htm

NPS. (2014e, 06 16). *National Park Service Science of Sound*. Retrieved 07 22, 2015, from http://www.nature.nps.gov/sound/science.cfm
NPS. (2015a). *Geology of the Coastal Plain.* Retrieved April 2015, from http://www.nps.gov/cue/geology/geo_coastalplain.htm
NPS. (2015aa). *Everglades Habitat Images*. Retrieved from http://www.nps.gov/ever/learn/news/evergladeshabitatimages.htm
NPS. (2015b). *Everglades Park Statistics*. Retrieved May 2015, from Everglades: http://www.nps.gov/ever/learn/news/parkstatistics.htm
NPS. (2015c). *Bartram's scrub-hairstreak - Everglades National Park*. Retrieved from http://www.nps.gov/ever/learn/nature/bartrams.htm
NPS. (2015d). *Florida leafwing - Everglades National Park*. Retrieved from http://www.nps.gov/ever/learn/nature/floridaleafwing.htm
NPS. (2015e). *Gulf Islands National Seashore: Florida District*. Retrieved August 2015, from http://www.nps.gov/guis/florida.htm
NPS. (2015f). *Canaveral National Seashore*. Retrieved August 2015, from http://www.nps.gov/cana/planyourvisit/outdooractivities.htm
NPS. (2015g). *Big Cypress National Preserve*. Retrieved August 2015, from http://www.nps.gov/bicy/index.htm
NPS. (2015h). *Everglades National Park*. Retrieved August 2015, from http://www.nps.gov/ever/index.htm
NPS. (2015i). *National Park Service - Find A Park, Florida*. Retrieved August 2015, from http://www.nps.gov/state/fl/index.htm
NPS. (2015j, October 12). *Everglades Wildlife Images*. Retrieved October 13, 2015, from http://www.nps.gov/ever/learn/news/evergladeswildlifeimages.htm
NPS. (2015k). *National Heritage Areas*. Retrieved September 18, 2015, from http://www.nps.gov/maps/full.html?mapId=01a03739-ab0c-40eb-bc3d-6791d3bb67fa
NPS. (2015l, April 27). *National Historic Landmarks Program*. Retrieved April 28, 2015, from http://www.nps.gov/nhl/INDEX.htm
NPS. (2015m). *National Historic Landmarks in Florida.* Retrieved October 6, 2015, from http://www.nps.gov/nhl/find/statelists/fl/FL.pdf
NPS. (2015n, April 4). *National Historic Landmarks Program: National Historic Landmarks in Florida*. Retrieved October 6, 2015, from http://www.nps.gov/nhl/find/statelists/fl.htm
NPS. (2015o, October 3). *Florida*. Retrieved October 5, 2015, from http://www.nps.gov/state/fl/index.htm
NPS. (2015p, October 5). *Fort Jefferson Images*. Retrieved October 5, 2015, from http://www.nps.gov/media/photo/gallery.htm?id=89404A1F-1DD8-B71C-07C25C8631876288
NPS. (2015q). *Wilderness*. Retrieved September 2015, from http://wilderness.nps.gov/faqnew.cfm
NPS. (2015r). *National Register of Historic Places Program: Fundamentals*. Retrieved September 23, 2015, from http://www.nps.gov/nr/national_register_fundamentals.htm
NPS. (2015s). *Southeast Archeological Center*. Retrieved September 2015, from http://www.nps.gov/seac/hnc/outline/03-archaic/index.htm
NPS. (2015t, July). *National Register of Historic Places Program: Research*. Retrieved October 2015, from National Register of Historical Places: http://www.nps.gov/nr/research/
NPS. (2015u). *National Park Services*. Retrieved 2015, from http://www.nps.gov/nr/

NPS. (2015v). *National Heritage Areas: A Map of All the National Heritage Areas*. Retrieved May 2015, from National Park Service: http://www.nps.gov/maps/full.html?mapId=01a03739-ab0c-40eb-bc3d-6791d3bb67fa

NPS. (2015w, October). *Dry Tortugas: History & Culture*. Retrieved October 2015, from http://www.nps.gov/drto/learn/historyculture/index.htm

NPS. (2015x). *Florida National Park Service*. Retrieved 8 7, 2015, from http://www.nps.gov/state/fl/index.htm

NPS. (2015y, October 6). *Everglades National Park*. Retrieved October 13, 2015, from http://www.nps.gov/ever/index.htm

NPS. (2015z, February 18). *National Historic Landmarks Program.* Retrieved May 2016, from https://www.nps.gov/nhl/

NPS. (2016a). *Ecosystems: Hardwood hammock*. Retrieved from Everglades: https://www.nps.gov/ever/learn/nature/hardwoodhammock.htm

NPS. (2016b, June). *National Historic Landmarks Program*. Retrieved from https://www.nps.gov/nhl/learn/intro.htm

NPS. (2016c). *Ecosystems: Freshwater Marl Prairie.* Retrieved August 7, 2016, from Everglades: https://www.nps.gov/ever/learn/nature/marlprairie.htm

NRCS. (1996a). *Soil Quality Resource Concerns: Soil Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051278.pdf

NRCS. (1996b). *Soil Quality Resource Concerns: Compaction*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051594.pdf

NRCS. (1999). *Soil Taxonomy A Basic System of Soil Classification for Making and Interpreting Soil Surveys.* Retrieved from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051232.pdf

NRCS. (2000, March). *Soil Quality - Urban Technical Note No. 1.* Retrieved from Erosion and Sedimentation on Construction Sites: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053285.pdf

NRCS. (2003). *Soil Compaction: Detection, Prevention, and Alleviation*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053258.pdf

NRCS. (2006). *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.* Retrieved May 2015, from Major Land Resource Area: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051845.pdf

NRCS. (2009). *Protecting pollinators*. Retrieved from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/newsroom/photos/?cid=nrcs144p2_057907

NRCS. (2015a). *What is Soil?* Retrieved June 2015, from Soil Education: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054280

NRCS. (2015b). *STATSGO2 Database.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053629

NRCS. (2015c). *STATSGO2 Database.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053629

NRCS. (2015d). *Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/erosion/

NRCS. (2015e). *Twelve Orders of Soil Taxonomy*. Retrieved August 2015, from Soils: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053588

NRCS. (2015f). *Hydric Soils -- Introduction.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961

NRCS. (2016). *Glossary of Landform and Geologic Temrs.* Retrieved from file:///C:/Users/543944/Downloads/629_glossary.pdf

NRHP. (1982). *Sarasota Multiple Property Submission.* Tallahassee: Florida State Historic Preservation Office.

NRHP. (1992). *Historic Buildings of Downtown Jacksonville, Florida.* Tallahassee: Florida State Historic Preservation Office.

NRHP. (2002). *Florida's Historic Lighthouses.* Tallahassee: Florida State Historic Preservation Office.

NTFI. (2005). *Why Can't We Talk? Working Together to Bridge the Communications Gap to Save Lives: A Guide for Public Officials.* U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. National Task Force on Interoperability (NTFI). Retrieved from https://www.ncjrs.gov/pdffiles1/nij/204348.pdf

NTIA. (2005, October). *Interference Protection Criteria Phase 1 - Compilation from Existing Sources 2005.* Retrieved from https://www.ntia.doc.gov/files/ntia/publications/ipc_phase_1_report.pdf

NTIA. (2014). *Download Data.* Retrieved from National Broadband Map: http://www.broadbandmap.gov/data-download

NWS. (2011a, October 21). *Addition Koppen-Geiger Climate Subdivisions*. Retrieved from National Weather Service: JetStream - Online School for Weather: http://www.srh.noaa.gov/jetstream//global/climate.htm#map

NWS. (2011b, October 21). *Climate*. Retrieved from National Weather Service: JetStream - Online School for Weather: http://www.srh.noaa.gov/jetstream//global/climate_max.htm

NWS. (2015a). *Flooding in Florida*. Retrieved from http://www.floodsafety.noaa.gov/states/fl-flood.shtml

NWS. (2015b, June 10). *2014 Summary of Hazardous Weather Fatalities, Injuries, and Damage by State.* Retrieved October 2, 2015, from Office of Climate, Water, and Weather Services: http://www.nws.noaa.gov/om/hazstats/state14.pdf

NWSRS. (2015a). *Florida*. Retrieved August 4, 2015, from http://www.rivers.gov/florida.php

NWSRS. (2015b). *Wekiva River, Florida*. Retrieved August 4, 2015, from http://www.rivers.gov/rivers/wekiva.php

NYDEC. (2000). *Montezuma Wetlands Complex Management Plan.* Retrieved from file:///C:/Users/543944/Downloads/MNT_2000_WetlandsMgtPlan%20(1).pdf

Olcott, P. G. (1995). *Carbonate-Rock Aquifers, HA 730-M*. Retrieved May 5, 2015, from http://pubs.usgs.gov/ha/ha730/ch_m/M-text4.html

OSHA. (2002). *Occupational Safety & Health Administration We Can Help*. Retrieved from Hearing Conservation: https://www.osha.gov/Publications/OSHA3074/osha3074.html

OSHA. (2003). *Fact Sheets on Natural Disaster Recovery: Flood Cleanup.* Retrieved December 2013, from https://www.osha.gov/OshDoc/data_Hurricane_Facts/Bulletin2.pdf

OSHA. (2015a). *Communication Towers*. Retrieved from https://www.osha.gov/doc/topics/communicationtower/index.html

OSHA. (2015b). *Occupational Safety & Health Administration We Can Help*. (S. L. OSHA Directorate of Technical Support and Emergency Management, & U. Salt Lake City,

Editors) Retrieved September 22, 2015, from Safety & Health Management System Tools: https://www.osha.gov/SLTC/etools/safetyhealth/comp3.html#Safe Work Practices

OSHA. (2016a). *OSHA Technical Manual: Noise.* Retrieved May 2016, from Section III: Chapter 5: https://www.osha.gov/dts/osta/otm/new_noise/

OSHA. (2016b, March 28). *Regulations (Standards - 29 CFR).* Retrieved from Occupational Safety & Health Administration: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9867

OSHA. (2016c). *Restoring Communications Systems*. Retrieved February 16, 2016, from Infrastructure Repair and Restoration: https://www.osha.gov/SLTC/etools/hurricane/communications.html

OSHA. (2016d). *Excavations: Hazard Recognition in Trenching and Shoring*. Retrieved from https://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html

Page, S. D. (2012, October 15). *Timely Processing of Prevention of Significant Deterioration (PSD) Permits when EPA or a PSD-Delegated Air Agency Issues the Permit.* Retrieved April 21, 2015, from https://www.epa.gov/nsr/timely-processing-prevention-significant-deterioration-psd-permits-when-epa-or-psd-delegated-air

Panama City Port Authority. (2015, September). *Port Overview*. Retrieved September 2015, from Panama City Port Authority: http://www.panamacityportauthority.com/port-overview.php

Pauketat, T. R. (2012). *The Oxford Handbook of North American Archaeology*. New York, New York: Oxford University Press, Inc.

Pedrotty, M. A., Webster, J. L., & Chmiel, A. R. (1999). *Historical and Architectural Overview of Military Aircraft Hangars: A General History, Thematic Typology, and Inventory of Aircraft Hangars Constructed on Department of Defense Installations.* United States Air Force, Air Combat Command. Chicago: United States Army Construction Engineering Research Laboratory.

Port Canaveral. (2015a, September). *Distribution and Logistics*. Retrieved September 2015, from Port Canaveral: http://www.portcanaveral.com/Cargo-Trade/Distribution-and-Logistics

Port Canaveral. (2015b, September). *Cargo Facilities*. Retrieved September 2015, from Port Canaveral: http://www.portcanaveral.com/Cargo-Trade/Facilities

Port Everglades. (2015a, September). *Port Everglades*. Retrieved September 2015, from Port Everglades: http://www.porteverglades.net/

Port Everglades. (2015b, September). *Near Dock Rail*. Retrieved September 2015, from Port Everglades: http://www.porteverglades.net/expansion/ship-to-rail/

Port Manatee. (2015a, September). *About Port Manatee*. Retrieved September 2015, from Port Manatee: http://www.portmanatee.com/About-Us

Port Manatee. (2015b, September). *Port Facts*. Retrieved September 2015, from Port Manatee: http://www.portmanatee.com/About-Us/Port-Facts

Port of Fernandina. (2015, September). *Intermodal System*. Retrieved September 2015, from Port of Fernandina: http://www.portoffernandina.org/#!intermodal-system/c1qu7

Port of Palm Beach. (2015, September). *Cruise from the Port of Palm Beach*. Retrieved September 2015, from Port of Palm Beach: http://www.portofpalmbeach.com/101/Cruise

Port of Port St. Joe. (2015a, September). *Home*. Retrieved September 2015, from Port of Port St. Joe: http://www.portofportstjoe.com/index.cfm

Port of Port St. Joe. (2015b, September). *Port Access Routes*. Retrieved September 2015, from Port of Port St. Joe: http://www.portofportstjoe.com/transportation.cfm

Port Pensacola. (2015a, September). *Facilities*. Retrieved September 2015, from The Port of Pensacola: http://www.portofpensacola.com/698/Facilities

Port Pensacola. (2015b, September). *About the Port*. Retrieved September 2015, from The Port of Pensacola: http://www.portofpensacola.com/685/About-the-Port

Port Tampa Bay. (2015a, September). *About Port Tampa Bay*. Retrieved September 2015, from Port Tampa Bay: http://www.tampaport.com/about-port-tampa-bay.aspx

Port Tampa Bay. (2015b, September). *Port Facilities*. Retrieved September 2015, from Port Tampa Bay: http://www.tampaport.com/Port-Facilities.aspx

Pranty, B. (2002, July). *The important bird areas of Florida*. Retrieved from http://netapp.audubon.org/IBA/State/US-FL

Project25.org. (2015a, August 28). *P25 Phase 1 FDMA System in Service (June 2015)*. Retrieved August 28, 2015, from http://www.project25.org/images/stories/ptig/docs/P25_Phase_1_FDMA_Systems_REV_2_update_June_2015.pdf

Project25.org. (2015b, August 28). *P25 Phase 1 TDMA System in Service June 2015*. Retrieved August 28, 2015, from http://www.project25.org/images/stories/ptig/docs/P25_Phase_2_TDMA_Systems_Updated_June_2015.pdf

ProximityOne. (2015). *State Population Projections, Outlook 2030*. Retrieved March 2015, from https://proximityone.wordpress.com/2013/12/19/state-population-projections-2030/

PSCR. (2015). *Location-Based Services R&D Roadmap.* Retrieved from http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1883.pdf

Purdue University. (2015). *Hydrologic Soil Groups.* Retrieved June 2015, from https://engineering.purdue.edu/mapserve/LTHIA7/documentation/hsg.html

Purdue University Consumer Horticulture. (2006). *What is Loam?* Retrieved May 19, 2016, from https://hort.purdue.edu/ext/loam.html

RadioReference.com. (2015a, October 6). *Statewide Law Enforcement Radio System (SLERS)*. Retrieved October 6, 2015, from http://www.radioreference.com/apps/db/?sid=1678

RadioReference.com. (2015b, October 6). *FL Common Shared Redio Reference*. Retrieved October 6, 2015, from https://www.radioreference.com/apps/db/?aid=2256

RadioReference.com. (2015c, October 6). *Statewide Law Enforcement Radio System (SLERS P25)*. Retrieved October 6, 2015, from http://www.radioreference.com/apps/db/?sid=7262

RadioReference.com. (2015d, October 6). *Miami-Date County*. Retrieved October 6, 2015, from https://www.radioreference.com/apps/db/?ctid=328

Ramsar Convention. (2014). *History of the Ramsar Convention.* Retrieved from http://www.ramsar.org/about/history-of-the-ramsar-convention

Rogers, D. J., Olshansky, R., & Rogers, B. R. (2004). *Damage to Foundations From Expansive Soils.* Missouri University of Science and Technology. Retrieved March 23, 2015, from http://web.mst.edu/~rogersda/expansive_soils/DAMAGE%20TO%20FOUNDATIONS%20FROM%20EXPANSIVE%20SOILS.pdf

Rupert, F., & Spencer, S. (2004). *Florida's Sinkholes*. Retrieved March 2015, from Florida Geological Survey -- Poster No. 11: http://www.dep.state.fl.us/geology/geologictopics/hazards/sinkholes.htm

Sacramento County Airport System. (2015). *Sacramento County Airport System Noise Page*. Retrieved 6 10, 2015, from http://www.sacramento.aero/scas/environment/noise/noise_101/

SAFMC. (1998, October). *Section 3, Description and Use of Essential Fish Habitat.* Retrieved from SAFMC Habitat Plan: http://www.safmc.net/habitat-ecosystem/pdf/HabitatPlan16-144.pdf

Sarasota Bay National Estuary Program. (2014). *Comprehensive Conservation and Management Plan Update and State of the Bay*. Retrieved August 28, 2015, from http://sarasotabay.org/wp-content/uploads/CCMP.StateoftheBay-for-website-August2014.pdf

Sarasota Bay National Estuary Program. (2015a). *Sarasota Bay Estuary Program*. Retrieved August 28, 2015, from http://sarasotabay.org/sarasota-bay/characteristics/

Sarasota Bay National Estuary Program. (2015b). *Habitat and Species*. Retrieved August 28, 2015, from http://sarasotabay.org/sarasota-bay/habitat-species/

Schmidt, W., & Clark, M. W. (1980). *Bulletin No. 57 Geology of Bay County, Florida.* Retrieved from http://ufdcimages.uflib.ufl.edu/UF/00/00/02/46/00001/B57SchmidtBayCo1980.pdf

Scott, T., Campbell, K., Rupert, F., Arthur, J., Missimer, T., Lloyd, J., . . . Duncan, J. (2001). *Geologic Map of the State of Florida.* Retrieved October 2015, from U.S. Geological Survey: http://sofia.usgs.gov/publications/maps/florida_geology/

SFRTA. (2015). *SFRTA Forward Plan*. Retrieved September 15, 2015, from http://www.sfrta.fl.gov/docs/planning/TDP/SFRTA-TDP-FINAL-DRAFT-ANNUAL-UPDATE-FY-2016-2015.pdf

SFWMD. (2010). *Canals in South Florida: A Technical Support Document*. Retrieved August 28, 2015, from http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/att%201%20canal%20science%20inventory.pdf

Simek, J. F., Cresler, O. J., Blankenship, S. A., Mosler, A., & Kalch, M. (2009). Prehistoric Cave Art From Florida. *Southeastern Archaeology*, *28*(1), 78-86. Retrieved October 2015, from http://www.jstor.org/stable/40713500

Smithsonian Institute. (2016a). *Glossary -- Courtesy of the Department of Paleobiology, National Museum of Natural History, Washington, DC*. Retrieved May 2016, from http://paleobiology.si.edu/geotime/main/glossary.html#T

Smithsonian Institute. (2016b). *Greater Siren Fact Sheet*. Retrieved from Reptiles & Amphibian: http://nationalzoo.si.edu/Animals/ReptilesAmphibians/Facts/FactSheets/Greatersiren.cfm

South Florida Council on OSHA. (2015). *Report: Workplace deaths in Florida with a focus on Southeast Florida.* Smith, Jeanette. Retrieved October 7, 2015, from http://fightforflorida.com/wp-content/uploads/2015/04/Florida-Fatalities-Workers-Memorial-Day.pdf

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene Jr., C. R., . . . Tyack, P. L. (2007). *Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations.* Retrieved from http://csi.whoi.edu/sites/default/files/literature/Full%20Text%20Part%20I_1.pdf

Southeast Regional Climate Change Compact. (2012). *A Region Responds to a Changing Climate: Southeast Florida Regional Climate Change Compact Counties: Regional Climate Action Plan.*

St. Johns River WMD. (2013a). *The Indian River Lagoon: An Estuary of National Significance*. Retrieved August 28, 2015, from http://floridaswater.com/indianriverlagoon/

St. Johns River WMD. (2013b). *Fast Facts about the Indian River Lagoon*. Retrieved August 4, 2015, from http://floridaswater.com/indianriverlagoon/fastfacts.html

St. Lucie County. (2013, September). *Compilation of Data and Recommendations for Port of Fort Pierce Master Plan Update*. Retrieved September 2013, from St. Lucie County Government: http://www.stlucieco.gov/home/showdocument?id=316

State of Florida. (2007, July 13). *2004 Executive Orders by Jeb Bush.* Retrieved 2015, from The Florida State University: http://archive.law.fsu.edu/library/collection/executiveorders/

State of Florida. (2010, August). *FAC Chapter 68-5: Conditional Non-native Species*. Retrieved from Florida Administrative Code & Florida Administrative Register: https://www.flrules.org/gateway/RuleNo.asp?title=RULES%20RELATING%20TO%20NON-NATIVE%20SPECIES&ID=68-5.002

State of Florida. (2015). *State Forests.* Retrieved October 2015, from http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/State-Forests

SunRail. (2015, September). *Media Information*. Retrieved September 15, 2015, from http://corporate.sunrail.com/media-info/

SWFMD. (2015). *Green Swamp Wilderness Preserve*. Retrieved August 2015, from https://www.swfwmd.state.fl.us/recreation/areas/greenswamp.html

Tampa Bay National Estuary Program. (2006). *Charting the Course, The Comprehensive Conservation and Management Plan for Tampa Bay*. Retrieved August 28, 2015, from http://www.tbep.org/pdfs/ctc/Introduction.pdf

Tampa Bay National Estuary Program. (2015a). *A Portrait of the Tampa Bay Estuary*. Retrieved August 28, 2015, from http://www.tbep.org/a_portrait_of_the_tampa_bay_estuary.html

Tampa Bay National Estuary Program. (2015b). *Fast Facts About Tampa Bay*. Retrieved August 28, 2015, from http://www.tbep.org/a_portrait_of_the_tampa_bay_estuary-fast_facts_about_tampa_bay.html

Tampa Bay National Estuary Program. (2015c). *Manatees*. Retrieved August 28, 2015, from http://www.tbep.org/a_portrait_of_the_tampa_bay_estuary-manatees.html

Tampa Bay National Estuary Program. (2015d). *Sea Turtles*. Retrieved August 28, 2015, from http://www.tbep.org/a_portrait_of_the_tampa_bay_estuary-sea_turtles.html

The Florida Museum of Natural History. (2008). *Educators' Guide - Fossil Hall: Evolution of Life and Land at the Florida Museum of Natural History.* Retrieved from Exhibit Guides: http://www.flmnh.ufl.edu/files/7713/4664/6581/Fossil_EduGuide.pdf

The Florida Senate. (2012). *Chapter 581 Section 083 - 2012 Florida Statutes*. Retrieved from http://www.flsenate.gov/Laws/Statutes/2012/581.083

The Florida State Senate. (2015). *The Florida State Senate, 2011 Florida Statutes*. Retrieved September 2015, from http://www.flsenate.gov/Laws/Statutes/2011/333.02

The Monroe County Tourist Development Council. (2015). *The Florida Keys*. Retrieved August 2015, from http://www.fla-keys.com/

Thompson, W. (2015). *Surficial Geology Handbook for Southern Maine*. Retrieved July 2015, from http://www.maine.gov/dacf/mgs/explore/surficial/sghandbook/surficial_geology_handbook_for_southern_maine.pdf

Tihansky, A. (1999). *Sinkholes, West-Central Florida.* Retrieved March 2015, from U.S. Geological Survey -- Tampa, FL: http://pubs.usgs.gov/circ/circ1182/pdf/15WCFlorida.pdf

TPA. (2015a, September). *Airport Administration*. Retrieved September 15, 2015, from http://www.tampaairport.com/airport-administration

TPA. (2015b, March 16). *Fact Sheet*. Retrieved September 15, 2015, from http://www.tampaairport.com/sites/default/master/files/Fact%20Sheet%20updated%203-2015.pdf

Tri-Rail. (2015). *System Map*. Retrieved September 15, 2015, from http://www.tri-rail.com/train-schedules/System-Map-MIC-Future.pdf

U.S. Bureau of Justice Statistics. (2011, July 26). *Census of State and Local Law Enforcement Agencies*. Retrieved from http://www.bjs.gov/index.cfm?ty=pbdetail&iid=2216

U.S. Census Bureau. (2006). *Government Finance and Employment Classification Manual.* 2006_classification_manual. Retrieved July 2015, from http://www2.census.gov/govs/pubs/classification/2006_classification_manual.pdf

U.S. Census Bureau. (2012, October 14). *2010 Census Urban and Rural Classification and Urban Area Criteria*. Retrieved October 14, 2015, from http://www.census.gov/geo/reference/ua/urban-rural-2010.html.

U.S. Census Bureau. (2015a). *Quick Facts - Florida*. Retrieved 2015, from https://www.census.gov/quickfacts/table/PST045215/12,00

U.S. Census Bureau. (2015b). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014.* Washington, D.C.: US. Census Bureau, Population Division. Retrieved from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.US01PR&prodType=table

U.S. Census Bureau. (2015c, March 11). *Foreign Trade*. Retrieved July 2015 , from United States Census Bureau: http://www.census.gov/foreign-trade/Press-Release/2013pr/12/ft920/index.html

U.S. Census Bureau. (2015d). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Retrieved June 2015, from Other Census Urban Area Information - Maps, Shapefiles & References: http://www.census.gov/geo/reference/ua/urban-rural-2010.html.

U.S. Census Bureau. (2015e). *Population Estimates Program, 2010-2014 Data.* NST-EST2014-alldata. Retrieved March 2015, from http://www.census.gov/popest/data/national/totals/2014/files/NST-EST2014-alldata.pdf

U.S. Census Bureau. (2015f). *2010 Census Summary File 1, Table GCT-PH1, Population, Housing Units, Area, and Density*. (Obtained via Census Bureau online American FactFinder tool) Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.US01PR&prodType=table

U.S. Census Bureau. (2015g). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Other Census Urban Area Information - Maps, Shapefiles & References. Retrieved June 2015, from http://www.census.gov/geo/reference/ua/urban-rural-2010.html

U.S. Census Bureau. (2015h). *American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race*. (Obtained via Census Bureau online Dataferrett tool) Retrieved April 2015, from http://dataferrett.census.gov/

U.S. Census Bureau. (2015i). *American Community Survey and Puerto Rico Community Survey 2013 Subject Definitions.* 2013_ACSSubjectDefinitions. Retrieved April 2015, from http://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2013_ACSSubjectDefinitions.pdf

U.S. Census Bureau. (2015j). *American Community Survey, 2009-2013 5-Year Estimates, Table DP05, Demographic and Housing Estimates*. (Obtained via Census Bureau online American FactFinder tool) Retrieved August 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. (2015k). *Small Area Income and Poverty Estimates (SAIPE), 2013.* Retrieved March 2015, from http://www.census.gov/did/www/saipe/data/statecounty/data/2013.html

U.S. Census Bureau. (2015l). *American Community Survey, 2013 1-Year Estimates, Table DP02, Selected social characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP02&prodType=table

U.S. Census Bureau. (2015m). *American Community Survey, 2013 1-Year Estimates, Table S1902, Mean Income in the Past 12 Months (in 2013 Inflation-Adjusted Dollars).* (Obtained via Census Bureau online American FactFinder tool) Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1902&prodType=table

U.S. Census Bureau. (2015n). *2009-2013 American Community Survey 5-Year Estimates, Table DP03: Selected economic characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April, July 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP03&prodType=table

U.S. Census Bureau. (2015o). *American Community Survey, 2013 1-year Estimates, Table DP03, Selected economic characteristics.* (Obtained via Census Bureau online American FactFinder tool) Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP03&prodType=table

U.S. Census Bureau. (2015p). *American Community Survey, 2009-2013 5-year Estimates, Table DP04, Selected housing characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April, July 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP04&prodType=table

U.S. Census Bureau. (2015q). *American Community Survey, 2013 1-Year Estimates, Table DP04, Selected housing characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP04&prodType=table

U.S. Census Bureau. (2015r). *2012 Census of Governments: Finance – Surveys of State and Local Government Finances, Table LGF001*. (Obtained via Census Bureau online American FactFinder tool) Retrieved June 2015, from

http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=COG_2012_LGF001&prodType=table

U.S. Census Bureau. (2015s). *American Community Survey, 2012 1-Year Estimates, Table B01003: Total Population*. (Obtained via Census Bureau online American FactFinder tool) Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_B01003&prodType=table

U.S. Census Bureau. (2015t). *American Community Survey, 2013 1-Year Estimates, Table DP05, Demographic and Housing Estimates*. (Obtained via Census Bureau online American FactFinder tool) Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP05&prodType=table

U.S. Census Bureau. (2015u). *American Community Survey, 2013 1-Year Estimates, Table S1701: Poverty Status in the Past 12 Months*. (Obtained via Census Bureau online American FactFinder tool) Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1701&prodType=table

U.S. Census Bureau. (2015v). *American Community Survey, 2009-2013 5-Year Summary File, Table B03002, Hispanic or Latino Origin by Race*. (Obtained via Census Bureau online DataFerrett tool) Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015w). *American Community Survey, 2009-2013 5-Year Summary File, Table B17021, Poverty Status of Individuals in the Past 12 Months by Living Arrangement*. (Obtained via Census Bureau online DataFerrett tool) Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015x). *American Community Survey, 2009-2013 5-Year Summary File, Table C17002, Ratio of Income to Poverty Level in the Past 12 Months*. (Obtained via Census Bureau online DataFerrett tool) Retrieved May 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015y). *Statistical Abstract of the United States.* Retrieved from Coastline and Shoreline of the United States by State: https://www.census.gov/compendia/statab/2012/tables/12s0364.pdf

U.S. Census Bureau. (2016). *American Community Survey (ACS)*. Retrieved March 2016, from http://www.census.gov/programs-surveys/acs/

U.S. DoC. (2013, February). *Metropolitan Statistical Areas of Florida*. Retrieved September 15, 2015, from U.S. Census Bureau: http://www2.census.gov/geo/maps/metroarea/stcbsa_pg/Feb2013/cbsa2013_FL.pdf

U.S. Fire Administration. (2015, June 11). *National Fire Department Census*. Retrieved from http://apps.usfa.fema.gov/census-download/main/download

U.S. Harbors. (2015). *Florida Harbors*. Retrieved December 16, 2015, from fl.usharbors.com

UNESCO. (2015a). *The Criteria for Selection*. Retrieved September 8, 2015, from http://whc.unesco.org/en/globalstrategy/

UNESCO. (2015b). *The Criteria for Selection*. Retrieved September 8, 2015, from http://whc.unesco.org/en/criteria/

University of California. (2010). *Environmental Justice for All: A Fifty State Survey of Legislation, Policies and Cases.* Retrieved from http://gov.uchastings.edu/public-law/docs/ejreport-fourthedition.pdf

University of California Museum of Paleontology. (2011, May). *Geologic Time Scale*. Retrieved June 2016, from http://www.ucmp.berkeley.edu/help/timeform.php

University of Florida. (2006). *A Guide to Florida-Friendly Landscaping: Florida Yards & Neighborhoods Handbook.* Retrieved from https://www.swfwmd.state.fl.us/publications/files/fl-friendlyhandbook.pdf

University of Florida. (2012). *Miami blue - Cyclargus thomasi bethunbakeri*. Retrieved from http://entnemdept.ufl.edu/creatures/bfly/miami_blue.htm

University of Florida. (2014). *Schaus swallowtail - Heraclides aristodemus ponceanus*. Retrieved from http://entnemdept.ufl.edu/creatures/bfly/schaus_swallowtail.htm

University of Florida. (2016). *Soil Classification*. Retrieved from http://www.sfrc.ufl.edu/Extension/ffws/soicl.htm

University of Minnesota. (2001). *Soils and Landscapes of Minnesota*. Retrieved July 2015, from http://www.extension.umn.edu/agriculture/tillage/soils-and-landscapes-of-minnesota/

University of Virginia Weldon Cooper Center. (2015). *University of Virginia Weldon Cooper Center for Public Service, National Population Projections, 2020-2040.* Projections for the 50 States and D.C., one-click download of all files, file USProjections_2020to2040_all_data_udpated_noshapefile.zip. Retrieved March 2015, from http://www.coopercenter.org/demographics/national-population-projections

University of West Florida Historic Trust. (2016). *Barkley House*. Retrieved August 8, 2016, from Historic Pensacola: http://www.historicpensacola.org/plan-your-visit/museums-properties/barkley-house/

Upchurch, S. (2007). *An Introduction to the Cody Escarpment, North-Central Florida.* Retrieved October 2015, from http://publicfiles.dep.state.fl.us/FGS/FGS_Publications/FGS%20Library%20Documents/Cody%20Scarp%20Upchurch.pdf

USACE. (1997, July 1). *Planning and Guidance Letter #97-09: Scenic and Aesthetic Considerations.* Retrieved October 15, 2015, from http://planning.usace.army.mil/toolbox/library/MemosandLetters/pgl97-09.pdf

USACE. (2015, August). *Corps Lakes Gateway: Florida*. Retrieved October 22, 2015, from http://corpslakes.usace.army.mil/visitors/states.cfm?state=FL

USCG. (2012). *National Response Center.* Retrieved October 2, 2015, from http://www.nrc.uscg.mil/FOIAFiles/CY12.xlsx

USCG. (2015, December 31). *National Response Center (2015 Reports).* Retrieved March 24, 2016, from http://www.nrc.uscg.mil/FOIAFiles/CY15.xlsx

USDA. (2012). *2012 Census of Agriculture, Florida.* Retrieved October 2015, from http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Florida/

USDA. (2014). *2014 State Agriculture Overview.* Retrieved October 2015, from http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=Florida

USDA. (2015a). *Ecoregions of the United States*. Retrieved from http://www.fs.fed.us/rm/ecoregions/products/map-ecoregions-united-states/

USDA. (2015b). *Plant Pests and Diseases*. Retrieved from https://www.aphis.usda.gov/wps/portal/aphis/ourfocus/planthealth?1dmy&urile=wcm%3apath%3a%2FAPHIS_Content_Library%2FSA_Our_Focus%2FSA_Plant_Health%2FSA_Domestic_Pests_And_Diseases

USDOC. (2013, February 21). *Department of Commerce Environmental Justice Strategy.* Retrieved July 2015, from http://open.commerce.gov/sites/default/files/DOC_Environmental_Justice_Strategy.pdf

USDOI. (2008). *Navajo Reservoir RMP/FEA Appendix E Noise*. Retrieved 07 22, 2015, from https://www.usbr.gov/uc/envdocs/ea/navajo/appdx-E.pdf

USEPA. (1973, July 27). *USEPA.gov.* Retrieved August 5, 2015, from National Service Center for Environmental Publications - Impact Characterization of Noise. (NTID 73.4): o http://nepis.epa.gov/Exe/ZyNET.exe/9101DPQN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=

USEPA. (1974). *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* Washington, D.C.: EPA.

USEPA. (1979, March 19). Notification to Federal Land Manager Under Section 165(d) of the Clean Air Act. Retrieved April 21, 2015, from http://www.epa.gov/sites/production/files/2015-07/documents/fdlndmgr.pdf

USEPA. (1992, October 19). *Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts, U.S. Environmental Protection Agency.* (J. S. Seitz, Ed.) Retrieved April 21, 2015, from http://www.epa.gov/sites/production/files/2015-07/documents/class1.pdf

USEPA. (1995). *America's wetlands: Our vital link between land and water*. Retrieved April 21, 2015, from U.S. Environmental Protection Agency, EPA843-K-95-001: http://water.epa.gov/type/wetlands/fish.cfm

USEPA. (2010, March 24). Revisions to the General Conformity Regulations. Retrieved April 20, 2015, from https://www.epa.gov/general-conformity/final-revisions-general-conformity-regulations

USEPA. (2011, December 12). *CERCLA Overview*. Retrieved from EPA Superfund: http://www.epa.gov/superfund/policy/cercla.htm

USEPA. (2012a). *Water: Estuaries and Coastal Watersheds*. Retrieved April 5, 2015, from Basic Information about Estuaries: http://water.epa.gov/type/oceb/nep/about.cfm

USEPA. (2012b, May). *List of 156 Mandatory Class I Federal Areas*. Retrieved April 20, 2015, from Visibility: http://www3.epa.gov/airquality/visibility/class1.html

USEPA. (2012c, July 16). *Noise Pollution*. Retrieved August 4, 2015, from http://www.epa.gov/air/noise.html

USEPA. (2012d). *Climate Change Indicators in the United States 2012.* Retrieved 2015, from Environmental Protection Agency: http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

USEPA. (2012e). *Fact Sheet - Managing Ozone Air Quality: Findings on Failure to Submit Elements of 1997 Ozone NAAQS State Implementation Plan*. Retrieved July 21, 2015, from http://www.epa.gov/groundlevelozone/fs20080317.html

USEPA. (2012f). *Climate Change Indicators in the United States 2012.* Retrieved 2015, from Environmental Protection Agency: http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

USEPA. (2013a, August 13). *General Conformity*. Retrieved April 20, 2015, from https://www.epa.gov/general-conformity

USEPA. (2013b). *Cleanups in my Community.* Retrieved October 2013, from http://www2.epa.gov/cleanups/cleanups-my-community

USEPA. (2013c, February 21). *EPA Terminology Services*. (U.S. Environmental Protection Agency) Retrieved July 28, 2015, from http://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2013d, February 21). *EPA Terminology Services (TS)*. (U.S. Environmental Protection Agency) Retrieved July 28, 2015, from http://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2014a). *General Facts About the Gulf of Mexico*. Retrieved August 12, 2015, from http://www.epa.gov/gmpo/about/facts.html

USEPA. (2014b, October 28). *Who Has to Obtain a Title V Permit*. Retrieved April 20, 2015, from https://www.epa.gov/title-v-operating-permits/who-has-obtain-title-v-permit

USEPA. (2014c). *National Ambient Air Quality Standards (NAAQS)*. Retrieved April 20, 2015, from http://www.epa.gov/air/criteria.html

USEPA. (2015a). *Florida Water Quality Assessment Report*. Retrieved August 10, 2015, from http://ofmpub.epa.gov/waters10/attains_state.control?p_state=FL

USEPA. (2015b, January). *Chesapeake Bay Glossary*. Retrieved July 15, 2015, from http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=Chesapeake%20Bay%20Glossary

USEPA. (2015c, May). *Sole Source Aquifer Protection Program*. Retrieved July 2015, from http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/solesourceaquifer.cfm

USEPA. (2015d, July 14). *Air Permit Programs*. Retrieved April 20, 2015, from Air Quality Planning and Standards: http://www3.epa.gov/airquality/permjmp.html

USEPA. (2015e, April 21). *The Green Book Nonattainment Areas for Criteria Pollutants*. Retrieved April 21, 2015, from http://www.epa.gov/airquality/greenbook/

USEPA. (2015f, October 27). *Title IV- Noise Pollution*. Retrieved November 2015, 2015, from http://www2.epa.gov/clean-air-act-overview/title-iv-noise-pollution

USEPA. (2015g). *U.S. Greenhouse Gas Inventory Report 1990-2013*. Retrieved 07 28, 2015, from Greenhouse Gas Emissions: http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html#data

USEPA. (2015h). *Cleanups in my Community.* Retrieved October 1, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=cimc:73::::71:P71_WELSEARCH:FL|State|FL|||true|true|true|true|true|true||-1|sites|N|basic

USEPA. (2015i, July 28). *Cleanups in My Community List Results*. Retrieved October 1, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=100:35:5784178371093:::35:P35_State_code,P35_ADV_QUERY:FL,((RCRA_EI_HE_CODE%3D%2527N%2527))OR((SF_EI_HE_CODE%3D%2527N%2527))

USEPA. (2015j, March). *2013 TRI Analysis: State - Florida*. Retrieved November 30, 2015, from http://iaspub.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?&pstate=FL&pyear=2013

USEPA. (2015k, November 12). *Envirofacts - PCS-ICIS*. Retrieved November 30, 2015, from http://www3.epa.gov/enviro/facts/pcs-icis/search.html
USEPA. (2015l). *Envirofacts Search Results*. Retrieved October 21, 2015, from http://www3.epa.gov/enviro/facts/multisystem.html
USEPA. (2015m, June). *U.S. Greenhouse Gas Emissions*. Retrieved September 22, 2015, from http://www3.epa.gov/climatechange/science/indicators/ghg/us-ghg-emissions.html
USEPA. (2015n, November 12). *Envirofacts - PCS-ICIS*. Retrieved November 30, 2015, from http://www3.epa.gov/enviro/facts/pcs-icis/search.html
USEPA. (2015o, July 17). *Technology Transfer Network - Basic Information*. Retrieved July 17, 2015, from http://cfpub.epa.gov/oarweb/mkb/basic_information.cfm
USEPA. (2015p, January 30). *Designations*. Retrieved April 20, 2015, from http://www.epa.gov/airquality/greenbook/define.html
USEPA. (2015q). *Environmental Justice*. Retrieved July 2015, from https://www.epa.gov/environmentaljustice
USEPA. (2015r). *EJSCREEN: Environmental Justice Screening and Mapping Tool*. Retrieved July 2015, from http://www2.epa.gov/ejscreen
USEPA. (2016a, February 21). *Ecoregions of North America*. Retrieved from Western Ecology Division: https://archive.epa.gov/wed/ecoregions/web/html/na_eco.html
USEPA. (2016b). *Environmental Justice*. Retrieved March 2016, from http://www3.epa.gov/environmentaljustice/
USEPA. (2016c, May 18). *Hazardous Air Pollutants*. Retrieved May 25, 2016, from https://www.epa.gov/haps
USEPA. (2016d). *Glossary of Climate Change Terms*. Retrieved from https://www3.epa.gov/climatechange/glossary.html
USEPA. (2016e). *Grants and Programs*. Retrieved March 2016, from http://www3.epa.gov/environmentaljustice/grants/index.html
USEPA. (2016f, May 28). *Waste and Cleanup Risk Assessment Glossary*. Retrieved from Vocabulary Catalog: https://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=Waste%20and%20Cleanup%20Risk%20Assess
USEPA. (2016g, May 19). *De Minimis Levels*. Retrieved from https://www3.epa.gov/airquality/genconform/deminimis.html
USFS. (2005, September). *Everglades Marl Prairie.* Retrieved from Rapid Assessment Reference Condition Model : http://www.fs.fed.us/database/feis/pdfs/PNVGs/Southeast/R9MAPR.pdf
USFS. (2007). *Florida's Forests, 2007.* Retrieved October 2015, from http://www.srs.fs.usda.gov/pubs/42079
USFS. (2009a, Sept 30). *Chapter 90 Communications Site Management.* Retrieved Nov 16, 2015, from Forest Service Handbook 2709.11 - Special Uses Handbook: http://www.fs.fed.us/specialuses/documents/Comm_Use_Policy_2709.11_90.doc
USFS. (2009b). *Soil-Disturbance Field Guide*. Retrieved from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf
USFS. (2015a). *National Forests in Florida*. Retrieved October 2015, from http://www.fs.usda.gov/main/florida/about-forest

USFS. (2015b). *Florida National Scenic Trail*. Retrieved August 2015, from http://www.fs.usda.gov/main/fnst/home
USFS. (2015c). *Apalachicola National Forest*. Retrieved August 2015, from http://www.fs.usda.gov/main/apalachicola/home
USFS. (2015d). *Osceola National Forest*. Retrieved August 2015, from http://www.fs.usda.gov/main/osceola/home
USFS. (2015e). *Ocala National Park*. Retrieved August 2015, from http://www.fs.usda.gov/main/ocala/home
USFS. (2015f). *Main Page*. Retrieved October 5, 2015, from http://www.fs.fed.us/
USFWS. (1975, July 3). *Determination that Seven Eastern U.S. Land Snails are Endangered or Threatened Species*. Retrieved from Federal Register Vol 43, No. 128: http://ecos.fws.gov/docs/federal_register/fr223.pdf
USFWS. (1977a, September 22). *Final Rule: Correction and augmentation of published rulemaking on Critical Habitats*. Retrieved from Federal Register Vol. 42, No. 184: http://ecos.fws.gov/docs/federal_register/fr161.pdf
USFWS. (1977b). *Critical habitat American crocodile.* Retrieved from https://www.fws.gov/verobeach/ReptilesPDFs/AmericanCrocodileCriticalHabitat.pdf
USFWS. (1979, March 23). *Designated Critical Habitat - Determination of Critical Habitat for the Leatherback Sea Turtle*. Retrieved from Federal Register Vol 44, No. 58: http://ecos.fws.gov/docs/federal_register/fr271.pdf
USFWS. (1982a). *Recovery plan gray bat.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/820701.pdf
USFWS. (1982b). *Recovery plan for eastern indigo snake.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/820422.pdf
USFWS. (1983a). *Recovery plan Chapman's rhododendron.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/chapmans%20rhododendron%20rp.pdf
USFWS. (1983b). *Recovery plan Harper's beauty.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/harpers%20beauty%20rp.pdf
USFWS. (1985a). *Recovery plan Kirtland's warbler.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/850930.pdf
USFWS. (1985b). *Miccosukee gooseberry final rule.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr985.pdf
USFWS. (1986a, May 21). *Proposed Threatened Status for the Florida Scub-Jay*. Retrieved from Federal Register Vol. 51, No. 98: https://www.fws.gov/ecos/ajax/docs/federal_register/fr1141.pdf
USFWS. (1986b). *Recovery plan for Florida torreya.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/FL%20torreya%20recov%20plan.pdf
USFWS. (1987a). *Recovery Plan for the Alabama Beach Mouse, Perdido Key Mouse, and Choctawhatchee Beach Mouse.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/870812.pdf
USFWS. (1987b). *Endangered and threatened status for two populations of the roseate tern.* Retrieved from http://ecos.fws.gov/docs/federal_register/fr1346.pdf
USFWS. (1987c). *Recovery plan longspurred mint.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/060313d.pdf
USFWS. (1990). *Recovery plan red wolf.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/901026.pdf

USFWS. (1993a). *Recovery plan Atlantic salt marsh snake.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/931215.pdf
USFWS. (1993b). *Recovery Plan for the Anastasia Island Beach Mouse and Southeastern Beach Mouse.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/930923b.pdf
USFWS. (1994a). *Recovery plan Apalachicola rosemary.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/940927d.pdf
USFWS. (1994b). *Recovery plan for Cooley's meadowrue.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/940421.pdf
USFWS. (1994c). *Recovery plan Florida skullcap.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/940622.pdf
USFWS. (1994d). *Recovery plan Godfrey's butterwort.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/940622.pdf
USFWS. (1994e). *Recovery plan telephus spurge.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/940622.pdf
USFWS. (1994f). *Recovery plan white birds-in-a-nest.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/940622.pdf
USFWS. (1995). *Recovery plan Gulf sturgeon.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/950922.pdf
USFWS. (1996a). *Piping Plover Atlantic Coast Population Revised Recovery Plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/960502.pdf
USFWS. (1996b). *Recovery plan for fringed campion.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/961001.pdf
USFWS. (1996c). *Significant Habitats and Habitat Complexes of the New York Bight Watershed*. Retrieved July 21, 2016, from https://nctc.fws.gov/resources/knowledge-resources/pubs5/web_link/text/int_fish.htm
USFWS. (1997a). *Recovery plan Florida salt marsh vole.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/970930d.pdf
USFWS. (1997b). *Gray bat fact sheet.* Retrieved from USFS Midwest Endangered Species: https://www.fws.gov/midwest/endangered/mammals/grbat_fc.html
USFWS. (1997c). *Recovery plan for wood stork.* Retrieved from http://www.fws.gov/northflorida/WoodStorks/Documents/19970127_rpp_Wood-stork-recovery-plan-1997.pdf
USFWS. (1998a). *Roseate tern recovery plan.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/981105.pdf
USFWS. (1998b). *Recovery plan Okaloosa darter.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/970407.pdf
USFWS. (1999a). *Key Largo Cottonmouse.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/KeyLargoCottonmouse.pdf
USFWS. (1999aa). *Recovery plan Lakela's mint.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Lakela.PDF
USFWS. (1999ab). *Recovery plan Lewton's polygala.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Lewton.PDF
USFWS. (1999ac, May 18). *Key Largo woodrat Recovery Plan Information*. Retrieved August 7, 2016, from https://www.fws.gov/verobeach/MSRPPDFs/KeyLargoWoodrat.pdf
USFWS. (1999ad). *Recovery plan papery whitlow-wort.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Papery.PDF

USFWS. (1999ae). *Recovery plan pigeon wings.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Pigeon.PDF
USFWS. (1999af). *Recovery plan pygmy fringe-tree.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Pygmy.PDF
USFWS. (1999ag). *Recovery plan sandlace.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Sandlace.PDF
USFWS. (1999ah). *Recovery plan scrub blazingstar.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/ScrubBlazing.PDF
USFWS. (1999ai). *Recovery plan scrub lupine.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/ScrubLupine.PDF
USFWS. (1999aj). *Recovery plan scrub mint.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/ScrubMint.PDF
USFWS. (1999ak). *Recovery plan scrub plum.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/ScrubPlum.PDF
USFWS. (1999al). *Recovery plan short-leaved rosemary.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/ShortLeaved.PDF
USFWS. (1999am). *Recovery plan Small's milkpea.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Small.PDF
USFWS. (1999an). *Recovery plan snakeroot.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Snakeroot.PDF
USFWS. (1999ao). *Recovery plan tiny polygala.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/TinyPoly.PDF
USFWS. (1999ap). *Recovery plan wide-leaf warea.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/WideLeaf.PDF
USFWS. (1999aq). *Recovery plan wireweed.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/WireWeed.PDF
USFWS. (1999ar). *Recovery plan Florida scrub jay.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/floridascrubjay.pdf
USFWS. (1999as). *Recovery plan sand skink.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/SandSkink.pdf
USFWS. (1999at). *Recovery plan Okeechobee gourd.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Okeechobee.PDF
USFWS. (1999au). *Key Deer*. Retrieved from South Florida Multi-Species Recovery Plan: https://www.fws.gov/verobeach/MSRPPDFs/KeyDeer.pdf
USFWS. (1999av). *Rice Rate.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/ricerat.pdf
USFWS. (1999aw). *Bachman's Warbler.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/bachmanswarbler.pdf
USFWS. (1999ax). *Cape Sable Seaside Sparrow.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/CapeSableSeasideSparrow.pdf
USFWS. (1999b). *Recovery plan Key Largo woodrat.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/KeyLargoWoodrat.pdf
USFWS. (1999c). *Recovery plan Lower Keys marsh rabbit.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/lowerkeysrabbit.pdf

USFWS. (1999d). *Southeastern beach mouse - multi-species recovery plan for south Florida.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/SoutheasternBeachMouse.pdf
USFWS. (1999e). *Recovery plan Audubon's crested caracara.* Retrieved from https://www.fws.gov/southeast/vbpdfs/species/birds/acca.pdf
USFWS. (1999f). *Recovery plan Bachman's warbler.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/bachmanswarbler.pdf
USFWS. (1999g). *Recovery plan Cape Sable seaside sparrow.* Retrieved from https://www.fws.gov/southeast/5yearreviews/5yearreviews/20100819%205%20yr%20review%20CSSS.pdf
USFWS. (1999h). *Recovery plan Everglade snail kite.* Retrieved from https://www.fws.gov/verobeach/msrppdfs/evergladesnailkite.pdf
USFWS. (1999i). *Recovery plan Florida grasshopper sparrow.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/FloridaGrasshopperSparrow.pdf
USFWS. (1999j). *Recovery plan American crocodile.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Croc.pdf
USFWS. (1999k). *Recovery plan Stock Island tree snail.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/StockIslandTreeSnail.pdf
USFWS. (1999l). *Recovery plan Avon Park harebells.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Avon.PDF
USFWS. (1999m). *Recovery plan beach jacquemontia.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Beach.PDF
USFWS. (1999n). *Recovery plan beautiful pawpaw.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Beautiful.PDF
USFWS. (1999o). *Recovery plan Carter's mustard.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Carter.PDF
USFWS. (1999p). *Recovery plan crenulate lead-plant.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Crenulate.pdf
USFWS. (1999q). *Recovery plan deltoid spurge.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Deltoid.PDF
USFWS. (1999r). *Recovery plan Florida bonamia.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/FLBonamia.PDF
USFWS. (1999s). *Recovery plan Florida perforate cladonia.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/FLPerforate.PDF
USFWS. (1999t). *Recovery plan Florida ziziphus.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/FLZizi.PDF
USFWS. (1999u). *Recovery plan four-petal pawpaw.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Fourpetal.PDF
USFWS. (1999v). *Recovery plan fragrant prickly-apple.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Fragrant.PDF
USFWS. (1999w). *Recovery plan Garber's spurge.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Garbers.PDF
USFWS. (1999x). *Recovery plan Garrett's mint.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Garrett.PDF
USFWS. (1999y). *Recovery plan Highlands scrub hypericum.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/Highland.PDF

USFWS. (1999z). *Recovery plan Key tree cactus.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/KeyCactus.PDF

USFWS. (2000). *Critical habitat rice rat*. Retrieved from https://www.fws.gov/verobeach/MammalsPDFs/RiceRatCriticalHabitat.pdf?spcode=A0AA

USFWS. (2001a). *Recovery plan for Florida manatee*. Retrieved from https://www.fws.gov/northflorida/Manatee/Recovery%20Plan/2001_FWS_Florida_Manatee_Recovery_Plan.pdf

USFWS. (2001b). *Critical habitat piping plover*. Retrieved from https://www.federalregister.gov/articles/2001/07/10/01-16905/endangered-and-threatened-wildlife-and-plants-final-determination-of-critical-habitat-for-wintering

USFWS. (2003a). *Recovery plan for the red-cockaded woodpecker (Picoides borealis).* Retrieved from http://ecos.fws.gov/docs/recovery_plan/030320_2.pdf

USFWS. (2003b). *Recovery plan for 7 mussels in Gulf of Mexico*. Retrieved from http://ecos.fws.gov/docs/recovery_plan/030930.pdf

USFWS. (2003c). *Critical habitat Gulf sturgeon.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/fr/fr68-13370.pdf

USFWS. (2003d). *Recovery plan for 7 mussels in Gulf of Mexico.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/030930.pdf

USFWS. (2005a). *Squirrel Chimney Cave Shrimp.* Retrieved from http://www.fws.gov/northflorida/Species-Accounts/PDFVersions/Squirrel-Chimney-Cave-Shrimp-2005.pdf

USFWS. (2005b). *Etonia rosemary (Conradina etonia).* Retrieved from http://www.fws.gov/northflorida/Species-Accounts/Etonia-Rosemary-2005.htm

USFWS. (2005c). *Red knot fact sheet.* Retrieved from http://www.fws.gov/northeast/redknot/pdf/Redknot_BWfactsheet092013.pdf

USFWS. (2007a). *Critical habitat for 7 mussels in Gulf of Mexico.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2007-11-15/pdf/07-5551.pdf#page=1

USFWS. (2007b). *Choctawhatchee Beach Mouse 5 Year Review: Summary and Evaluation.* Retrieved from https://www.fws.gov/southeast/5yearreviews/5yearreviews/ChoctawhatcheeBeachMouse.pdf

USFWS. (2007c). *Ruge's Pawpaw (Deeringothamnjus rugelii) 5 Year-Review: Summary and Evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1990.pdf

USFWS. (2007d, November 6). *Critical habitat revised desgination for the Cape Sable Seaside Sparrow, Final Rule*. Retrieved from Federal Register ol. 72, No. 214: https://www.gpo.gov/fdsys/pkg/FR-2007-11-06/pdf/07-5460.pdf#page=2

USFWS. (2008a). *Loggerhead sea turtle recovery plan for northwest Atlantic Ocean population.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/090116.pdf

USFWS. (2008b). *American chaffseed (Schwalbea americana) 5-year review: summary and evaluation.* Retrieved from http://www.fws.gov/northeast/EcologicalServices/pdf/endangered/5_yr_chaffseed.pdf

USFWS. (2008c). *Ribes echinellum (Miccosukee gooseberry) 5-Year Reviw: Summary and Evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc1925.pdf

USFWS. (2008d). *Draft revised recovery plan for the Mojave population of.* Retrieved from https://www.fws.gov/nevada/desert_tortoise/documents/recovery_plan/draftrevrp_mojave_desert_tortoise.pdf

USFWS. (2008e). *Recovery plan Florida panther.* Retrieved from http://ecos.fws.gov/docs/recovery_plan/081218.pdf

USFWS. (2009a). *Final rule on flatwoods salamanders.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2009-02-10/pdf/E9-2403.pdf#page=1

USFWS. (2009b). *Soil-Disturbance Field Guide.* Retrieved September 2015, from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf

USFWS. (2009c). *Florida golden aster (Chrysopsis floridana).* Retrieved from http://www.fws.gov/northflorida/Species-Accounts/Fla-Golden-Aster-2005.htm

USFWS. (2010). *Recovery Plan for the St. Andrew Beach Mouse.* Retrieved from https://ecos.fws.gov/docs/recovery_plan/20110104_SABM_recov_plan_FINAL.pdf

USFWS. (2011a). *Roseate tern.* Retrieved from http://www.fws.gov/northeast/pdf/Roseatetern0511.pdf

USFWS. (2011b, August 10). *Endangered and Threatened Wildlife and Plants: Emergency listing of the Miami Blue Butterfly*. Retrieved from Federal Register Vol. 76, No. 154: https://www.gpo.gov/fdsys/pkg/FR-2011-08-10/pdf/2011-19812.pdf

USFWS. (2012a). *Critical habitat for 8 freshwater mussels.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2012-10-10/pdf/2012-24161.pdf

USFWS. (2012b). *Recovery plan gentian pinkroot.* Retrieved from http://www.fws.gov/panamacity/resources/Spigelia%20gentianoides%20Recovery%20Plan.pdf

USFWS. (2012c). *Florida, U.S. Fish and Wildlife Service*. Retrieved October 2015, from http://www.fws.gov/southeast/maps/fl.html

USFWS. (2012d, November). *Frequently asked questions about invasive species*. Retrieved from Invasive Species: https://www.fws.gov/invasives/faq.html#q2

USFWS. (2012e). *Critical habitat for 8 freshwater mussels*. Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2012-10-10/pdf/2012-24161.pdf

USFWS. (2013a). *Endangered status ruling for Florida semaphore cactus.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2013-10-24/pdf/2013-24177.pdf

USFWS. (2013b). *Proposed Endangered Status for Brickellia mosieri (Florida Brickell-bush) and Linum carteri var. carteri (Carter's Small-flowered Flax)* . Retrieved from Federal Register: https://www.gpo.gov/fdsys/pkg/FR-2013-10-03/pdf/2013-24173.pdf

USFWS. (2013c). *Red knot fact sheet*. Retrieved from http://www.fws.gov/northeast/redknot/pdf/Redknot_BWfactsheet092013.pdf

USFWS. (2013d, November 26). *Florida Panther National Wildlife Refuge*. Retrieved October 5, 2015, from http://www.fws.gov/refuge/Florida_Panther/about.html

USFWS. (2013e). *Migratory Bird Treaty Act*. Retrieved from http://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php

USFWS. (2014a). *National Wetlands Inventory website*. Retrieved May 15, 2015, from http://www.fws.gov/wetlands/

USFWS. (2014b). *Coastal Salt Marsh.* Retrieved May 2015, from Multi-Species Recovery Plan for South Florida: http://www.fws.gov/verobeach/MSRPPDFs/SaltMarsh.pdf

USFWS. (2014c). *Rufa red knot background information and threats assessment.* Retrieved from http://www.fws.gov/northeast/redknot/pdf/20141125_REKN_FL_supplemental_doc_FINAL.pdf

USFWS. (2014d). *American chaffseed (Schwalbea americana).* Retrieved from http://www.fws.gov/northeast/njfieldoffice/Endangered/chaffseed.html

USFWS. (2014e). *Statistical Data Tables for Lands Under Control of the Fish & Wildlife Service.* Retrieved October 2015, from http://www.fws.gov/refuges/land/LandReport.html

USFWS. (2014f). *Perdido Key Beach Mouse 5-Year Review: Summary and Evaluation.* Retrieved from https://www.fws.gov/panamacity/resources/PKBM_5_YearReviewFINAL.pdf

USFWS. (2014g). *Critical habitat for Cape Sable thoroughwort.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2014-01-08/pdf/2013-31576.pdf

USFWS. (2014h). *Candidate species - Section 4 of the Endangered Species Act.* Retrieved from https://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf

USFWS. (2014i). *Freshwater Marshes and Wet Praries.* Retrieved from https://www.fws.gov/verobeach/MSRPPDFs/FreshMarWetPrairie.pdf

USFWS. (2015a, October 15). *About: Mission.* Retrieved October 23, 2015, from http://www.fws.gov/refuges/about/mission.html

USFWS. (2015aa). *Species profile for Bartram's hairstreak butterfly (Strymon acis bartrami).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I07G

USFWS. (2015ab). *Species profile for beach jacquemontia (Jacquemontia reclinata).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2BZ#crithab

USFWS. (2015ac). *Species profile for beautiful pawpaw (Deeringothamnus pulchellus).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q28O#crithab

USFWS. (2015ad). *Species profile for bluetail mole skink (Eumeces egregius lividus).* Retrieved from http://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=C03T

USFWS. (2015ae). *Species profile for Brooksville bellflower (Campanula robinsiae).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1TV#crithab

USFWS. (2015af). *Species profile for Cape Sable seaside sparrow (Ammodramus maritimus mirabilis).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B00Q#crithab

USFWS. (2015ag). *Species profile for Cape Sable thoroughwort (Chromolaena frustrata).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q3HJ#crithab

USFWS. (2015ah). *Species profile for Carter's mustard (Warea carteri).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2MA#crithab

USFWS. (2015ai). *Species profile for Chapman rhododendron (Rhododendron chapmanii).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q215#crithab

USFWS. (2015aj). *Species profile for Chipola slabshell (Elliptio chipolaensis).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=F03O

USFWS. (2015ak, October). *Species profile for Cooley's meadowrue (Thalictrum cooleyi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q231

USFWS. (2015al). *Species profile for Cooley's water-willow (Justicia cooleyi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1XO#crithab

USFWS. (2015am). *Species profile for crenulate lead-plant (Amorpha crenulata)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2RI&ftb_embed=true#crithab

USFWS. (2015an). *Species profile for deltoid spurge (Chamaesyce deltoidea ssp. deltoidea)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q26X&ftb_embed=true#crithab

USFWS. (2015ao). *Species profile for eastern indigo snake (Drymarchon corais couperi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=C026

USFWS. (2015ap). *Species profile for etonia rosemary (Conradina etonia)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q3AG#crithab

USFWS. (2015aq). *Species profile for Everglade snail kite (Rostrhamus sociabilis plumbeus)*. Retrieved from http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B00F

USFWS. (2015ar). *Species profile for Florida bonneted bat (Eumops floridanus)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JB#recovery

USFWS. (2015as). *Species profile for Florida brickell-bush (Brickellia mosieri)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q09E

USFWS. (2015at). *Species profile for Florida golden aster (Chrysopsis floridana)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q272#crithab

USFWS. (2015au). *Species profile for Florida grasshopper sparrow (Ammodramus savannarum floridanus)*. Retrieved from https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=B07G

USFWS. (2015av). *Species profile for Florida leafwing butterfly (Anaea troglodyta floridalis)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I087

USFWS. (2015aw). *Species profile for Florida panther (Puma (=felis) concolor coryi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A008

USFWS. (2015ax). *Species profile for Florida perforate cladonia (Cladonia perforata)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=U000#crithab

USFWS. (2015ay). *Species profile for Florida salt marsh vole (Microtus pennsylvanicus dukecampbelli)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0ET

USFWS. (2015az). *Species profile for Florida scrub-jay (Aphelocoma coerulescens)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B082#crithab

USFWS. (2015b, December 10). *American Crocodile*. Retrieved from Crocodile Lake: https://www.fws.gov/refuge/Crocodile_Lake/wildlife_and_habitat/american_crocodile/

USFWS. (2015ba). *Species profile for Florida semaphore cactus (Consolea corallicola)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q3HT

USFWS. (2015bb). *Species profile for Florida skullcap (Scutellaria floridana)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2I9#crithab

USFWS. (2015bc, October). *Species profile for Florida torreya (Torreya taxifolia)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=R006

USFWS. (2015bd). *Species profile for Florida ziziphus (Ziziphus celata)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2WX#crithab

USFWS. (2015be). *Species profile for four-petal pawpaw (Asimina tetramera)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1T7

USFWS. (2015bf). *Species profile for fragrant prickly-apple (Cereus eriophorus var. fragrans)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1U6#crithab

USFWS. (2015bg). *Species profile for fringed campion (Silene polypetala)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q21P

USFWS. (2015bh). *Species profile for frosted flatwoods salamander (Ambystoma cingulatum)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=D042

USFWS. (2015bi). *Species profile for Garber's spurge (Chamaesyce garberi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1U9#crithab

USFWS. (2015bj). *Species profile for Garrett's mint (Dicerandra christmanii)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2RL#crithab

USFWS. (2015bk). *Species profile for gentian pinkroot (Spigelia gentianoides)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q21W#crithab

USFWS. (2015bl). *Species profile for Godfrey's butterwort (Pinguicula ionantha)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2G0#crithab

USFWS. (2015bm). *Species profile for gray bat (Myotis grisescens)*. Retrieved from https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A04J

USFWS. (2015bn, October). *Species profile for Gulf moccasinshell (Medionidus penicillatus)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=F03M

USFWS. (2015bo). *Species profile for Gulf sturgeon (Acipenser oxyrinchus desotoi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E04W

USFWS. (2015bp). *Species profile for Harper's beauty (Harperocallis flava)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1WX#crithab

USFWS. (2015bq). *Species profile for hawksbill sea turtle (Eretmochelys imbricata)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00E

USFWS. (2015br). *Species profile for Highlands scrub hypericum (Hypericum cumulicola)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1XJ#crithab

USFWS. (2015bs). *Species profile for Kemp's Ridley sea turtle (Lepidochelys kempii)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00O

USFWS. (2015bt). *Species profile for Key deer (Odocoileus virginianus clavium)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A003

USFWS. (2015bu). *Species profile for Key Largo cotton mouse (Peromyscus gossypinus allapaticola)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A086&ftb_embed=true

USFWS. (2015bv). *Species profile for Key Largo woodrat (Neotoma floridana smalli)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A087

USFWS. (2015bw). *Species profile for Key tree cactus (Pilosocereus robinii)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q208&ftb

USFWS. (2015bx). *Species profile for Kirtland's warbler (Setophaga kirtlandii)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=B03I

USFWS. (2015by). *Species profile for Lakela's mint (Dicerandra immaculata)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1VF

USFWS. (2015bz). *Species profile for leatherback sea turtle (Dermochelys coriacea)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00F

USFWS. (2015c). *Anastasia Island (Peromyscus polionotus phasma) and southeastern (Peromyscus polionotus niveiventris) beach mice species*. Retrieved from http://www.fws.gov/northflorida/species-accounts/beach-mice-2005.htm

USFWS. (2015ca). *Species profile for Lewton's polygala (Polygala lewtonii)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q20Q

USFWS. (2015cb). *Species profile for loggerhead sea turtle (Caretta caretta)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00U

USFWS. (2015cc). *Species profile for longspurred mint (Dicerandra cornutissima)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2OH#crithab

USFWS. (2015cd). *Species profile for Lower Keys marsh rabbit (Sylvilagus palustris hefneri)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0AA

USFWS. (2015ce). *Species profile for Miami blue butterfly (Cyclargus (=hemiargus) thomasi bethunebakeri)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=I02Q

USFWS. (2015cf). *Species profile for Miccosukee gooseberry (Ribes echinellum)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q217

USFWS. (2015cg). *Species profile for Okaloosa darter (Etheostoma okaloosae)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E00H#crithab

USFWS. (2015ch). *Species profile for Okeechobee gourd (Cucurbita okeechobeensis ssp. okeechobeensis)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q280#crithab

USFWS. (2015ci). *Species profile for papery whitlow-wort (Paronychia chartacea)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1ZV&ftb_embed=true#crithab

USFWS. (2015cj). *Species profile for Perdido Key beach mouse (Peromyscus polionotus trissyllepsis)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A08C

USFWS. (2015ck). *Species profile for pigeon wings (Clitoria fragrans)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q27C&ftb_embed=true#crithab

USFWS. (2015cl). *Species profile for piping plover (Charadrius melodus)*. Retrieved from http://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=B079

USFWS. (2015cm, October). *Species profile for purple bankclimber (Elliptoideus sloatianus)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=F02E

USFWS. (2015cn). *Species profile for pygmy fringe-tree (Chionanthus pygmaeus)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q26Y#crithab

USFWS. (2015co). *Species profile for red wolf (Canis rufus)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=A00F

USFWS. (2015cp). *Species profile for red-cockaded woodpecker (Picoides borealis)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B04F

USFWS. (2015cq). *Species profile for rice rat (Oryzomys palustris natator)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A083#crithab

USFWS. (2015cr). *Species profile for Rugel's pawpaw (Deeringothamnus rugelii)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q28P#recovery

USFWS. (2015cs). *Species profile for sand skink (Neoseps reynoldsi)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C03V

USFWS. (2015ct). *Species profile for sandlace (Polygonella myriophylla)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q20S&ftb_embed=true#crithab

USFWS. (2015cu). *Species profile for Schaus swallowtail butterfly (Heraclides aristodemus ponceanus)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=I016

USFWS. (2015cv). *Species profile for scrub blazingstar (Liatris ohlingerae)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1XZ#crithab

USFWS. (2015cw). *Species profile for scrub buckwheat (Eriogonum longifolium var. gnaphalifolium)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile;jsessionid=3EF3C0ADC4DB915DE534928457C7C0B0?spcode=Q29N

USFWS. (2015cx). *Species profile for scrub lupine (Lupinus aridorum)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2PR&ftb_embed=true

USFWS. (2015cy, October). *Species profile for shinyrayed pocketbook (Lampsilis subangulata)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=F02Y

USFWS. (2015cz). *Species profile for Small's milkpea (Galactia smallii)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2RJ&ftb_embed=true#crithab

USFWS. (2015d). *Britton's beargrass (Nolina brittoniana)*. Retrieved from http://www.fws.gov/northflorida/Species-Accounts/Brittons-Beargrass-2005.htm

USFWS. (2015da). *Species profile for snakeroot (Eryngium cuneifolium)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q29T#crithab

USFWS. (2015db). *Species profile for southeastern beach mouse (Peromyscus polionotus niveiventris)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0C9

USFWS. (2015dc). *Species profile for St. Andrew beach mouse (Peromyscus polionotus peninsularis)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0CB

USFWS. (2015de). *Species profile for telephus spurge (Euphorbia telephioides)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2A5#crithab

USFWS. (2015df). *Species profile for tiny polygala (Polygala smallii)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2GW

USFWS. (2015dg, October). *Species profile for West Indian manatee (Trichechus manatus)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=A007

USFWS. (2015dh). *Species profile for white birds-in-a-nest (Macbridea alba)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1YP&ftb_embed=true#crithab

USFWS. (2015di). *Species profile for wide-leaf warea (Warea amplexifolia)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q2M9#crithab

USFWS. (2015dj). *Species profile for wireweed (Polygonella basiramia)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile.action%3bjsessionid=4A0E6ADA0A4CD007517E7D6ECA75581A?spcode=Q20R#crithab

USFWS. (2015dk, October). *Species profile for wood stork (Mycteria americana)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B06O

USFWS. (2015dl). *Species account for Florida Bonamia*. Retrieved from http://www.fws.gov/northflorida/Species-Accounts/Fla-Bonamia-2005.htm

USFWS. (2015dm). *Status of the Species - Bartum's scrub-hairstreak butterfly*. Retrieved from https://www.fws.gov/verobeach/StatusoftheSpecies/20151006_SOS_BartramsScrubHairstreak.pdf

USFWS. (2015dn, January 26). *Wetlands Mapper Legend Categories*. Retrieved April 20, 2015, from National Wetland Inventory: http://www.fws.gov/wetlands/Data/Mapper-Wetlands-Legend.html

USFWS. (2015do, October 9). *Bartram's scrub-hairstreak butterful*. Retrieved from National Key Deer Refuge: https://www.fws.gov/refuge/National_Key_Deer_Refuge/wildlife_and_habitat/bartrams.html

USFWS. (2015dp). *Critical habitat for Florida Brickell-bush and Carter's small-flowered flax.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2015-08-17/pdf/2015-19533.pdf

USFWS. (2015dq). *Piping plover (Charadrius melodus).* Retrieved from http://www.fws.gov/charleston/pdf/PIPL_page.pdf

USFWS. (2015dr). *Piping plover, Atlantic Coast population*. Retrieved from http://www.fws.gov/northeast/pipingplover/overview.html

USFWS. (2015ds). *Q&A for Florida bonneted bat.* Retrieved from http://www.fws.gov/southeast/news/images/FAQsFL-BonnetedBat.pdf

USFWS. (2015dt). *Red-cockaded woodpecker recovery*. Retrieved from http://www.fws.gov/rcwrecovery/rcw.html

USFWS. (2015du). *Species profile for aboriginal prickly-apple (Harrisia aboriginum).* Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q0DR

USFWS. (2015dv). *Species profile for American crocodile (Crocodylus acutus)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C02J#crithab

USFWS. (2015dw). *Species profile for Apalachicola rosemary (Conradina glabra)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q1UQ#crithab

USFWS. (2015dx). *Species profile for Atlantic salt marsh snake (Nerodia clarkii taeniata).* Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C01T

USFWS. (2015dy). *Species profile for Audubon's crested caracara (Polyborus plancus audubonii)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06Q#crithab

USFWS. (2015dz). *Species profile for Avon Park harebells (Crotalaria avonensis)*. Retrieved from https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q31F#crithab

USFWS. (2015e). *Brooksville bellflower (Campanula robinsiae) and Cooley's water willow (Justicia cooleyi)*. Retrieved from http://www.fws.gov/northflorida/Species-Accounts/Bellflower-Waterwillow-2005.htm

USFWS. (2015ea). *Species profile for Bachman's warbler (Vermivora bachmanii)*. Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=B03G

USFWS. (2015f). *Chassahowitzka National Wildlife Refuge.* Retrieved August 2015, from http://www.fws.gov/southeast/pubs/chasstearsheet.pdf

USFWS. (2015g). *Critical habitat for Florida semaphore cactus and aboriginal prickly-apple.* Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2015-01-22/pdf/2015-00344.pdf

USFWS. (2015h). *Critical habitat portal*. Retrieved from http://ecos.fws.gov/crithab/

USFWS. (2015i). *Crystal River National Wildlife Refuge.* Retrieved August 2015, from http://www.fws.gov/southeast/pubs/CrystalRiver-Tearsheet.pdf

USFWS. (2015j, January 26). *Data Limitations, Exclusions and Precautions*. Retrieved May 11, 2015, from http://www.fws.gov/wetlands/Data/Limitations.html

USFWS. (2015k). *Designation of Critical Habitat for Brickellia mosieri (Florida Brickell-bush) and Linum carteri var. carteri (Carter's Small-flowered Flax); Final Rule*. Retrieved from Federal Register: https://www.gpo.gov/fdsys/pkg/FR-2015-08-17/pdf/2015-19533.pdf

USFWS. (2015l). *Egmont Key National Wildlife Refuge*. Retrieved August 2015, from http://www.fws.gov/egmontkey/

USFWS. (2015m). *Endangered and Threatened Wildlife and Plants; Endangered Species Status for Trichomanes punctatum ssp. floridanum (Florida Bristle Fern).* Retrieved May 2016, from Federal Register: https://www.gpo.gov/fdsys/pkg/FR-2015-10-06/pdf/2015-25299.pdf

USFWS. (2015n). *Everglades Headwaters National Wildlife Refuge and Conservation Area*. Retrieved October 5, 2015, from http://www.fws.gov/evergladesheadwaters/#.VhJOX7HD9jo

USFWS. (2015o). *Fact sheet Gulf sturgeon.* Retrieved from http://www.fws.gov/panamacity/resources/SturgeonFactS08.pdf

USFWS. (2015p). *Fact sheet Okaloosa darter*. Retrieved from http://www.fws.gov/panamacity/okaloosadarter.html

USFWS. (2015q). *FAQ Florida bonneted bat.* Retrieved from http://www.fws.gov/southeast/news/images/FAQsFL-BonnetedBat.pdf

USFWS. (2015r). *Harperocallis flava Harper's beauty 5 Year Review: Summary and Evaluation.* Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4762.pdf

USFWS. (2015s). *Hawksbill sea turtle fact sheet.* Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/hawksbill-sea-turtle.htm

USFWS. (2015t). *Kemp's Ridley sea turtle fact sheet.* Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/PDF/Kemps-Ridley-Sea-Turtle.pdf

USFWS. (2015u). *Leatherback sea turtle fact sheet.* Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/PDF/Leatherback-Sea-Turtle.pdf

USFWS. (2015v). *Listed species believed to or known to occur in Florida*. Retrieved from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=FL

USFWS. (2015w, April). *Loggerhead Sea Turtle (Caretta caretta).* Retrieved from Fact Sheet: https://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/PDF/Loggerhead-Sea-Turtle.pdf

USFWS. (2015x). *Loggerhead sea turtle fact sheet.* Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/PDF/Loggerhead-Sea-Turtle.pdf

USFWS. (2015y). *National Wildlife Refuge Locator*. Retrieved October 5, 2015, from http://www.fws.gov/refuges/refugeLocatorMaps/Florida.html

USFWS. (2015z). *Pelican Island National Wildlife Refuge*. Retrieved October 6, 2015, from http://www.fws.gov/refuges/profiles/index.cfm?id=41572

USFWS. (2016a). *Tropical Hardwood Hammock.* Retrieved September 2016, from https://www.fws.gov/verobeach/msrppdfs/trophammock.pdf

USFWS. (2016b, March). *West Indian Manatee*. Retrieved from Southeast Region: https://www.fws.gov/southeast/wildlife/mammal/manatee/

USFWS. (2016c). *Kemp's Ridley sea turtle*. Retrieved from Environmental Conservation Online System: https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=C00O

USFWS. (2016d, June). *Gulf Sturgeon Fact Sheet.* Retrieved from Gulf Sturgeon: https://www.fws.gov/panamacity/resources/SturgeonFactS08.pdf

USFWS. (2016e). *Choctawhatchee Beach mouse*. Retrieved from Environmental Conservation Online System: http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A08B#conservationPlans

USFWS. (2016f). *Bachman's warbler*. Retrieved from ECOS: http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B03G

USFWS. (2016g, June 21). *Hawksbill Sea Turtle*. Retrieved from Fact Sheet: https://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/hawksbill-sea-turtle.htm

USFWS. (2016h). *Florida Panther fact sheet*. Retrieved from Natural Wildlife Refuge - Florida: https://www.fws.gov/refuge/florida_panther/wah/panther.html

USFWS. (2016i). *Elkhorn coral*. Retrieved from ECOS: https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=P001

USFWS. (2016j). *Species profile for fat threeridge*. Retrieved from ECOS: http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=F032

USFWS. (2016k). *Schaus Swallowtail Butterfly: Partnerships with Private Landowners: A Vital Piece of the Conservation Puzzle.* Retrieved from https://www.fws.gov/southeast/pubs/facts/schaus_swallowtail_fs.pdf

USFWS. (2016l). *Species profile for Squirrel Chimney Cave Shrimp*. Retrieved from ECOS: http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=K02F

USFWS. (2016m). *Species profile for Staghorn coral*. Retrieved from ECOS: http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=P000

USFWS. (2016n). *Britton's beargrass (Nolina brittoniana).* Retrieved from ECOS: http://ecos.fws.gov/tess_public/profile/speciesProfile?spcode=Q2E9

USFWS. (2016o). *Species Account for Longspurred Mint*. Retrieved from North Florida Ecological Services Office: https://www.fws.gov/northflorida/Species-Accounts/Longspurred-Mint-2005.htm

USFWS. (2016p). *Species Account Rugel's Pawpaw*. Retrieved from North Florida Ecological Services Office: https://www.fws.gov/northflorida/Species-Accounts/Rugels-Pawpaw-2005.htm

USFWS. (2016q). *Species Account for the Scrub Buckwheat*. Retrieved from North Florida Ecologicial Services Office: https://www.fws.gov/northflorida/species-accounts/scrub-buckwheat-2005.htm

USFWS. (2016r). *Green Sea Turtle Fact Sheet*. Retrieved from North Florida Ecological Services Office: https://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/green-sea-turtle.htm

USGCRP. (2009). *Global Climate Change Impacts in the United States.* New York: Cambridge University Press.

USGCRP. (2014a). *National Climate Assessment: Southeast and Caribbean*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/southeast

USGCRP. (2014b). *U.S. Global Change Research Program: Precipitation Change*. Retrieved from National Climate Assessment: http://nca2014.globalchange.gov/report/our-changing-climate/precipitation-change

USGCRP. (2014c). *National Climate Assessment: Coastal Zone Development and Ecosystems*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/coasts#narrative-page-16832

USGCRP. (2014d). *National Climate Assessment: Changes in Storms*. Retrieved July September, 2015, from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms

USGCRP. (2014e, April 27). *National Climate Assessment*. Retrieved from http://nca2014.globalchange.gov/report/regions/northeast#intro-section-2

USGS. (1995a). *Groundwater Atlas of the United States*. Retrieved August 11, 2015, from http://pubs.usgs.gov/ha/ha730/ch_g/G-text3.html

USGS. (1995b). *Floridian Aquifer System*. Retrieved August 11, 2015, from http://pubs.usgs.gov/ha/ha730/ch_g/G-text6.html

USGS. (1995c). *Surficial Aquifer System*. Retrieved August 11, 2015, from http://pubs.usgs.gov/ha/ha730/ch_g/G-text2.html

USGS. (1995d). *Biscayne Aquifer*. Retrieved August 11, 2015d, from http://pubs.usgs.gov/ha/ha730/ch_g/G-text4.html

USGS. (1996). *Water Quality of Surficial Aquifers in the Georgia-Florida Coastal Plain*. Retrieved August 11, 2015, from http://fl.water.usgs.gov/PDF_files/wri95_4269_crandall.pdf

USGS. (1999). *How Ground Water Occurs*. Retrieved February 12, 2013, from U.S. Geological Survey General Interest Publication: http://pubs.usgs.gov/gip/gw/how_a.html

USGS. (2000a). *Land Subsidence in the United States (Fact Sheet 165-00)*. Retrieved September 2013, from http://water.usgs.gov/ogw/pubs/fs00165/SubsidenceFS.v7.PDF

USGS. (2000b). *Estimated Withdrawals From Principal Aquifers in the United States*. Retrieved August 11, 2015, from http://pubs.usgs.gov/circ/2005/1279/pdf/circ1279.pdf

USGS. (2001). *Elevations and Distances in the United States*. Retrieved July 2016, from http://pubs.usgs.gov/gip/Elevations-Distances/elvadist.html
USGS. (2003a). *National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction*. Retrieved September 2013, from http://pubs.usgs.gov/circ/c1244/c1244.pdf
USGS. (2003b). *A Tapestry of Time and Terrain: The Union of Two Maps, Geology and Topography*. Retrieved September 2013
USGS. (2005). *Elevations and Distances in the United States.* Retrieved October 2015, from http://egsc.usgs.gov/isb//pubs/booklets/elvadist/elvadist.html
USGS. (2010). *What is "Peak Acceleration" or "Peak Ground Acceleration" (PGA)?* Retrieved April 2015, from http://geohazards.usgs.gov/deaggint/2002/documentation/parm.php
USGS. (2011, August). *Gap Analysis Program (GAP).* Retrieved from National Land Cover, Version 2: http://gapanalysis.usgs.gov/gaplandcover/data/
USGS. (2012a). *Earthquake Glossary - Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/glossary/?term=earthquake
USGS. (2012b, December). *The USGS Land Cover Institute*. Retrieved August 2015, from http://landcover.usgs.gov/classes.php/
USGS. (2012c, November). *Gap Analysis Program (GAP).* Retrieved from Protected Areas Database of the United States (PADUS), version 1.3 Fee: http://gapanalysis.usgs.gov/padus/
USGS. (2012d). *Florida Land Cover*. Retrieved October 2015, from http://landcover.usgs.gov/florida.php
USGS. (2013a, June 17). *Water Basics Glossary*. Retrieved February 2016, from http://water.usgs.gov/water-basics_glossary.html
USGS. (2013b). *Land Subsidence from Ground-water Pumping*. Retrieved September 2013, from http://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/
USGS. (2013c). *South Florida Restoration Science Forum*. Retrieved August 28, 2015, from http://sofia.usgs.gov/sfrsf/rooms/historical/soils/past.html
USGS. (2013d). *The South Florida Environment -- A Region Under Stress (Circular 1134).* Retrieved March 2015, from http://sofia.usgs.gov/publications/circular/1134/esns/
USGS. (2013e). *Glossary of Glacier Terminology.* Retrieved August 2015, from http://pubs.usgs.gov/of/2004/1216/text.html#tz
USGS. (2014a). *Geologic Units in Florida.* Retrieved October 2015, from https://mrdata.usgs.gov/geology/state/fips-unit.php?state=FL
USGS. (2014b). *Florida Seismicity Map: 1973 - 2012.* Retrieved March 2015, from http://earthquake.usgs.gov/earthquakes/states/florida/seismicity.php
USGS. (2014c). *Winter Park Florida Sinkhole of 1981.* Retrieved March 2015, from http://gallery.usgs.gov/photos/03_13_2014_dhx3BNm00U_03_13_2014_0#.VRMncfnF-So
USGS. (2014d). *Measuring the Size of an Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/topics/measure.php
USGS. (2014e). *Landslide Overview Map of the Conterminous United States.* Retrieved June 2015, from http://landslides.usgs.gov/hazards/nationalmap/
USGS. (2014f). *National Atlas of the United States*. Retrieved September 2015, from http://nationalmap.gov/small_scale/printable/fedlands.html
USGS. (2014g, June 3). *Cascadia Subduction Zone*. Retrieved December 2015, from http://earthquake.usgs.gov/data/crust/cascadia.php

USGS. (2014h, November). *Water Resources of the United States*. Retrieved July 2015, from http://www.usgs.gov/water/

USGS. (2015a). *Water Science Glossary of Terms.* Retrieved June 2015, from http://water.usgs.gov/edu/dictionary.html#B

USGS. (2015b). *Florida Earthquake History*. Retrieved March 2015, from http://earthquake.usgs.gov/earthquakes/states/florida/history.php

USGS. (2015c). *Paleontology.* Retrieved July 2015, from http://www.usgs.gov/science/science.php?term=861

USGS. (2015d). *Multimedia Gallery Home - Search: Winter Park.* Retrieved March 2015, from http://gallery.usgs.gov/search/

USGS. (2015e). *Geologic Processes*. Retrieved Nov 16, 2015, from http://www2.usgs.gov/science/science.php?thcode=2&code=1117

USGS. (2015f). *Physical Agents of Land Loss: Relative Sea Level*. Retrieved from http://pubs.usgs.gov/of/2003/of03-337/sealevel.html

USGS. (2015g). *Geologic Glossary*. Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/misc/glossarya.html

USGS. (2015h). *About U.S. Volcanoes.* Retrieved August 2015, from http://volcanoes.usgs.gov/about/volcanoes/

USGS. (2015i). *Ground Water Atlas of the United States: Alabama, Florida, Georgia, South Carolina.* Retrieved October 2015, from http://pubs.usgs.gov/ha/ha730/ch_g/G-text1.html

USGS. (2015j). *Breeding Bird Atlas Explorer*. Retrieved from http://www.pwrc.usgs.gov/bba/

USGS. (2016a). *Minerals Commodity Summaries 2016.* Retrieved 2016, from http://minerals.usgs.gov/minerals/pubs/mcs/2016/mcs2016.pdf

USGS. (2016b, February 10). *Explanations for the National Water Conditions*. Retrieved from Water Resources of the United States: http://water.usgs.gov/nwc/explain_data.html

USIFAS. (2013). *Wild Hogs in Florida: Ecology and Management*. Retrieved from https://edis.ifas.ufl.edu/uw322

Visit Florida. (2015). *Florida's Official Travel Planning Website*. Retrieved August 2015, from http://www.visitflorida.com/en-us/about-visit-florida.html

Visit Jacksonville. (2015). *Discover Jacksonville*. Retrieved August 2015, from http://www.visitjacksonville.com/

Visit Orlando. (2015). *Orlando Overview*. Retrieved August 2015, from http://media.visitorlando.com/press-kits/english-press-kit/orlando-overview/

Visit Pensacola. (2015). *Visit Pensacola*. Retrieved August 2015, from http://www.visitpensacola.com/

Walsh, S. (2001). *Freshwater Macrofauna of Florida Karst Habitats, Water-Resources Investigations Report 01-4011. U.S. Geological Survey Karst Interest Group Proceedings, pp. 78–88.* USGS.

Wheeler, R. J. (2004). *Southern Florida Sites Associated with the Tequesta and Their Ancestors.* Florida Division of Historical Resources. Retrieved August 8, 2016, from https://www.nps.gov/nhl/learn/themes/Tequesta.pdf

Whitman, D. (1997). *Notes on the geology and Water Resources of South Florida.* Retrieved April 2015, from http://www2.fiu.edu/~whitmand/Courses/Fl_geo_notes.html

Wilderness.net. (2015a). *Wilderness Data Search Results*. Retrieved September 27, 2015, from http://www.wilderness.net/NWPS/stateView?state=WI

Wilderness.net. (2015b). *The Wilderness Act of 1964*. Retrieved September 17, 2015, from http://www.wilderness.net/nwps/legisact

Wilderness.net. (2015c). *List Wilderness Areas by Location*. Retrieved October 5, 2015, from http://www.wilderness.net/NWPS/stateView?state=FL

Willem Vereecken, W. V. (2011, July). Power Consumption in Telecommunications Networks: Overview and Reduction Strategies. *IEEE Communications Magazine*, pp. 62-69. Retrieved September 22, 2015, from http://www.researchgate.net/publication/228774201

Wolfe, P. A. (1920). [Birds-eye view of Fort Marion, Saint Augustine, Florida]. *Library of Congress Prints and Photographs Online Collection*. St. Augustine, Florida: Library of Congress. Retrieved October 2015, from http://www.loc.gov/resource/cph.3c39610/

World Heritage Convention. (2015). *Everglades National Park*. Retrieved October 6, 2015, from http://whc.unesco.org/en/list/76

World Heritage Encyclopedia. (2016). *List of mammals of Florida.* Retrieved from World Public Library: http://www.worldlibrary.org/articles/list_of_mammals_of_florida

World Wildlife Fund. (2015). *What is an ecoregion?* Retrieved from http://wwf.panda.org/about_our_earth/ecoregions/about/what_is_an_ecoregion/

GIS REFERENCES

BIA. (2003, December). *Cultural Resources: Approximate Historic Boundaries of Tribes*. (GIS Metadata) Retrieved August 2015, from http://sagemap.wr.usgs.gov/ftp/regional/ind3.html and http://www.arcgis.com/home/item.html?id=2e915ef3df48422283e5b2c7d89dfcba

BLS. (2015). *Socioeconomics: Unemployment*. (GIS Metadata) Retrieved August 2015, from Local Area Unemployment Statistics, Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages. State Data, Annual Average Series, Employment status of the civilian noninstitutional population, annual averages.: http://www.bls.gov/lau/rdscnp16.htm

Digital Aeronautical Flight Information File. (2015, June). *Land Use, Recreation, and Airspace: MTR Airspace*. (GIS Metadata) Retrieved June 2015, from National Geospatial-Intelligence Agency: https://pki.geo.nga.mil/servlet/ShowHomepage?menu=Products and Services

Digital Aeronautical Flight Information File. (2015, June). *Land Use, Recreation, and Airspace: SUA Airspace*. (GIS Metadata) Retrieved June 2015, from National Geospatial-Intelligence Agency: https://pki.geo.nga.mil/servlet/ShowHomepage?menu=Products and Services

EIA. (2011). *Geology: Oil and Gas*. (GIS Metadata) Retrieved August 2015, from http://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/US_OG_Counties/FeatureServer

Environmental Systems Research Institute (ESRI). (2016). *All Maps*. (GIS Metadata) Retrieved August 2015, from http://www.arcgis.com/home/group.html?owner=esri&title=ESRI%20Data%20%26%20Maps&content=all&_ga=1.174384612.712313298.1421186728&q=rivers&t=group&start=1

FAA. (2015, June). *Infrastructure: Transportation*. (GIS Metadata) Retrieved June 2015, from Airport hubs data. Data is updated every 8 weeks. Data downloaded by state: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). *Land Use, Recreation, and Airspace: Composite Airspace*. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). *Land Use, Recreation, and Airspace: Private Airspace*. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks. : http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015, June). *Land Use, Recreation, and Airspace: Public Airspace*. (GIS Metadata) Retrieved June 2015, from Data is updated every 8 weeks.: http://www.faa.gov/airports/airport_safety/airportdata_5010/

FCC. (2014, June). *Infrastructure: FCC Towers*. (GIS Metadata) Retrieved August 2015, from Data was obtained through a more advanced search by Booz Allen Hamilton being in direct touch with Cavell, Mertz & Associates to obtain all the relevant data across the country.: http://wireless2.fcc.gov/UlsApp/AsrSearch/asrAdvancedSearch.jsp

FCC. (2014, June). *Infrastructure: FCC Wireless*. (GIS Metadata) Retrieved August 2015, from David F. LaBranche, P.E. Geospatial Information Officer (GIO) OASD (EI&E) 571-372-

6768 at Defense Installations Spatial Data Infrastructure (DISDI).: http://www.broadbandmap.gov/data-download

FCC. (2015). *Infrastructure: FCC Fiber*. (GIS Metadata) Retrieved August 2015, from http://www.broadbandmap.gov/data-download

FDEP. (1999). *Water Resources: Impaired Water*. (GIS Metadata) Retrieved March 2015, from http://geodata.dep.state.fl.us/

FDEP. (1999). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved March 2015, from http://geodata.dep.state.fl.us/

FDEP. (2006). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved March 2015, from ttp://geodata.dep.state.fl.us/

FDEP. (2006). *Water: Estuaries and Critical Resource Waters*. (GIS Metadata) Retrieved March 2015, from http://geodata.dep.state.fl.us/

FHWA. (2015, September 14). *Infrastructure: Transportation*. (GIS Metadata) Retrieved September 14, 2015, from Byways and National Scenic Trails; Gary A. Jensen; Research Implementation Team Leader; FHWA; 1200 New Jersey Ave, SE Room E76-304: http://www.fhwa.dot.gov/byways/ https://www.nps.gov/ncrc/programs/nts/nts_trails.html

FHWA. (2015, August). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved August 2015, from National Scenic Byways Program. Data obtained by Gary A. Jensen, Research Implementation Team Leader, Office of Human Environment HEPH-30, Federal Highway Administration, 1200 New Jersey Avenue, SE Room E76-304, Washington, DC 20590, 202-366-2048, gary.je: http://www.fhwa.dot.gov/byways/

FLEPA. (2014, March 3). *Geology: Sinkholes*. (GIS Metadata) Retrieved August 2015, from http://www.arcgis.com/home/item.html?id=ec6f4b915036468ca208a1ac411aa48d

Global Volcanism Program, Smithsonian Institute. (2010, November 2). *Geology: Volcanoes*. (GIS Metadata) Retrieved August 2015, from http://www.arcgis.com/home/item.html?id=429becc8c5a44feaa64f17578aff045e

Iowa Geologic Survey. (2015). *Geology: Coal Mines*. (GIS Metadata) Retrieved November 2015, from http://programs.iowadnr.gov/geospatial/rest/services/Geology/CoalMines/MapServer

National Atlas and Interagency Wild and Scenic Rivers Coordinating Council. (2009). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from NPS: https://www.rivers.gov/mapping-gis.php

National Atlas and Interagency Wild and Scenic Rivers Coordinating Council. (2009). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved September 2015, from National Wild and Scenic Rivers Program, NPS, Department of Interior: https://www.rivers.gov/mapping-gis.php

National Audubon Society. (2015). *Biological Resources: Important Bird Areas*. (GIS Metadata) Retrieved September 2015, from Web service, data is not saved locally: http://gis.audubon.org/arcgisweb/rest/services/NAS/ImportantBirdAreas_Poly/MapServer

National Conference of State Legislatures. (2010). *Cultural Resources: Approximate Historic Boundaries of Tribes*. (GIS Metadata) Retrieved August 2016, from http://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx#federal

National Heritage Areas Program Office. (2011). *Visual Resources: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive*. (GIS Metadata)

Retrieved August 2015, from Department of Interior, National Parks Service, National Heritage Areas Program Office: https://www.nps.gov/heritageareas/

National Heritage Areas Program Office. (2015, April). *Cultural Resources: National Heritage*. (GIS Metadata) Retrieved September 2015, from Department of Interior, NPS, National Heritage Areas Program Office: https://www.nps.gov/heritageareas/

Native Languages of the Americas. (2015). *Cultural Resources: Approximate Historic Boundaries of Tribes*. (GIS Metadata) Retrieved August 2015, from http://www.native-languages.org/states.htm

NERR. (2012). *Water Resources: Estuaries and Critical Resource Waters*. (GIS Metadata) Retrieved August 2015, from NOAA, Office of Coastal Management, National Estuarine Research Reserve System (NERRS): http://cdmo.baruch.sc.edu/get/gis.cfm

NPS. (2011). *Air Quality: Class 1 Areas*. (GIS Metadata) Retrieved August 2015, from http://science.nature.nps.gov/im/gis/index.cfm

NPS. (2015). *Cultural: National Heritage*. (GIS Metadata) Retrieved March 2015, from National Parks Service, Department of Interior [National Monuments and Icons]: http://mapservices.nps.gov/arcgis/rest/services/cultural_resources/nhl_public/MapServer

NPS. (2015). *Land Use, Recreation, and Airspace: Recreation*. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NPS. (2015, August). *Visual Resources: Cultural Heritage*. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [US Parks]: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NPS. (2015, August). *Visual Resources: Cultural Heritage*. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [National Monuments and Icons]: http://mapservices.nps.gov/arcgis/rest/services/cultural_resources/nhl_public/MapServer

NPS. (2015, August). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from United States Park, National Parks Service, Department of Interior [National Scenic and Historic trails]: https://www.nps.gov/ncrc/programs/nts/nts_trails.html

NPS. (2015, August). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from United States Park, NPS, Department of Interior [US Parks]: http://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941

NRCS. (2006). *Soils: Major Land Resource Area/Land Resource Region*. (GIS Metadata) Retrieved April 2015, from Both shapefiles for MLRA and LRR are created from the same zip file download: https://gdg.sc.egov.usda.gov/

NRCS. (2006). *Soils: Soil Suborders*. (GIS Metadata) Retrieved April 2015, from Downloaded by state-level: https://gdg.sc.egov.usda.gov/

NRHP. (2015). *Cultural Resources: National Heritage*. (GIS Metadata) Retrieved August 2015, from Stutts M. 2014. NRHP. National Register properties are located throughout the U.S. and their associated territories around the globe.: https://irma.nps.gov/DataStore/Reference/Profile/2210280

The Florida Museum of Natural History. (2008). *Geology: Major Florida Fossil Sites.* Retrieved from Educators' Guide - Fossil Hall: Evolution of Life and Land at the Florida Museum of Natural History: http://www.flmnh.ufl.edu/files/7713/4664/6581/Fossil_EduGuide.pdf

U.S. Census Bureau. (2015c). *Environmental Justice*. (GIS Metadata) Retrieved July 2915, from U.S. Environmental Protection Agency. "EJSCREEN Environmental Justice Mapping

and Screening Tool: EJSCREEN Technical Documentation.": http://www2.epa.gov/ejscreen/technical-documentation-ejscreen

U.S. Census Bureau. (2015f, April). *Socioeconomics: Population Distribution*. (GIS Metadata) Retrieved August 2015, from American Community Survey and Puerto Rico Community Survey 2013 Subject Definitions. 2013_ACSSubjectDefinitions: http://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2013_ACSSubjectDefinitions.pdf

U.S. Census Bureau. (2015j). *Socioeconomics: Median Household Income*. (GIS Metadata) Retrieved August 2015, from American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race. Obtained via Census Bureau online DataFerrett tool.: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). *Environmental Justice*. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). *Socioeconomics: Median Household Income*. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). *Socioeconomics: Population Distribution*. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S. first sorted by state FIPS code, then USACE code.: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. Census Bureau. (Undated(a)). *Socioeconomics: Unemployment*. (GIS Metadata) Retrieved August 2015, from "2010 Census Urban and Rural Classification and Urban Area Criteria." Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S. first sorted by state FIPS code then by USACE code.: http://www.census.gov/geo/maps-data/data/tiger-data.html

U.S. DOT Bureau of Transportation Statistics National Transportation Atlas Database. (2015). *Infrastructure: Transportation*. (GIS Metadata) Retrieved August 2015, from Railroads, Major Highways data: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/2015/polyline

UFGPC. (2009). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved March 2015, from University of Florida GeoPlan Center: https://www.geoplan.ufl.edu/about.shtml

United States National Atlas. (2014). *Land Use, Recreation, and Airspace: Recreation.* (GIS Metadata) Retrieved September 2015, from http://nationalmap.gov/small_scale/

United States National Atlas. (2014). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from http://nationalmap.gov/small_scale/

USACE. (2015, March 17). *Infrastructure: Transportation*. (GIS Metadata) Retrieved August 2015, from Port Data. Has since been updated: http://www.navigationdatacenter.us/gis/gis1.htm

USEPA. (2011). *Water Resources: Principal Aquifers*. (GIS Metadata) Retrieved August 2015, from https://www.epa.gov/dwssa/map-sole-source-aquifer-locations

USEPA. (2012). *Geology: Oil and Gas*. (GIS Metadata) Retrieved June 2015, from http://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/US_OG_Counties/FeatureServer

USEPA. (2013). *Biological Resources: Ecoregions*. (GIS Metadata) Retrieved August 2015, from Level III and IV ecoregions of the continental United States. National Health and Environmental Effects Research Laboratory, Corvallis, Oregon, Map scale 1:3,000,000: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm

USEPA. (2014). *Water Resources: Impaired Water*. (GIS Metadata) Retrieved August 2015, from https://www.epa.gov/waterdata/waters-geospatial-data-downloads

USEPA. (2015). *Human Health and Safety: TRI*. (GIS Metadata) Retrieved September 2015, from Web service, data is not saved locally: https://map11.epa.gov/arcgis/rest/services/NEPAssist/NEPAVELayersPublic

USEPA. (2015). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved August 2015, from https://www.epa.gov/enviroatlas/forms/enviroatlas-data-download

USEPA. (2015b, April 21). *Air Quality: Nonattainment Areas*. (GIS Metadata) Retrieved August 2015, from The Green Book Nonattainment Areas for Criteria Pollutants: https://www3.epa.gov/airquality/greenbook/gis_download.html

USFWS. (2014). *Wetlands*. (GIS Metadata) Retrieved August 2015, from State level data layer: https://www.fws.gov/wetlands/Data/Data-Download.html

USFWS. (2015). *Biological Resources: Critical Habitat*. (GIS Metadata) Retrieved September 2015, from https://www.fws.gov/gis/data/national/

USFWS. (2015, December 4). *Land Use, Recreation, and Airspace: Recreation*. (GIS Metadata) Retrieved September 2015, from National Wildlife Refuge Boundaries: http://www.arcgis.com/home/item.html?id=7b90f9c5e8044d189a5764758ce3775e

USFWS. (2015, December 14). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from USFWS National Wildlife Refuge System, Realty Division: http://www.arcgis.com/home/item.html?id=7b90f9c5e8044d189a5764758ce3775e

USGS. (1999 to 2001). *Visual Resources: Land Cover*. (GIS Metadata) Retrieved August 2015, from USGS GAP Analysis Land Cover, National Land Cover Dataset; Landsat 7 ETM+; Imagery provided for Spring, Summer and Fall dates between 1999 and 2001: http://gapanalysis.usgs.gov/gaplandcover/data/download/

USGS. (2003, October). *Water Resources: Groundwater*. (GIS Metadata) Retrieved August 2015, from http://water.usgs.gov/ogw/aquifer/map.html

USGS. (2008/2013). *Geology: Karst Subsidence*. (GIS Metadata) Retrieved May 2015, from Two data layers within the same source show different varieties of Karst, and were published on different dates: http://services.arcgis.com/hoKRg7d6zCP8hwp2/arcgis/rest/services/Appalachian_Karst_Features/FeatureServer

USGS. (2010). *Geology: Surface Geology*. (GIS Metadata) Retrieved April 2015, from http://www.arcgis.com/home/item.html?id=2967ae2d1be14a8fbf5888b4ac75a01f

USGS. (2012). *Cultural Resources: Physiographic Provinces*. (GIS Metadata) Retrieved April 2015, from Physiographic provinces and regions are made from the same dataset; downloaded by state-level:

http://services.arcgis.com/ZzrwjTRez6FJiOq4/arcgis/rest/services/US_PhysiographicProvinces/FeatureServer

USGS. (2012). *Geology: Earthquakes*. (GIS Metadata) Retrieved August 2015, from Author: Russel L. Wheeler: http://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/Earthquakes_in_NE_US,_1638-1998/FeatureServer

USGS. (2012). *Geology: Landslide Incidence*. (GIS Metadata) Retrieved May 2015, from Web service, data is not saved locally: https://www.arcgis.com/home/item.html?id=b3fa4e3c494040b491485dbb7d038c8a

USGS. (2013). *Geology: Marcellus Shale*. (GIS Metadata) Retrieved April 2015, from http://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/Extent_of_Marcellus_Shale_Formation/FeatureServer

USGS. (2014). *Cultural: National Heritage*. (GIS Metadata) Retrieved March 2015, from TopoView: Historical Topo Map Viewer: http://ngmdb.usgs.gov/maps/TopoView/viewer/#7/27.761/-83.798

USGS. (2014). *Geology: Seismic Hazard*. (GIS Metadata) Retrieved April 2015, from http://services.arcgis.com/VTyQ9soqVukalItT/arcgis/rest/services/USPGA_Seismic_Hazard/FeatureServer

USGS. (2015). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved September 2015, from Watershed Boundary Dataset (WBD): http://nhd.usgs.gov/wbd.html

USGS, Protected Areas of the United States. (2012, 11 30). *Land Use, Recreation, and Airspace: Land Ownership*. (GIS Metadata) Retrieved August 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). *Land Use, Recreation, and Airspace: Recreation*. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update.: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). *Visual Resources: Cultural Heritage*. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update.: http://gapanalysis.usgs.gov/padus/data/download/

USGS, Protected Areas of the United States. (2012, November 30). *Visual Resources: Natural Areas*. (GIS Metadata) Retrieved September 2015, from Data was updated in 5/5/2016. Maps were completed in December 2015 prior to this update. : http://gapanalysis.usgs.gov/padus/data/download/

USGS, USDA-NRCS. (2015). *Water Resources: Surface Water / Watershed*. (GIS Metadata) Retrieved August 2015, from USDA NRCS watershed Boundary Data and Tools: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/watersheds/dataset/

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