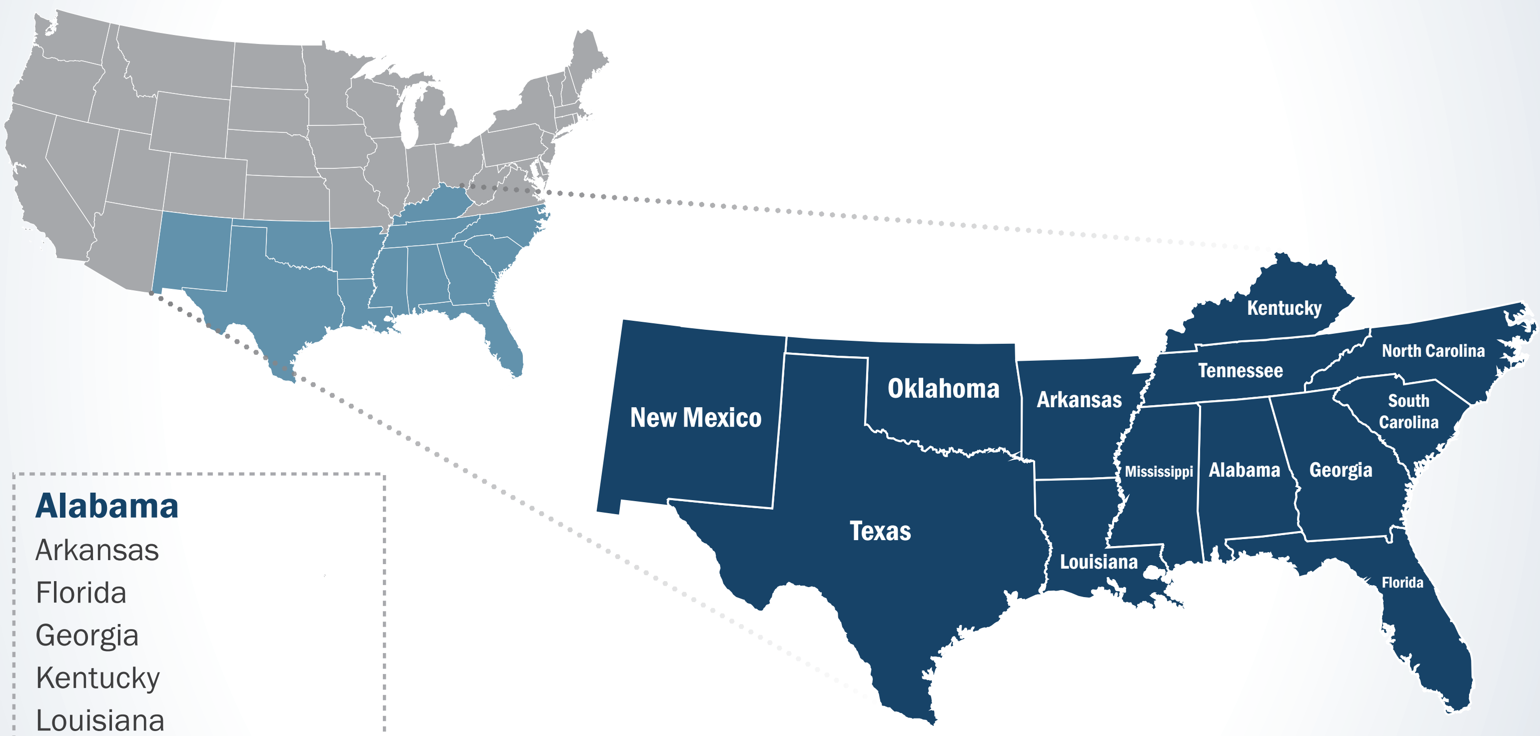
FirstNet®

Nationwide Public Safety Broadband Network

# Draft Programmatic Environmental Impact Statement for the Southern United States

**VOLUME 1 -** CHAPTER 3




**Alabama**
Arkansas
Florida
Georgia
Kentucky
Louisiana
Mississippi
New Mexico
North Carolina
Oklahoma
South Carolina
Tennessee
Texas

OCTOBER 2016

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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 1 - CHAPTER 3

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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

October 2016

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# 3 ALABAMA


Alabama was populated for centuries by American Indian tribes with a rich cultural history. Alabama was part of the area originally organized into the Mississippi Territory in 1798, after Georgia ceded some of its western land claims to the federal government. Alabama became the Alabama Territory in 1817; in 1819, Alabama became the 22nd state to join the Union (ADAH, 2015a). Alabama is bordered by Georgia to the east, Florida and the Gulf of Mexico to the south, Mississippi to the west, and Tennessee to the north. This chapter provides details about the existing environment of Alabama as it relates to the Proposed Action.

General facts about Alabama are provided below:

- **State Nickname:** The Yellowhammer State
- **2014 Estimated Land Area:** 50,645 square miles; **U.S. Rank:** 28 (U.S. Census Bureau, 2015a)
- **Capital:** Montgomery
- **Counties:** 67 (U.S. Census Bureau, 2015b)
- **2014 Estimated Population:** 4,858,979 (U.S. Census Bureau, 2016a); **U.S. Rank:** 24 (U.S. Census Bureau, 2015a)
- **Most Populated Cites:** Birmingham, Montgomery, Mobile, and Huntsville (U.S. Census Bureau, 2015b)
- **Main Rivers:** Alabama River, Cahaba River, Coosa River, Black Warrior River, Tombigbee River, Tennessee River, Tallapoosa River, Chattahoochee River, and Mobile River
- **Bordering Waterbodies:** Gulf of Mexico and Chattahoochee River
- **Mountain Ranges:** A portion of the Appalachian Mountains
- **Highest Point:** Mount Cheaha (2,407 ft.) (USGS, 2015a)

# 3.1 AFFECTED ENVIRONMENT

## 3.1.1 Infrastructure

### *3.1.1.1 Introduction*

This section provides information on key Alabama 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 3.1.1.3 provides an overview of Alabama's traffic and transportation infrastructure, including road and rail networks, airport facilities, and ports and harbors. Alabama's public safety infrastructure could include any infrastructure used 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 Alabama are presented in more detail in Section 3.1.1.4. Section 3.1.1.5 describes Alabama's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Alabama utilities, such as power, water, and sewer, is presented in Section 3.1.1.6.

### *3.1.1.2 Specific Regulatory Considerations*

Multiple Alabama laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 3.1.1-1 identifies the relevant laws and regulations for Alabama. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

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

**Table 3.1.1-1: Relevant Alabama Infrastructure Laws and Regulations**

| State Law/Regulation | Regulatory Agency | Applicability |
|---|---|---|
| Code of Alabama: Title 38 Public Welfare | Alabama Emergency Management Agency (AEMA) | Prepares and maintains a plan for emergency management; carries out all obligations and duties for state emergency or disaster response; directs state emergency or disaster operations. |
| Code of Alabama: Title 37 Public Utilities and Public Transportation | Alabama Public Service Commission (PSC) | Supervises and regulates rates, property rights, equipment, facilities, service territories, and franchises of public utilities (natural gas, electric, water, wastewater, and telecommunications). |
| Code of Alabama: Title 37 Public Utilities and Public Transportation | Alabama Department of Transportation (ALDOT) | Establishes airports and other air navigation facilities; operation of motor vehicles; constructs, reconstructs, maintains, and improves all public roads, causeways, highways, and bridges. |

### *3.1.1.3 Transportation*

This section describes the transportation infrastructure in Alabama, including specific information related to the road networks, airport facilities, rail networks, ports, and harbors (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 Alabama are based on a review of maps, aerial photography, and federal and state data sources.

The Alabama Department of Transportation (ALDOT) 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 mission of the ALDOT is to "To provide a safe, efficient, environmentally sound intermodal transportation system for all users, especially the taxpayers of Alabama. To also facilitate economic and social development and prosperity through the efficient movement of people and goods and to facilitate intermodal connections within Alabama. ALDOT must also demand excellence in transportation and be involved in promoting adequate funding to promote and maintain Alabama's transportation infrastructure" (ALDOT, 2015a).

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

- 101,837 miles of public roads (FHWA, 2014a) and 16,088 bridges (FHWA, 2015a);
- 3,973 miles of rail network (ALDOT, 2014)*;*
- 289 aviation facilities, including airstrips and heliports (FAA, 2015a);
- 7 harbors (U.S. Harbors, 2015); and
- 1 major port that includes both public and private facilities (ASPA, 2016).

### Road Networks

As identified in Figure 3.1.1-1, the major urban centers of the state are Huntsville-Decatur-Albertville in the north, Birmingham-Hoover-Talladega in the center, Columbus-Auburn-Opelika in the east, Dothan-Enterprise-Ozark in the southeast, and Mobile-Daphne-Fairhope in the southwest (U.S. Census Bureau, 2013). Alabama has five 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 3.1.1-2 lists the interstates and their start/end points in Alabama. 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 3.1.1-2: Alabama Interstates**

| Interstate | Southern or Western Terminus in AL | Northern or Eastern Terminus in AL |
|---|---|---|
| I-10 | MS line at Wilmer | FL line at Robertsdale |
| I-20 | MS line at Cuba | GA line at Muscadine |
| I-59 | MS line at Cuba | GA line at Valley Head |
| I-65 | I-10 in Mobile | TN line at Ardmore |
| I-85 | I-65 in Montgomery | GA line at Lanett |

In addition to the Interstate System, Alabama 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 3.1.1-1 illustrates the major transportation networks, including roadways, in Alabama. Section 3.1.8, Visual Resources, describes the National and State Scenic Byways found in Alabama 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 (USDOT) Federal Highway Administration (FHWA). Alabama has four National Scenic Byways:

- Alabama's Coastal Connection: 130 miles in southwestern Alabama, starting at Grand Bay, circling Mobile Bay, and ending in Spanish Fort (FHWA, 2015c);
- Natchez Trace Parkway: 444 miles through Alabama, Mississippi and Tennessee, with the Alabama section in the very northwest corner of the state running from Bear Creek Mound at the Mississippi state line to just south of Cypress Creek at the Tennessee state line (FHWA, 2015d);
- Selma to Montgomery March Byway: 54 miles that traces the 1965 Selma to Montgomery March led by Martin Luther King, Jr. (FHWA, 2015e); and
- Talladega Scenic Drive: 26.4 miles in the Talladega National Forest (FHWA, 2015f).

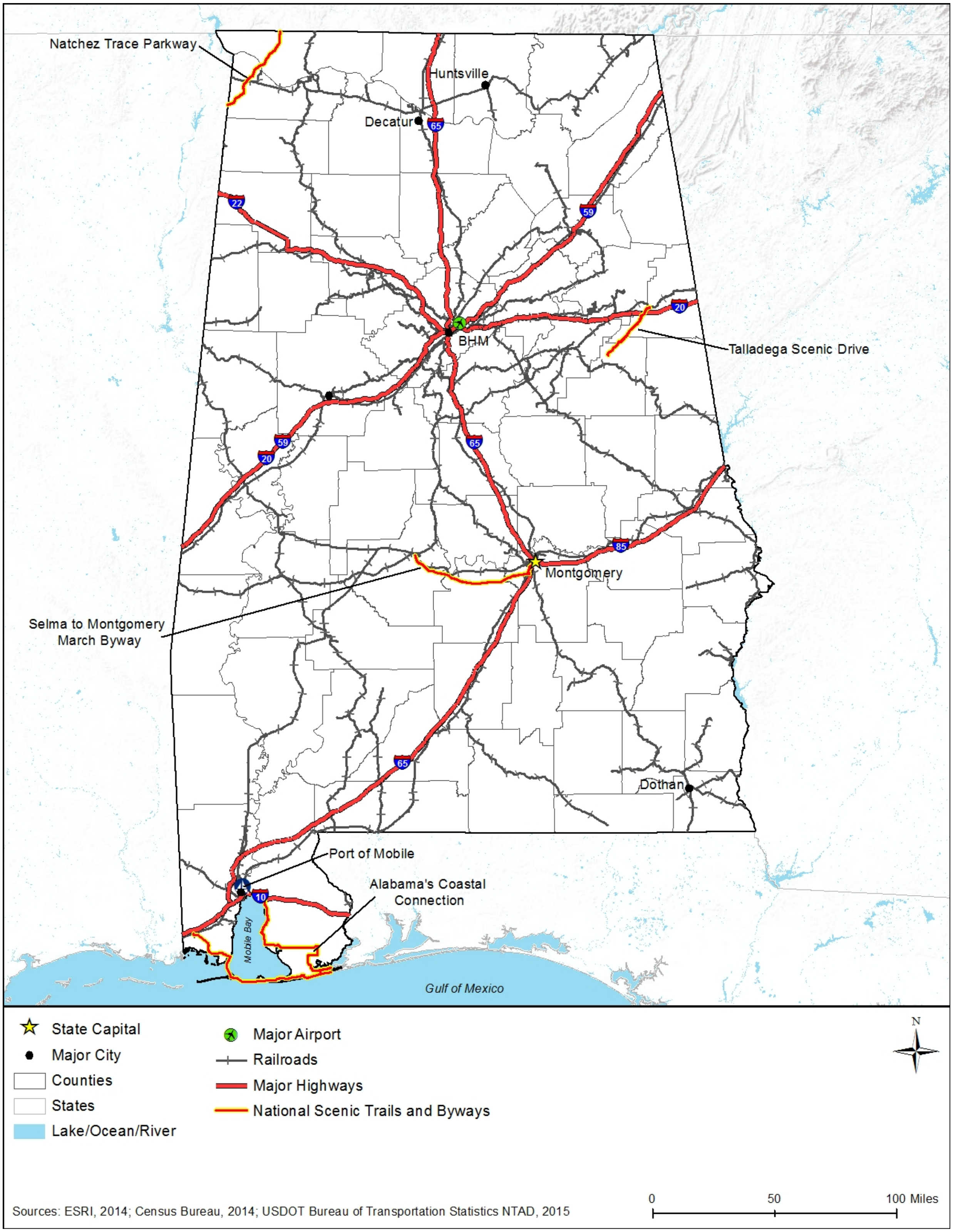


**Figure 3.1.1-1: Alabama Transportation Networks**

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

- The Appalachian Highlands Scenic Byway
- Barbour County Governors' Trail
- The Black Belt Nature and Heritage Trail
- Black Warrior River Scenic Byway
- Leeds Stagecoach Route
- Lookout Mountain Parkway
- Tensaw Parkway

### Airports

Air service to the state is provided by the Birmingham-Shuttlesworth International Airport (BHM). The airport is operated by the Birmingham Airport Authority, which is an "independent Authority of the City of Birmingham" (BHM, 2015). In 2014, BHM served 2,624,665 passengers and 23,025.6 tons of cargo (BHM, 2014).

Figure 3.1.1-1 illustrates the major transportation networks, including the airport, in the state. Section 3.1.7, Land Use, Recreation, and Airspace, provides greater detail on airports and airspace in Alabama.

### Rail Networks

Alabama is connected to a network of passenger rail (Amtrak) and freight rail. Alabama has 3,973 miles of rail tracks that are owned and operated by 28 freight railroad companies (ALDOT, 2014). Figure 3.1.1-1 illustrates the major transportation networks, including rail lines, in Alabama.

Amtrak runs one line through Alabama: the Crescent. Table 3.1.1-3 provides a complete list of Amtrak lines that run through Alabama.

**Table 3.1.1-3: Amtrak Train Routes Serving Alabama**

| Route | Starting Point | Ending Point | Length of Trip | Cities Served in Alabama |
|---|---|---|---|---|
| Crescent | New York, NY | New Orleans, LA | 30 hours | Anniston, Birmingham, Tuscaloosa |

Source: (Amtrak, 2015a) (Amtrak, 2015b)

In 2011, 162.4 million tons of freight traveled by rail in Alabama, by either starting, ending, or simply traveling through the state (ALDOT, 2014). In that year, 26,366,641 tons of freight originated in Alabama (16 percent) and 36,478,988 tons (22 percent) terminated in the state (ALDOT, 2014). Also in 2011, 13,392,231 tons (8 percent) of freight rail cargo traveled entirely within Alabama and 89,044,155 (54 percent) tons traveled through the state but did not start or end there (ALDOT, 2014).

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

### Harbors and Ports

Alabama has approximately 18 named port and harbors, most of which are river facilities that serve a specific industrial facility or municipality. The Port of Mobile is Alabama's single largest commercial port. The Port of Mobile occupies a 4,000-acre, 41-berth facility that handles a wide range of container, bulk, and break-bulk cargo, including aluminum, steel, lumber, frozen poultry, and soybeans (ASPA, 2016). As shown in Figure 3.1.1-1, the port is at the mouth of the Mobile River in southwest Alabama, in Mobile Bay, which is 30-mile long waterbody, with 11-mile wide inlet to the Gulf of Mexico. "Excluding the dredged ship channel, the bay is shallow, as the average depth is measured at only 12 feet" (World Atlas, 2015a). The port's dredged 40-foot channel and harbor supported 1, 446 vessel calls in Fiscal Year 2015 (ASPA, 2016). The facility's location makes it an important international trade port, and in 2013, the U.S. Census recorded the Port of Mobile as having imported $7.9 billion worth of trade goods, weighing 12.4 million tons. That year, the port also exported $3.8 billion, weighing 18 million tons (U.S. Census Bureau, 2015c).

### *3.1.1.4 Public Safety Services*

Alabama public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 3.1.1-4 presents Alabama'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 3.1.9, Socioeconomics; however, these demographics are key to understanding the breadth of public safety services throughout the state.

**Table 3.1.1-4: Key Alabama Indicators**

| **Alabama State Indicators** | |
|---|---|
| Estimated Population (2014) | 4,849,377 |
| Land Area (square miles) (2010) | 50,645 |
| Population Density (persons per sq. mile) (2014) | 96 |
| Municipal Governments (2013) | 458 |

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

Table 3.1.1-5 presents Alabama's public safety infrastructure, including fire and police stations. Table 3.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and medical personnel in the state.

**Table 3.1.1-5: Public Safety Infrastructure in Alabama by Type**

| Infrastructure Type | Number |
| --- | --- |
| Fire and Rescue Stations [a] | 1,288 |
| Law Enforcement Agencies [b] | 417 |
| Fire Departments [c] | 800 |

[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 3.1.1-6: First Responder Personnel in Alabama by Type**

| First Responder Personnel | Number |
| --- | --- |
| Police, Fire and Ambulance Dispatchers [a] | 2,320 |
| Fire and Rescue Personnel [b] | 20,589 |
| Law Enforcement Personnel [c] | 18,364 |
| Emergency Medical Technicians and Paramedics [d e] | 3,610 |

[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)

### *3.1.1.5 Telecommunications Resources*

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure in Alabama; 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 3.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio (LMR) network (traditional radio network) and a commercial broadband access network (wireless technology); 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).

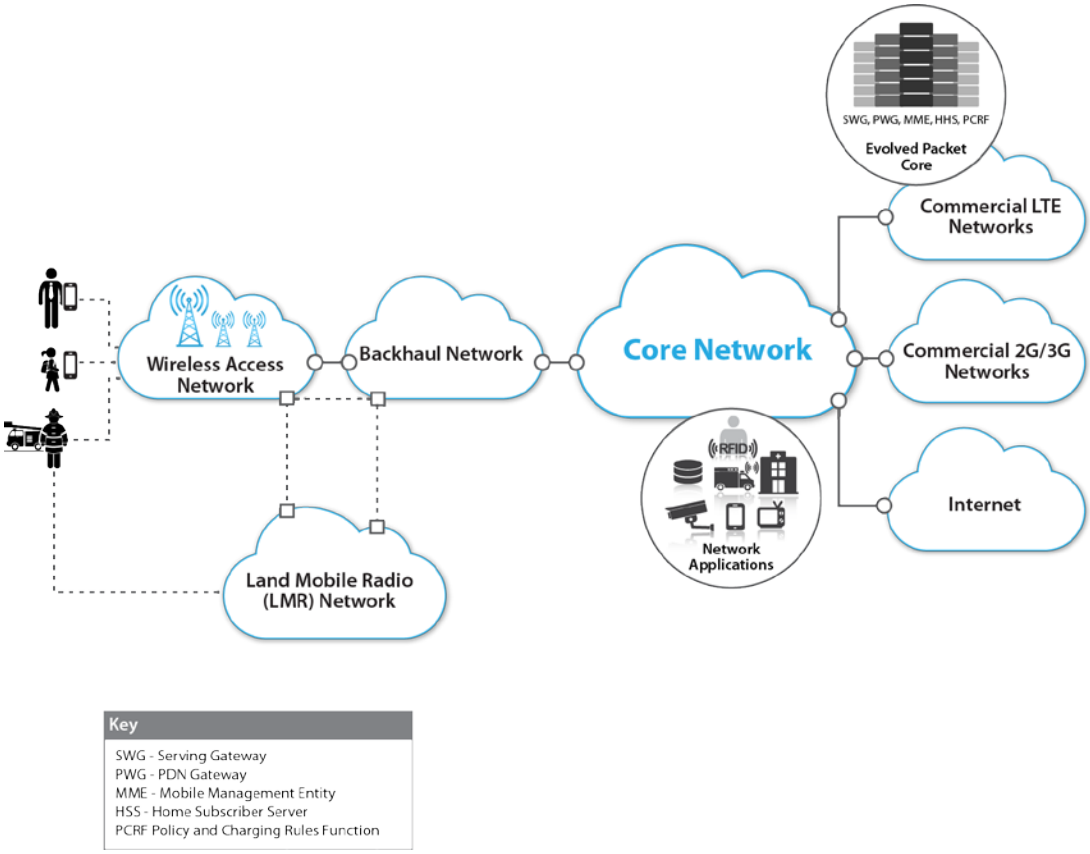


**Figure 3.1.1-2: Wireless Network Configuration**

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, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has 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 United States and at the state level, including in Alabama. 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.

In 2015, the U.S. Department of Commerce (DOC) Public Safety Communications Research Program (PSCR) – Boulder Laboratories, prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This effort was designed to help enable the public safety community to incorporate disparate LMR networks with a nationwide public safety LTE broadband network. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

Public safety network communications in Alabama reflect a combination of legacy analog Very High Frequency (VHF),[3] Ultra High Frequency (UHF),[4] 700 megahertz (MHz), and 800 MHz systems operating on multiple frequencies bands as well as the digital Phase 2 TDMA[5] Project 25 (P-25) Alabama First Responder Network (AFRN) operating at 700 MHz (Project 25.org, 2015a). In addition, there are six digital Phase 1 Frequency Division Multiple Access (FDMA) P-25 Public Safety networks operating in Alabama,[6] which are listed in Table 3.1.1-7 (Project 25.org, 2015b).

**Table 3.1.1-7: Phase 1 P-25 Systems in Alabama**

| Alabama Phase 1 P-25 Systems | Frequency Band |
|---|---|
| AL Regional Communications System (ARCS) | 800 MHz |
| Center for Domestic Preparedness | UHF Lo |
| Dothan Public Safety | 800 MHz |
| Gadsden & Etowash County | 700 MHz |
| Jefferson County | 800 MHz |
| Shelby County First Responders | VHF |

Source: (Project 25.org, 2015a) (Project 25.org, 2015b)

[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).
[5] Time Division Multiple Access.
[6] As of mid-year 2015.

Alabama also leverages the SouthernLINC network. The Alabama's 2013 Statewide Communication Interoperability Plan (SCIP) notes, "Alabama also relies heavily on SouthernLINC, a statewide commercial push-to-talk service that combines cellular telephone, 800 Megahertz (MHz) radio, through Integrated Digital Enhanced Network (iDEN) technology. SouthernLINC is used by numerous State and local first responders for primary and administrative communications purposes" (State of Alabama, 2013).

Alabama Public Safety agencies and users are divided into seven regions as Figure 3.1.1-3 indicates; this regional structure applies to both day to day operations as well as for emergency communications incidents (State of Alabama, 2012).

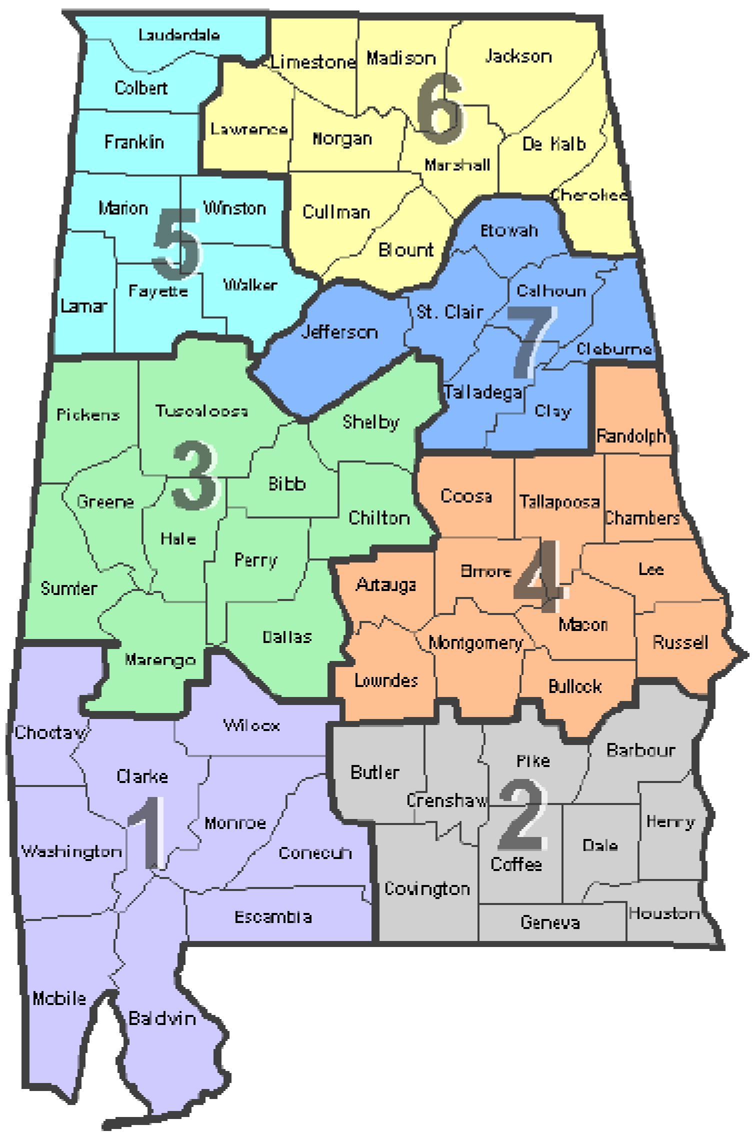


**Figure 3.1.1-3: Alabama Public Safety Regions**

Source: (State of Alabama, 2012)

In Alabama, the Alabama Law Enforcement Agency (ALEA) performs a leadership role in Public Safety network governance and operations; as the State's 2013 SCIP indicates, "The ALEA oversees interoperable communications efforts in the State and serves as the organization responsible for planning, building, implementing, and maintaining a unified system-of-systems radio network for first responders in Alabama" (State of Alabama, 2013).

*Statewide Public Safety Networks*

The AFRN is a Phase 2 digital P-25 network providing statewide and multicounty coverage in Alabama (RadioReference.com, 2015a). The Alabama Regional Communications System (ARCS) is a four county digital 800 MHz system, led by Calhoun County, which is joining the statewide AFRN system, which will improve further the State's LMR interoperability (RadioReference.com, 2015b).

The Alabama Highway Patrol (AHP) communicates on VHF frequencies for both special detail and car to car communications and the seven AHP Troops use VHF frequencies for dispatch and tactical communications within their seven assigned regions (RadioReference.com, 2015c). In addition for statewide emergency communications needs, the Alabama Emergency Management Agency (AEMA) has access to a Statewide UHF network, the AEMA UHF Net, to address a variety of disaster and emergency communications needs (RadioReference.com, 2015d). Mutual Aid in Alabama is provided on a variety of Common/Shared channels: for Law Enforcement: the Police use the Mutual Aid Law Enforcement (MALE) system on VHF; Fire agencies also use MALE as well on VHF; and Emergency Medical Services (EMS) uses VHF frequencies for EMS tactical communications and dispatch, with VHF and UHF used for Statewide Air Ambulance Medevac (RadioReference.com, 2015e).

*City and County Public Safety Networks*

Legacy VHF and UHF systems provide dispatch and tactical communications voice communications capabilities to city/town and counties in Alabama for local Police/Sheriff, Fire, and EMS users. Madison County, in northern Alabama where the city of Huntsville is located, is typical of the situation in Alabama where local Police and Sheriff Departments depend upon VHF networks for dispatch and tactical communications; county Fire users operate on VHF for dispatch needs; while local Rescue units communicate use UHF frequencies (RadioReference.com, 2015f). Local and regional communications are complemented in Madison County with the digital P-25 AFRN as well as by the SouthernLINC network also available in Madison County (RadioReference.com, 2015f).

Multiple digital P-25 networks operating in VHF, 700 MHz, and 800 MHz frequencies provide regional coverage in many of Alabama's counties across the State's seven regions as Figure 3.1.1-4 indicates (Alabama First Responder Wireless Commission, 2014).

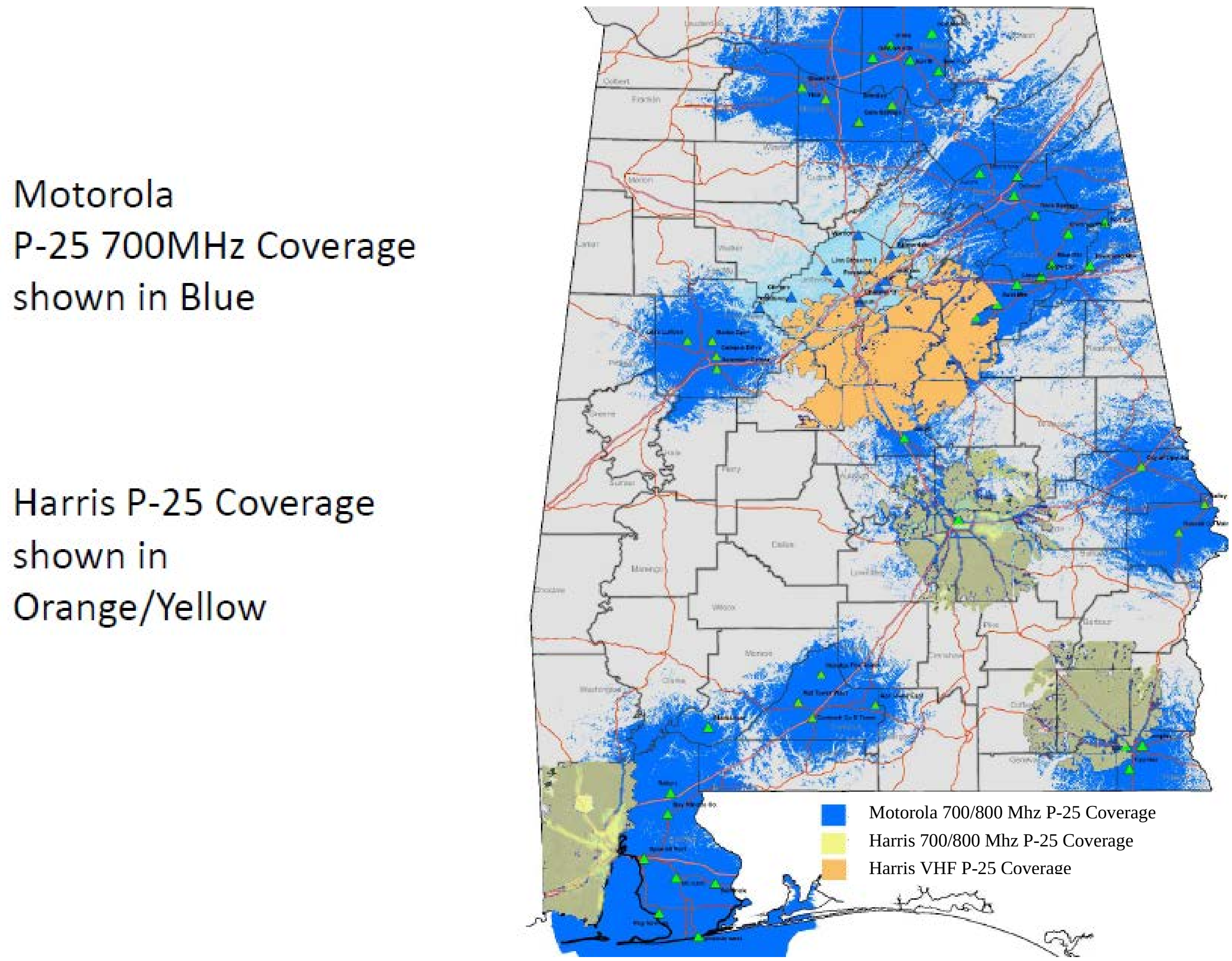


**Figure 3.1.1-4: Alabama P-25 Network Coverage**

Source: (Alabama First Responder Wireless Commission, 2014)

*Public Safety Answering Points (PSAP)*

According to the Federal Communication Commission's (FCC) Master PSAP registry, there are 174 PSAPs in Alabama serving Alabama's 67 counties (FCC, 2015b).

### Commercial Telecommunications Infrastructure

Alabama'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 Alabama'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.

*Carriers, Coverage, and Subscribers*

Alabama'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 3.1.1-8 presents the number of providers of switched access[7] lines, Internet access,[8] and mobile wireless services including coverage.

**Table 3.1.1-8: Telecommunications Access Providers and Coverage in Alabama as of December 31, 2013**

| Commercial Telecommunications Access Providers | Number of Service Providers | Coverage of Households |
|---|---|---|
| Switched access line[a] | 155 | 97% of households[b] |
| Internet access[c] | 71 | 40% of households |
| Mobile wireless[d] | 8 | 94% 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 3.1.1-9 shows the wireless providers in Alabama along with their geographic coverage. The following three maps: Figure 3.1.1-5, Figure 3.1.1-6, and Figure 3.1.1-7 show the combined coverage for the top two providers (AT&T and Verizon Wireless, each of which covers the entire state), Sprint and T-Mobile's coverage, and the coverage of all other providers with less than 5 percent coverage area, respectively.[9]

[7] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2014b).
[8] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.
[9] 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 "Alabama Other Fiber Providers." All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "Alabama Other Wireless Providers." Providers under 5% were denoted in their respective tables.

### Table 3.1.1-9: Wireless Telecommunications Coverage by Providers in Alabama

| Wireless Telecommunications Providers | Coverage |
|---|---|
| AT&T Mobility Limited Liability Company (LLC) | 98.86% |
| Verizon Wireless | 92.89% |
| Sprint | 30.85% |
| T-Mobile | 19.07% |
| Other [a] | 11.69% |

[a] Other: Provider with less than 5 percent coverage area. Providers include: Pine Belt Wireless; CnG Wireless; Advanced Broadband; Utilities Board City of Sylacauga; CyberBroadband; BlountBroadband LLC; FTC Wireless Internet; WiSouth Networks; Alabama HighSpeed; Gosuto Wireless; AL-GA Wireless Broadband, LLC; Smith Lake Broadband; Multi-Path Networks, Inc.; SouthNet; A Tombigbee Electric Company; Starlite Computers; Cricket Wireless.

Source: (NTIA, 2014)

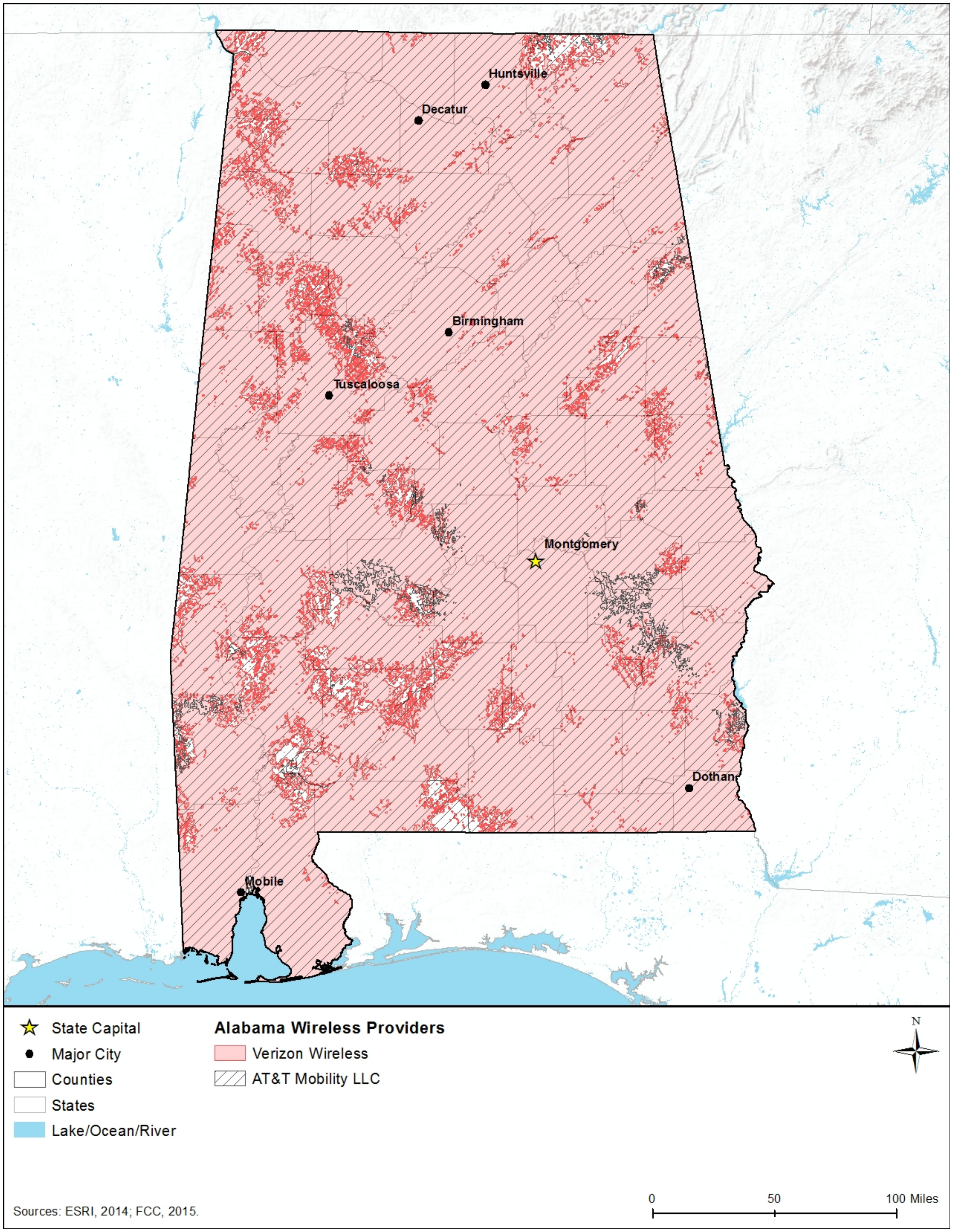


**Figure 3.1.1-5: AT&T and Verizon Wireless Availability in Alabama**

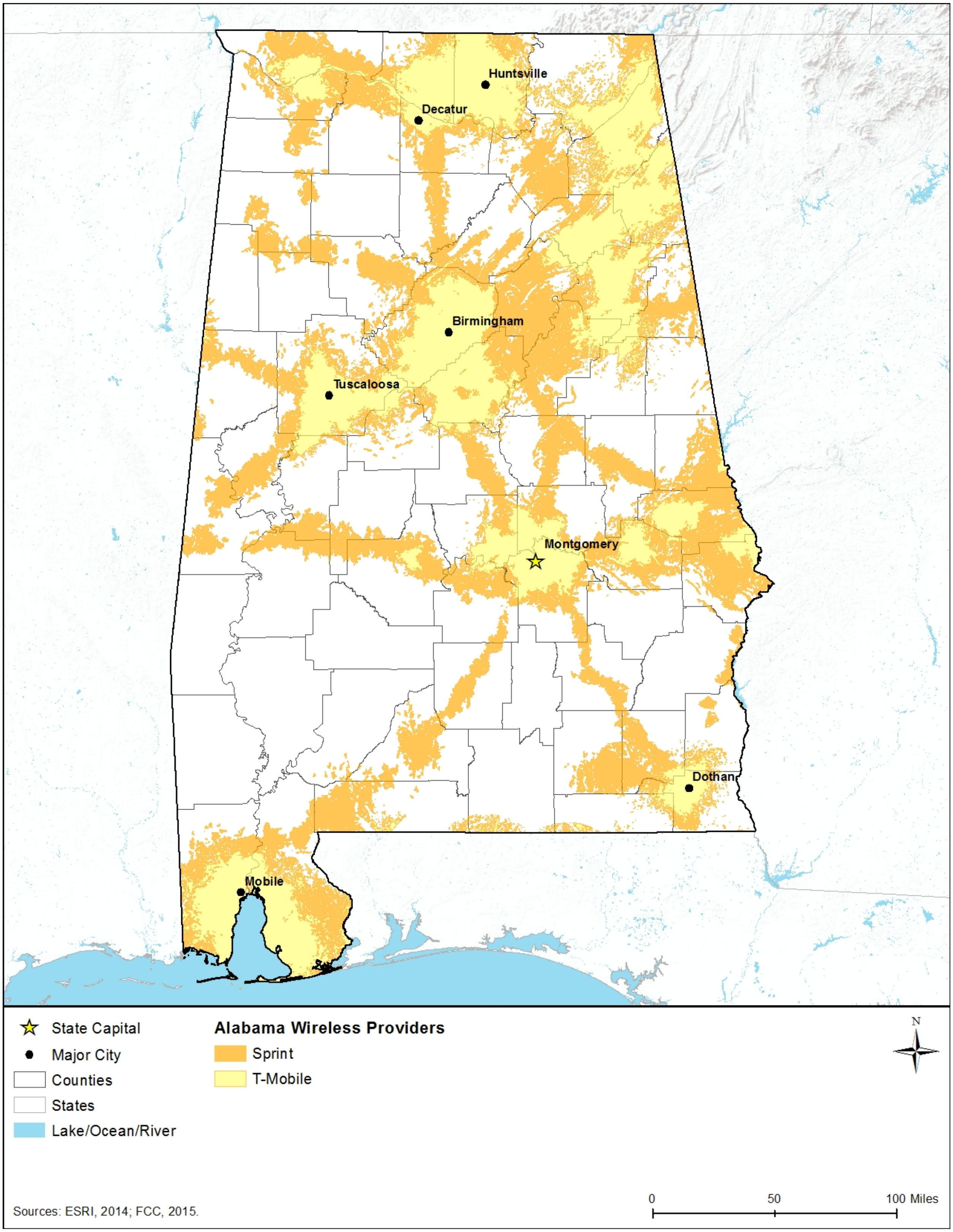


**Figure 3.1.1-6: Sprint and T-Mobile Wireless Availability in Alabama**

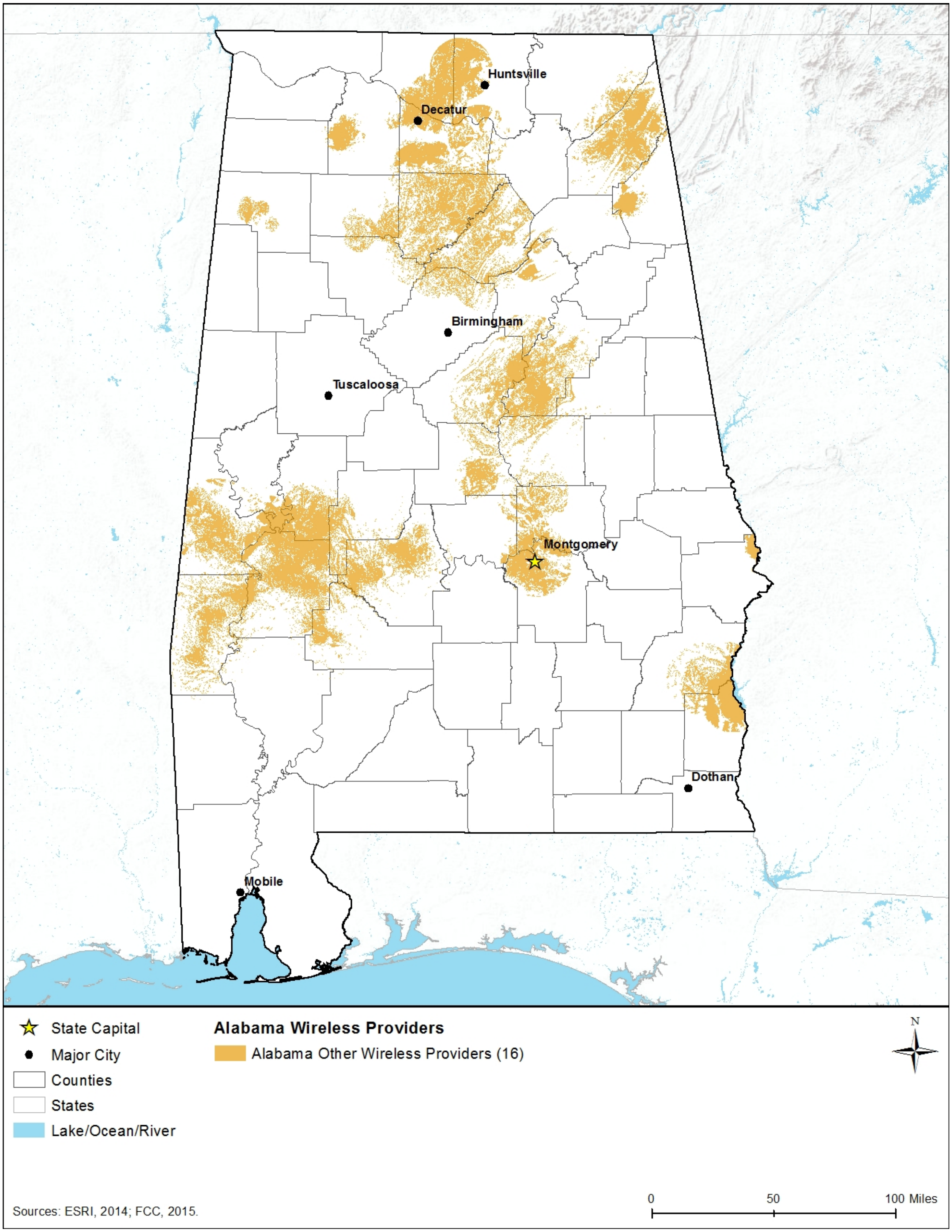


**Figure 3.1.1-7: Other Providers Fiber Availability in Alabama**

*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 3.1.1-8 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 3.1.1-8: Types of Towers**

Telecommunications tower infrastructure proliferates throughout Alabama, although tower infrastructure is concentrated in the higher and more densely populated areas of Alabama. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b).[10] Table 3.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in Alabama. Figure 3.1.1-9 presents the location of those 3,375 structures, as of June 2015.

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

### Table 3.1.1-10: Number of Commercial Towers in Alabama by Type

| Constructed [a] Towers [b] | | Constructed Monopole Towers | |
|---|---|---|---|
| 100ft. and over | 576 | 100ft. and over | 0 |
| 75ft. – 100ft | 1,422 | 75ft. – 100ft. | 1 |
| 50ft. – 75ft | 527 | 50ft. – 75ft. | 59 |
| 25ft. – 50ft | 240 | 25ft. – 50ft. | 48 |
| 25ft. and below | 43 | 25ft. and below | 11 |
| **Subtotal** | **2,808** | **Subtotal** | **120** |
| **Constructed Guyed Towers** | | **Buildings with Constructed Towers** | |
| 100ft. and over | 74 | 100ft. and over | 1 |
| 75ft. – 100ft | 118 | 75ft. – 100ft. | 1 |
| 50ft. – 75ft | 28 | 50ft. – 75ft. | 4 |
| 25ft. – 50ft | 7 | 25ft. – 50ft. | 3 |
| 25ft. and below | 2 | 25ft. and below | 1 |
| **Subtotal** | **292** | **Subtotal** | **10** |
| **Constructed Lattice Towers** | | **Multiple Constructed Structures [c]** | |
| 100ft. and over | 7 | 100ft. and over | 4 |
| 75ft. – 100ft. | 192 | 75ft. – 100ft. | 0 |
| 50ft. – 75ft. | 38 | 50ft. – 75ft. | 0 |
| 25ft. – 50ft. | 13 | 25ft. – 50ft. | 0 |
| 25ft. and below | 2 | 25ft. and below | 0 |
| **Subtotal** | **252** | **Subtotal** | **4** |
| **Constructed Tanks [d]** | | | |
| Tanks | 10 | | |
| **Subtotal** | **10** | | |
| **Total All Tower Structures** | | **3,496** | |

[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, 2015a)
[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, 2015a)

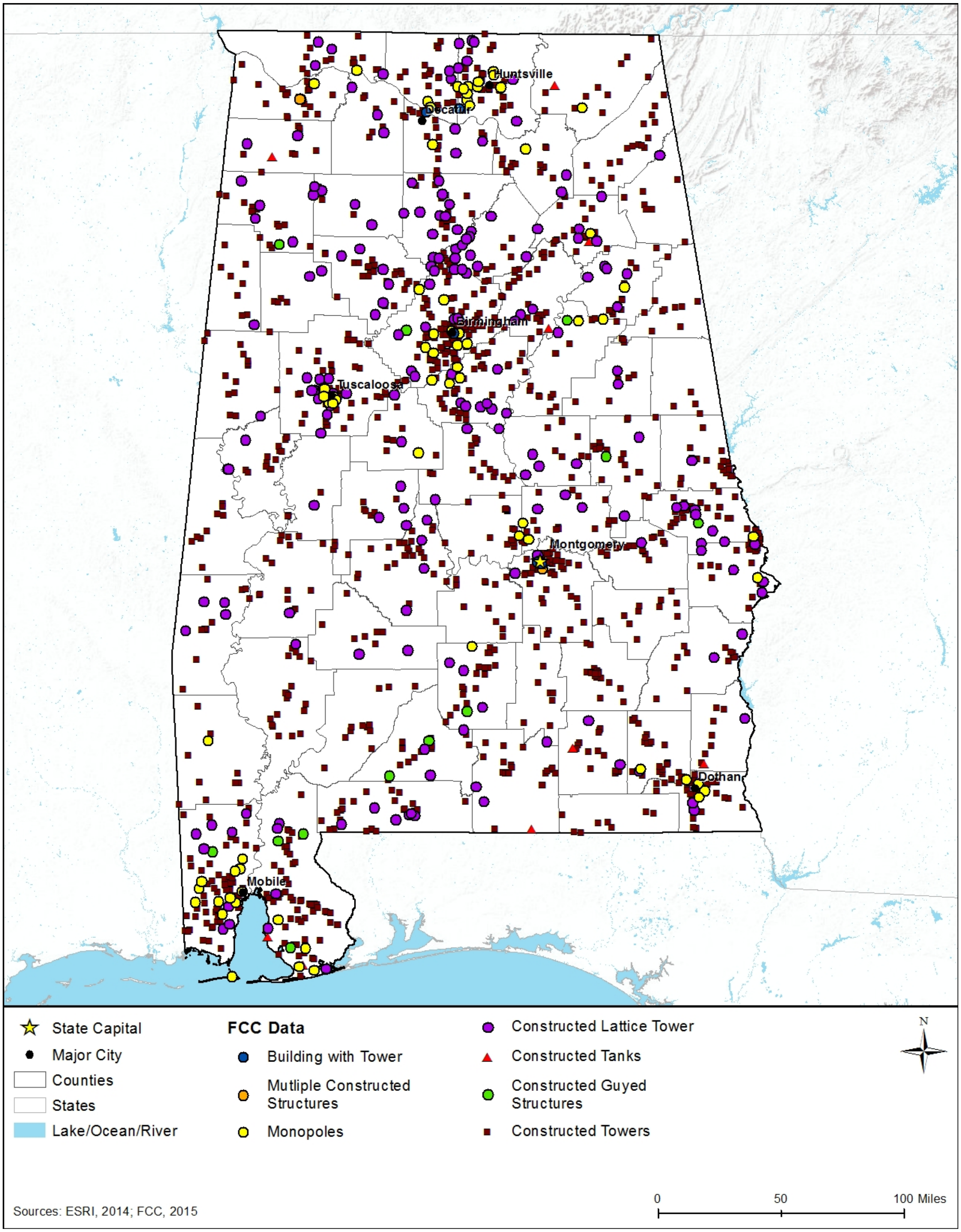


**Figure 3.1.1-9: FCC Tower Structure Locations in Alabama**

*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 (ROWs). 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 3.1.1-10.

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).

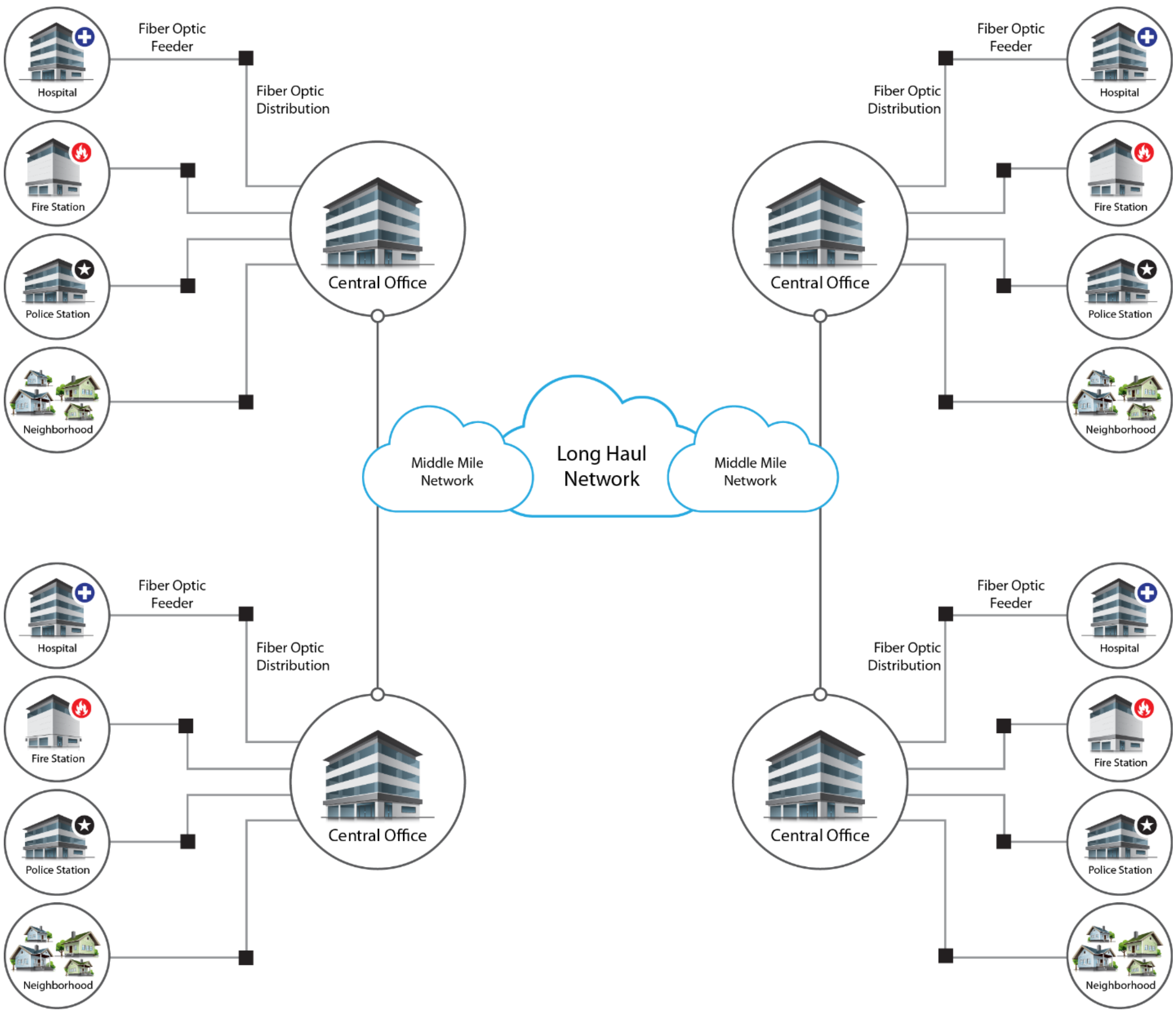


**Figure 3.1.1-10: Typical Fiber Optic Network in Alabama**

Source: (ITU-T, 2012)
Prepared by: Booz Allen Hamilton

*Last Mile Fiber Assets*

In Alabama, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Alabama, there are 47 fiber providers that offer service in the state, as listed in Table 3.1.1-11. Figure 3.1.1-11 shows coverage for AT&T, Figure 3.1.1-12 shows coverage for Charter Communications and CenturyLink, and Figure 3.1.1-13 shows coverage for all other providers with a less than 5 percent coverage area, respectively.

**Table 3.1.1-11: Fiber Provider Coverage**

| Fiber Provider | Coverage |
|---|---|
| AT&T Alabama | 14.00% |
| Charter Communications | 11.45% |
| CenturyLink | 10.07% |
| Other [a] | 23.47% |

[a] Other: Provider with less than 5 percent coverage area. Providers include: Mediacom; Comcast; Frontier Communications; WOW!; Troy Cablevision, Inc.; Bright House Networks; Farmers Telecommunications Cooperative, Inc.; Southern Light; Millry Communications; MegaPath Corporation; TV Cable Of Andalusia, Inc.; Windstream; Time Warner Cable; Union Springs Telephone Company; Cable One; Cable TV of East Alabama; TDS; North Alabama Electric Co-op; TEC; MonCre Telephone Cooperative, Inc.; Level 3 Communications, LLC; Coosa Cable Company Inc.; Pine Belt Telephone Company, Inc.; Brindlee Mountain Telephone; Camellia Communications; Ardmore Telephone Company; Hopper Telecommunications Co.; Blountsville Telephone; Otelco Telephone LLC; New Hope Telephone Cooperative; Northland Cable Television; FairPoint Communications; Hayneville Telephone Company; Opp Cablevision; West Alabama TV Cable Co., Inc.; Moundville Telephone Company; TW Telecom; Scottsboro Electric Power Board; Com-Link, Inc.; Castleberry Telephone Company, Inc.; Demopolis CATV; Ragland Telephone Company; MetroCast Communications; Cogent Communications.

Source: (NTIA, 2014)

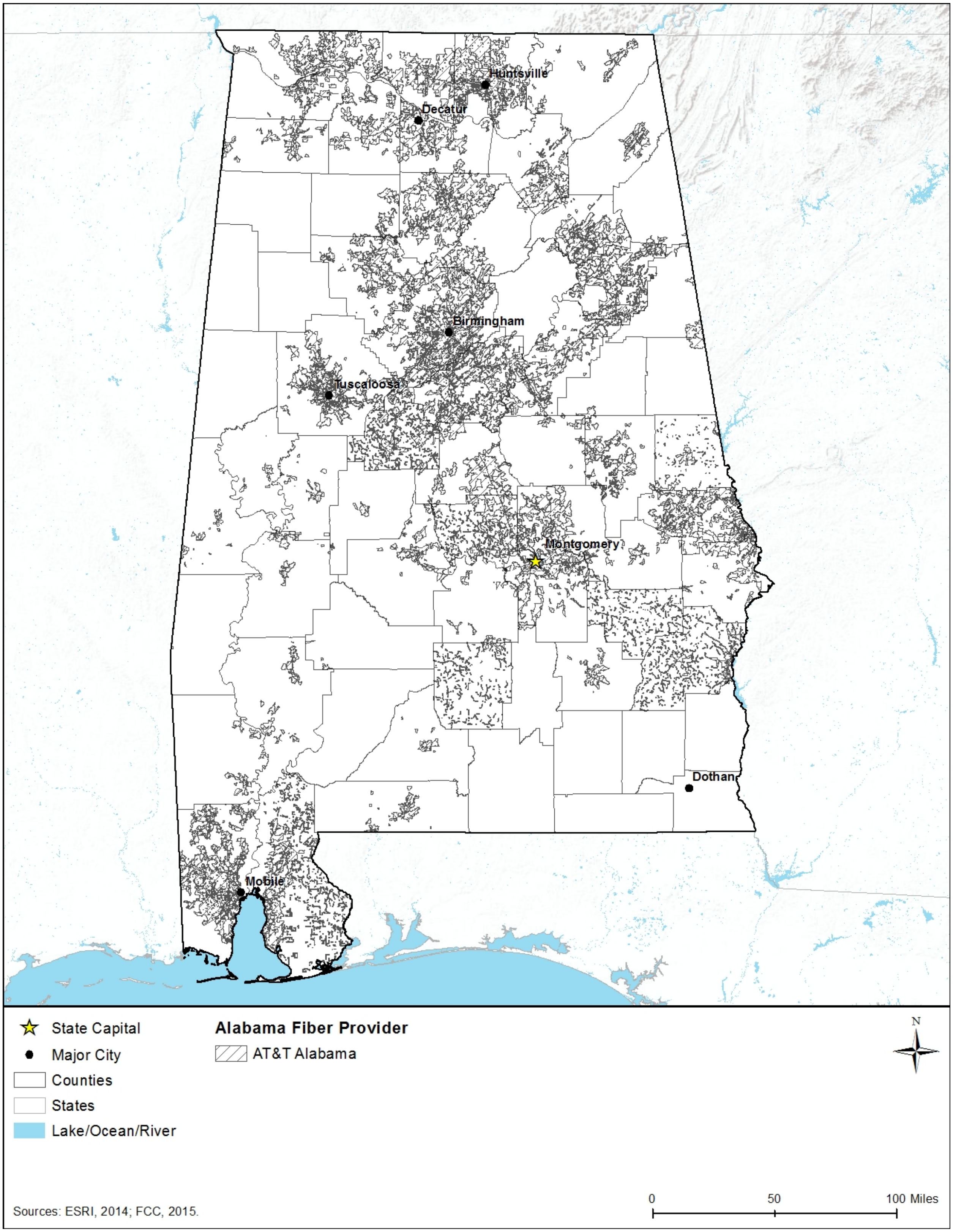


**Figure 3.1.1-11: Fiber Availability in Alabama for AT&T Alabama**

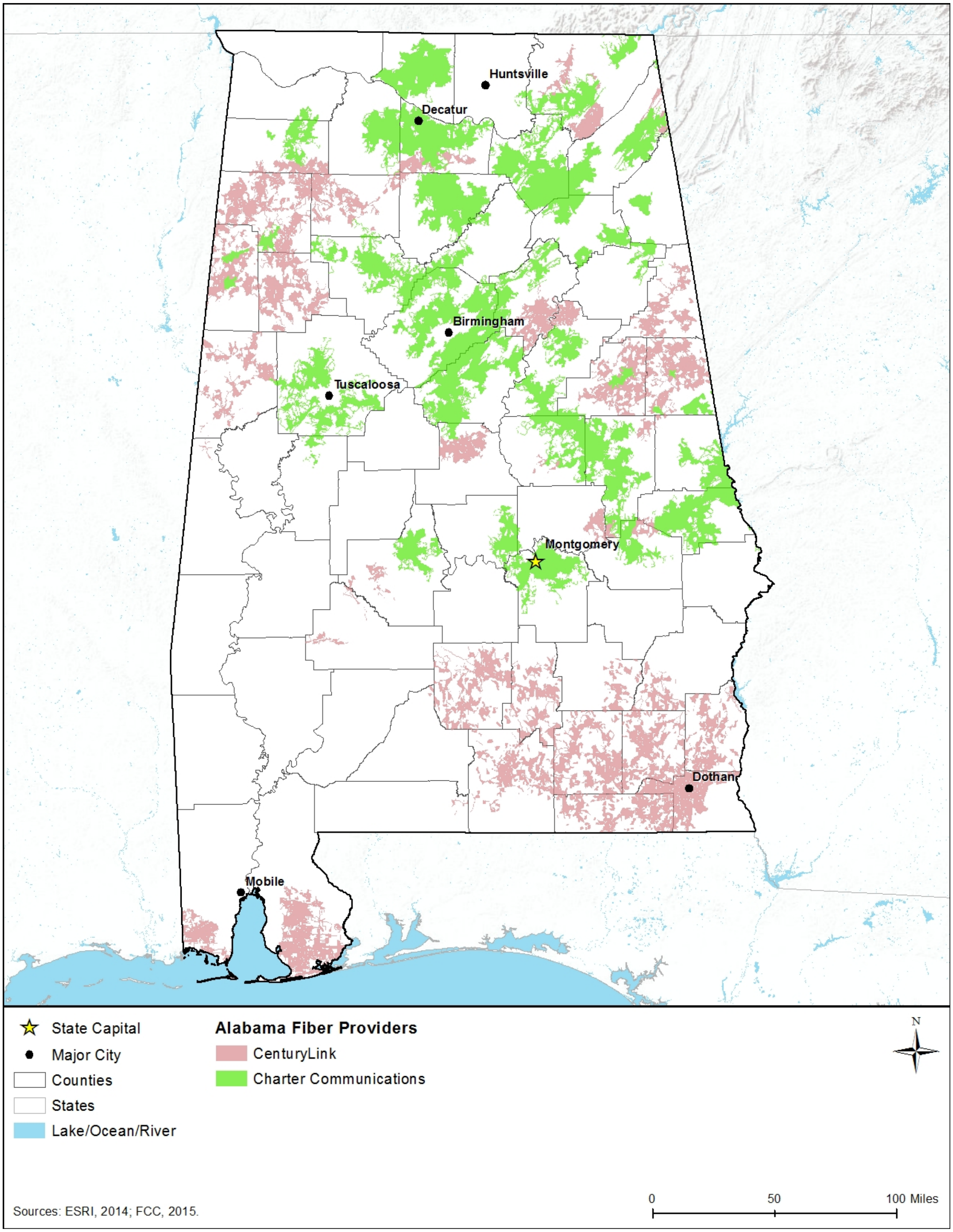


**Figure 3.1.1-12: CenturyLink's and Charter Communication's Fiber Availability in Alabama**

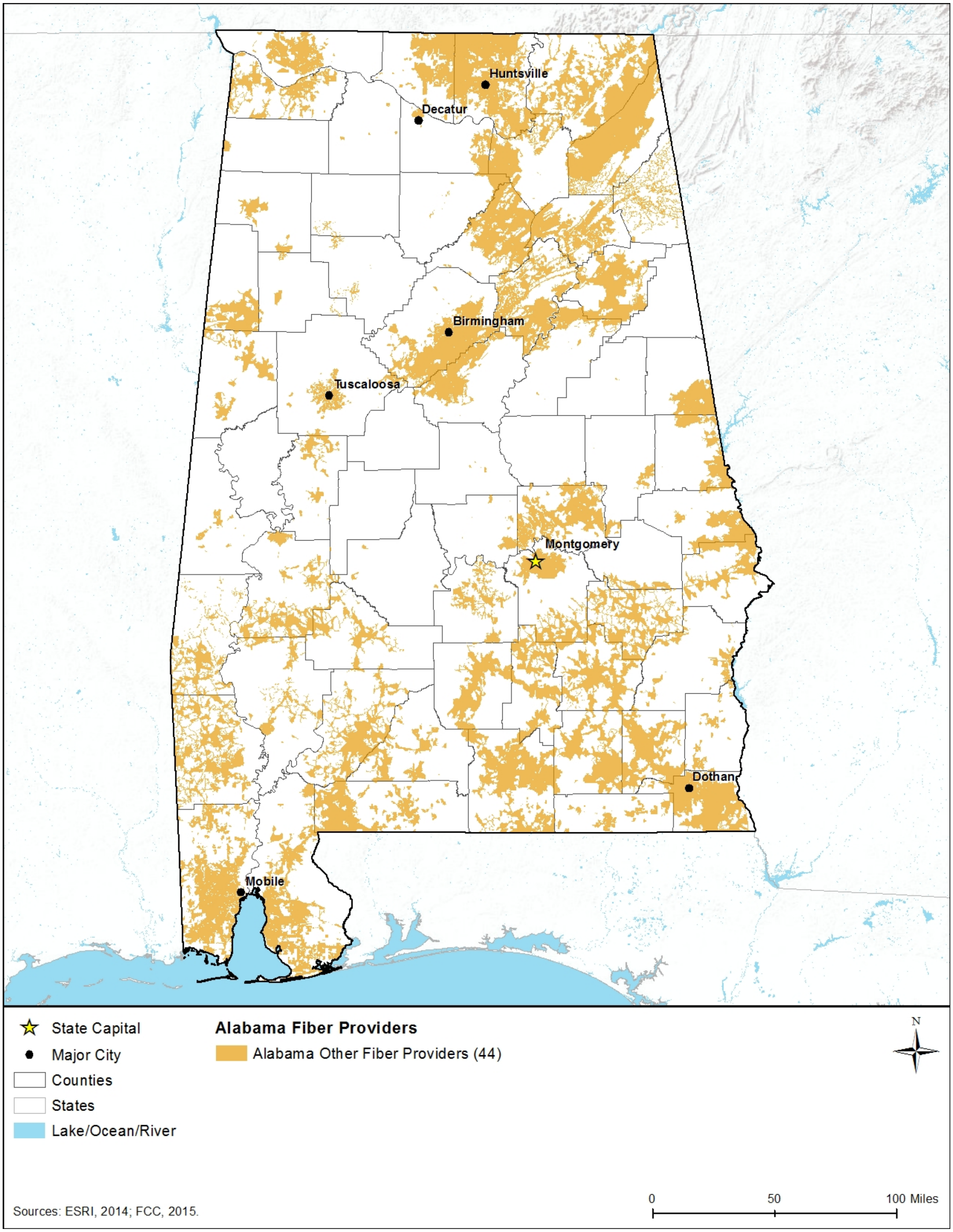


**Figure 3.1.1-13: Other Providers Fiber Availability in Alabama**

*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.

### *3.1.1.6 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 3.1.4, Water Resources, describes the potable water sources in the state.

**Electricity**

The Alabama PSC oversees the rates and service quality of investor owned electric utilities in the state. There is only one company that falls under their jurisdiction: Alabama Power Company, and other entities such as cooperative electric utilities or municipal electric systems do not fall under their regulation (PSC, 2015). Eleven of these municipalities belong to the Alabama Municipal Electric Authority (AMEA), an organization that "provides for its Member communities a reliable and economical source of electric power" (AMEA, 2015a). These communities are spread about the state, but most are located on its eastern side (AMEA, 2015b). Much of Alabama's power comes from three sources: coal, natural gas, or nuclear power; combined, these three source account for 91 percent of the electricity generated in 2014 (EIA, 2015a). In the same year, Alabama generated 149,340 megawatthours[11] of electricity of which 47,302 megawatthours came from coal, 48,270 from natural gas, and 41,244 came from nuclear power facilities. Hydroelectric power produced 9,684 megawatthours (approximately 6 percent of the total) of electricity, with the remaining amount coming from wood biomass. In 2014, "Alabama ranked eighth in 2015 in net electricity generation from renewable energy resources. In 2015, conventional hydroelectric power supplied 75 percent of Alabama's generation from renewable resources" (EIA, 2016a). These trends have remained constant since at least 2001, where coal, natural gas, and nuclear power produced about 88 percent of the state's power. Hydroelectric power and biomass account for another 9 percent of the electricity generated (EIA, 2015a). The largest portion (43.3 percent) of electricity used in Alabama is used by the industrial sector, transportation accounts for 23.9 percent, and the residential and commercial sectors account for just 19.3 percent and 13.4 percent, respectively (EIA, 2016a).

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[11] One megawatthour is defined as "one thousand kilowatthours 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, 2016b)

### Water

The quality of Alabama's drinking water is monitored by individual water systems and reported to the Alabama Department of Environmental Management (ADEM). The over 700 water systems in the state supply water to 4 million people. These facilities test their water monthly for bacterial contamination. Chemical contamination tests are conducted both quarterly and annually, with results being reported back to the public and the ADEM. These public reports also include information on the source waters and the treatment process that the water undergoes (ADEM, 2015a). Standards for water in the state are published by the Water Supply Program, and include regulations and standards for drinking water (and its distribution), groundwater, and surface water (ADEM, 2014a). There are 116 segments of bodies of water that are used as supply for public water systems (ADEM, 2015b). An annual report produced by the ADEM details all compliance violations by water systems for the year. The Integrated Water Quality Monitoring and Assessment Report details the health and status of wetlands, groundwater, surface waterbodies in the state (ADEM, 2014b). On average, 94 percent of the state's water systems meet their compliance standards, which is in part due to the fact that water systems operators must be licensed through the ADEM (ADEM, 2015c). The rates and service quality of the state's water utilities are overseen by the Alabama PSC (PSC, 1988).

### Wastewater

Facilities that discharge pollutants into water in Alabama must first obtain a National Pollutant Discharge Elimination System (NPDES) permit from the ADEM. The ADEM offers both general permits and more specific permits such as Industrial or Mining permits (ADEM, 2015d). Municipal permits cover both municipal point source and stormwater discharges, as well as some semi-public and private dischargers (ADEM, 2015e). Industrial wastewater permits allow for the discharge of wastewater into surface waters or wastewater treatment works (ADEM, 2015f). The Alabama Onsite Wastewater Board handles the licensing and regulation of those involved with onsite wastewater systems (also called septic systems), including those individuals involved in manufacturing, installation, and service of onsite systems (Alabama Onsite Wastewater Board, 2015). As of 2010, there were eight wastewater treatment facilities in the state (AHAM, 2010). Publicly owned wastewater treatment facilities are eligible to receive funds for infrastructure improvement from the Clean Water State Revolving Fund, which is a mix of federal and state money (ADEM, 2015g).

### Solid Waste Management

While the collection and movement of solid waste is coordinated by the Alabama Department of Public Health, the majority of it is deposited in landfills overseen by the ADEM. (ADEM, 2015h). The Solid Waste Program of the ADEM oversees these landfills, as well as the inspection, closure, and design of other types of solid waste management facilities, such as composting facilities. They also handle reporting aspects of the state's solid waste facilities (ADEM, 2012). As of 2015, Alabama was also home to 32 municipal landfills across the state which accept household and commercial solid waste, as well as nonhazardous sludge (ADEM, 2015q). Though some municipal landfills may accept construction or industrial wastes, there are

148 landfills specifically designated for the disposal of construction, demolition, or industrial waste materials. These materials include sheetrock, insulation, and scrap metal. "Uncontaminated concrete, soil, brick, old or weathered waste asphalt paving, ash resulting from the combustion of untreated wood, rock, and similar materials" are not considered construction wastes (ADEM, 2015p). The state's Solid Waste Plan identifies a goal of reducing Alabama's solid waste by 25 percent (ADEM, 2012).

## 3.1.2 Soils

### *3.1.2.1 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.

### *3.1.2.2 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 3.1.2-1.

**Table 3.1.2-1: Relevant Alabama Soil Laws and Regulations**

| State Law/Regulation | Agency | Applicability |
|---|---|---|
| Alabama Water Pollution Control Act (Code of Alabama 1975 §§ 22-22-1 through 22-22-14) | Alabama Department of Environmental Management (ADEM) | Requires erosion and sediment control measures for construction activities disturbing one acre or more, as part of the NPDES General Permit. |

### *3.1.2.3 Environmental Setting*

Alabama is composed of three Land Resource Regions (LRR),[12] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Atlantic and Gulf Coast Lowland Forest and Crop Region;
- East and Central Farming and Forest Region; and
- South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region.

Within and among Alabama's three LRRs are eight Major Land Resource Areas (MLRA),[13] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Alabama's MLRAs are presented in Figure 3.1.2-1 and Table 3.1.2-2.

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[14] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[15] 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[16] (discussed further in the subsections below).

[12] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[13] 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).
[14] The flora and fauna of a region.
[15] 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).
[16] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

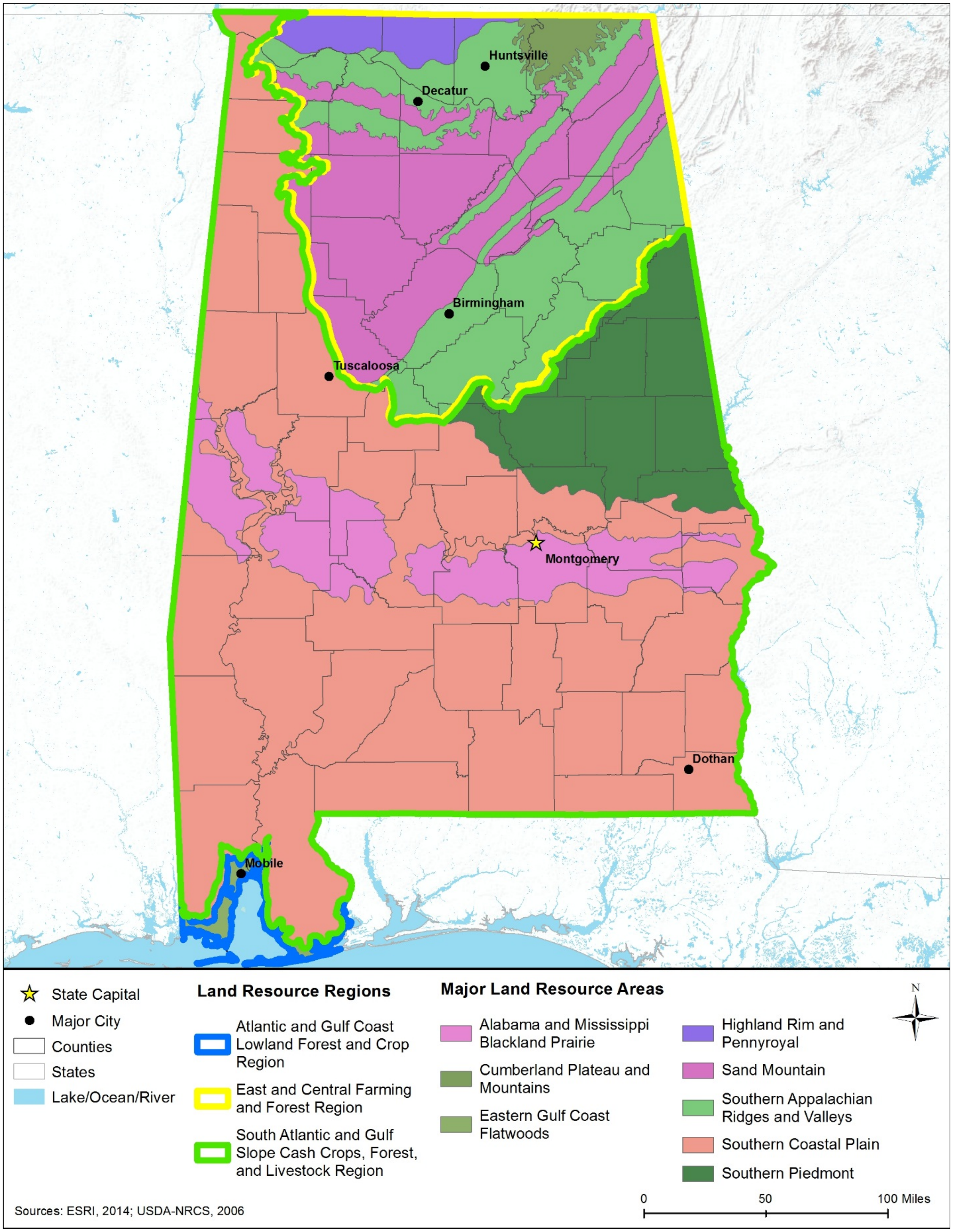



**Figure 3.1.2-1: Locations of Major Land Resource Areas in Alabama**

### Table 3.1.2-2: Characteristics of Major Land Resource Areas in Alabama

| MLRA Name | Region of State | Soil Characteristics |
|---|---|---|
| Alabama and Mississippi Blackland Prairie | Central Alabama | Inceptisols[a] and Vertisols[b] are the dominant soil orders. These clayey or loamy soils[c] are typically somewhat poorly drained to well drained, and range from shallow to very deep. |
| Cumberland Plateau and Mountains | Northeastern Alabama | Most of the soils are Ultisols.[d] These soils range from shallow to very deep, and from moderately well drained to somewhat excessively drained. They are clayey or loamy. |
| Eastern Gulf Coast Flatwoods | Southern Alabama | Alfisols,[e] Entisols,[f] Histosols,[g] Spodosols,[h] and Ultisols are the dominant soil orders. These sandy, mucky, or loamy soils typically range from somewhat poorly drained to very poorly drained, and are deep or very deep. |
| Highland Rim and Pennyroyal | Northern Alabama | Alfisols, Inceptisols, and Ultisols are the dominant soil orders. These clayey or loamy soils are typically moderately well drained or well drained, and are moderately deep to very deep. |
| Sand Mountain | Northern Alabama | Inceptisols and Ultisols are the dominant orders. These loamy soils are typically well drained, and range from shallow to very deep. |
| Southern Appalachian Ridges and Valleys | Northeastern Alabama | These soils are typically Ultisols and Inceptisols (less so). They are generally well drained, range from shallow to very deep, and are shaly or stony. |
| Southern Coastal Plain | Western and Southern Alabama | Entisols, Inceptisols, and Ultisols are the dominant soil orders. These loamy soils range from poorly drained to somewhat excessively drained, and are typically very deep. |
| Southern Piedmont | Eastern Alabama | Alfisols, Inceptisols, and Ultisols are the dominant soil orders. These well-drained soils are clayey or loamy and typically range from shallow to very deep. |

[a] 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 percent of the world's ice-free land surface." (NRCS, 2015b)
[b] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2 percent of the world's ice-free land surface." (NRCS, 2015b)
[c] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)
[d] 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 percent of the world's ice-free land surface." (NRCS, 2015b)
[e] 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 percent of the world's ice-free land surface." (NRCS, 2015b)
[f] 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 percent of the world's ice-free land surface." (NRCS, 2015b)
[g] Histosols: "Histosols have a high content of organic matter and no permafrost. Most are saturated year round, but a few are freely drained. They form in decomposed plan remains that accumulate in water, forest litter, or moss faster than they decay. Histosols make up about 1 percent of the world's ice-free land surface." (NRCS, 2015b)
[h] Spodosols: "Spodosols formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in the subsoil. They commonly occur in areas of course-textured deposits under coniferous forests of humid regions, tend to be acid and infertile, and make up about 4 percent of the world's ice-free land surface." (NRCS, 2015b)

Source: (NRCS, 2006)

### *3.1.2.4 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;[17] there are twelve soil orders in the world and they are characterized by both observed and inferred[18] 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 (NRCS, 2015c). The State Soil Geographic (STATSGO2)[19] soil database identifies 13 different soil suborders in Alabama (NRCS, 2015d). Figure 3.1.2-2 depicts the distribution of the soil suborders, and Table 3.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[17] Taxonomy: A formal representation of relationships between items in a hierarchical structure. (USEPA, 2015k)
[18] "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, 2015b).
[19] STATSGO2 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 is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

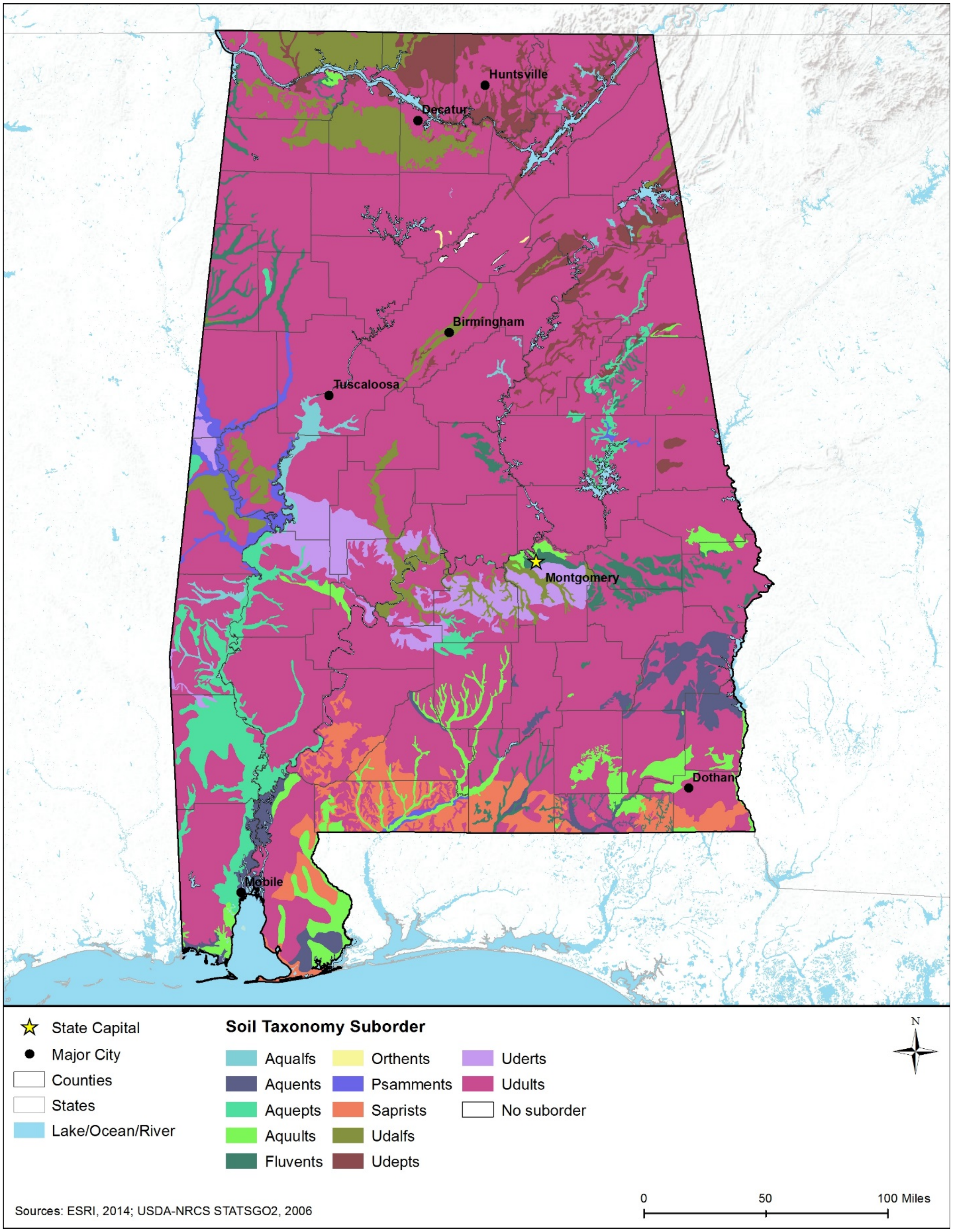



**Figure 3.1.2-2: Alabama Soil Taxonomy Suborders**

### Table 3.1.2-3: Major Characteristics of Soil Suborders[a] Found in Alabama, as depicted in Figure 3.1.2-2

| Soil Order | Soil Suborder | Ecological Site Description | Soil Texture | Slope (%) | Drainage Class | Hydric Soil[b] | Hydrologic Group | Runoff Potential | Permeability[c] | 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. | Loam, Silty clay loam, Unweathered bedrock | 0-2 | Somewhat poorly drained to poorly drained | No, Yes | C, D | Medium, High | Low, 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, Loam, Loamy sand, Sandy loam, Silt loam, Variable | 0-2 | Poorly drained to 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 |
| 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. | Clay, Clay loam, Fine sandy loam, Loam, Mucky loam, Sandy loam, Silt loam, Silty clay loam | 0-2 | Somewhat poorly drained to very poorly drained | No, Yes | A, C | Low, Medium | High, Low | Low to Medium, depending on slope | High, due to hydric soil and poor drainage conditions |
| Aquults | 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, Clay loam, Loam, Sandy clay loam, Sandy loam, Silt loam, Variable | 0-2 | Somewhat poorly drained to poorly drained | No, Yes | B, C, D | Medium, High | Moderate, Low, 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. | Fine sandy loam, Loam, Sandy loam, Variable | 0-2 | Moderately well drained to well drained | No | B, C | Medium | Moderate, Low | Medium | Low |
| Entisols | Orthents | Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat. | Very channery silt loam | 2-60 | Somewhat excessively drained | No | B | Medium | Moderate | Medium | Low |
| 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, Sand, Variable | 0-15 | Excessively drained | No | A | Low | High | Low | Low |
| 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. | Clay, Muck | 0-1 | Very poorly drained | Yes | D | High | Very Low | High | 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. | Clay, Fine sandy loam, Gravelly silt loam, Loam, Sandy loam, Silt loam, Silty clay, Silty clay loam | 0-45 | Somewhat poorly drained to well drained | No | B, C, D | Medium, High | Moderate, Low, Very Low | Medium to High, depending on slope | Low |

| Soil Order | Soil Suborder | Ecological Site Description | Soil Texture | Slope (%) | Drainage Class | Hydric Soil[b] | Hydrologic Group | Runoff Potential | Permeability[c] | Erosion Potential | Compaction and Rutting Potential |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inceptisols | Udepts | Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture. | Channery silt loam, Gravelly sandy loam, Gravelly silt loam, Loam, Silt loam, Silty clay loam, Stratified sandy loam to silty clay loam, Variable | 0-25 | Somewhat poorly drained to somewhat excessively drained | No, Yes | B, C, D | Medium, High | Moderate, Low, Very Low | Medium to High, depending on slops | High, due to hydric soil and poor drainage conditions |
| Vertisols | Uderts | Uderts are found in humid areas, and primarily used as cropland, forest, or pasture. They have low permeability, and water usually must be drained from the surface of cropland. | Clay, Silty clay, Silty clay loam | 0-12 | Somewhat poorly drained to moderately well drained | No | D | High | Very Low | High | Low |
| 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, Clay loam, Fine sandy loam, Gravelly clay, Gravelly fine sandy loam, Gravelly loam, Gravelly loamy sand, Gravelly sandy clay loam, Gravelly sandy loam, Gravelly silt loam, Gravelly silty clay, Gravelly silty clay loam, Loam, Loamy sand, Sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stony clay loam, Stratified loamy sand to sandy clay loam, Stratified sand to fine sandy loam, Unweathered bedrock, Variable, Very channery sandy loam, Very gravelly loam, Weathered bedrock | 0-70 | Somewhat poorly drained to somewhat excessively drained | No | A, B, C, D | Low, Medium, High | High, Moderate, Low, Very Low | Low to High, depending on slope | Low |

[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, 2015e). 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 3.1.2.5.

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

### *3.1.2.5 Runoff Potential*

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential. [20] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 3.1.2-3 provides a summary of the runoff potential for each soil suborder in Alabama.

**A. Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[21] 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, Psamments, and Udults fall into this category in Alabama.

**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. Aquults, Fluvents, Orthents, Udalfs, Udepts, and Udults fall into this category in Alabama.

**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. Aqualfs, Aquepts, Aquults, Fluvents, Udalfs, Udepts, and Udults fall into this category in Alabama.

**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, Aquults, Saprists, Udalfs, Udepts, Uderts, and Udults fall into this category in Alabama.

### *3.1.2.6 Soil Erosion*

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading 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 safety hazard (NRCS, 1996a). Table 3.1.2-3 provides a summary of the erosion potential for each soil suborder in Alabama. Soils with the highest erosion potential in Alabama include

[20] 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.
[21] 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)

those in the Aqualfs, Aquents, Aquepts, Aquods, Orthents, Orthods, Saprists, and Udepts suborders, which are found throughout most of the state (Figure 3.1.2-2).

#### *3.1.2.7 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 (USFS, 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 ten 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 3.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Alabama. Soils with the highest potential for compaction and rutting in Alabama include those in the Aqualfs, Aquents, Aquepts, Aquults, Saprists, and Udepts suborder, which are found in throughout most of the state (Figure 3.1.2-2).

### 3.1.3 Geology

#### *3.1.3.1 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 3.1.4), Climate Change (Section 3.1.14), and Human Health and Safety (Section 3.1.15).

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

- Section 3.1.3.3, Major Physiographic Regions[22] and Provinces;[23]
- Section 3.1.3.4, Surface Geology;
- Section 3.1.3.5, Bedrock Geology;[24]
- Section 3.1.3.6, Paleontological Resources;[25]
- Section 3.1.3.7, Fossil Fuel and Mineral Resources; and
- Section 3.1.3.8, Potential Geologic Hazards.

[22] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[23] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[24] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015h).
[25] Paleontology: “Study of life in past geologic time based on fossil plants and animals” (USGS, 2015i).

#### *3.1.3.2 Specific Regulatory Considerations*

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 3.1.3-1 below.

**Table 3.1.3-1: Relevant Alabama Geology Laws and Regulations**

| State Law/Regulation | Agency | Applicability |
|---|---|---|
| Alabama Code Section 1-2-20 | State of Alabama | The state fossil, "*Basilosaurus Cetoides*" can only be removed from the state after prior written approval from the governor has been obtained. |
| Alabama Building Code | State of Alabama Building Commission | Guidelines for Seismic Design. |

#### *3.1.3.3 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 generally due to differences in the nature or structure of the underlying rocks. 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, 1916).

Alabama is within three physiographic regions: Atlantic Plain, Appalachian Highlands, and Interior Plains (Figure 3.1.3-1). These regions, along with their respective physiographic provinces are discussed in greater detail below.

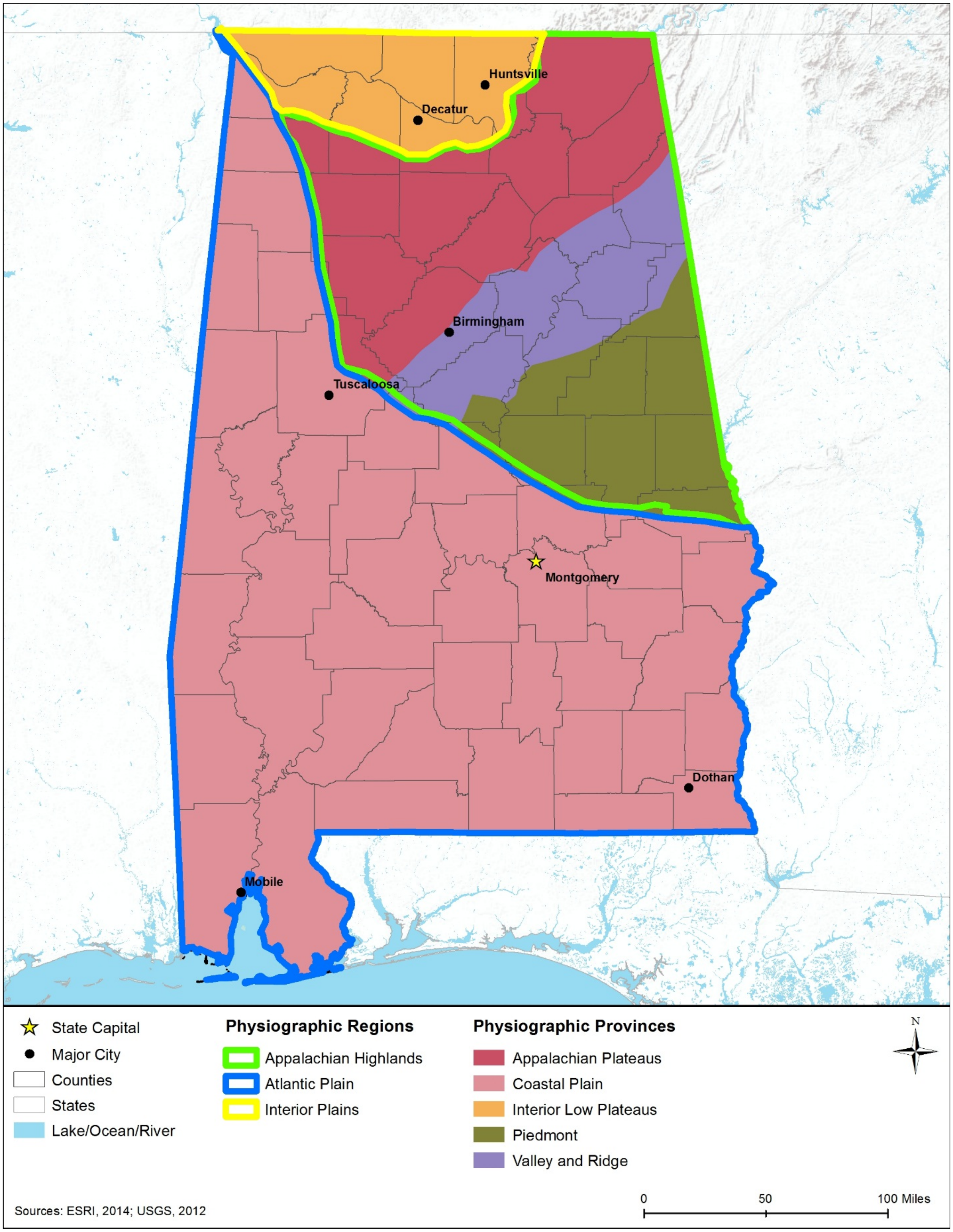



**Figure 3.1.3-1: Physiographic Regions, Provinces, and Sections of Alabama**

### 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)

<u>Coastal Plain Province</u> – Within Alabama, the Atlantic Plan Region is composed of the Coastal Plain physiographic province. This includes most of the state, with the exception of the northeastern quadrant which falls within the Appalachian Highlands Region. The area is characterized by lowlands with sporadic broad hills; at its greatest, topographic relief is about 400 feet in stream valleys (GSA, 1988). Terraces and barrier islands are frequently encountered in southern areas of the state along the Gulf Coast (NPS, 2014a). "Sediment reaching the Gulf along the Florida Panhandle, Alabama, and Mississippi coasts is almost entirely form erosion of hard rocks in the southern Appalachian Mountains" (Lillie, 1999). Coastal Plain sediments range from 50 feet thick in the northwestern portions of the state to more than 8,000 feet thick in southern Alabama (GSA, 1988).

### Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[27] created when the North American plates collided with the Eurasian and African plates more than 500 MYA. Once similar in height to the present-day Rocky Mountains,[28] the Appalachian Highlands have eroded considerably, and most peaks are now under 5,000 feet above sea level (ASL). The current Appalachian Highlands Region is characterized by prime and unique farmlands and is rich in mineral resources (USGS, 2003a). Within Alabama, the Atlantic Plain Region is separated from the Appalachian Highlands Region by the Fall Line which runs between the two regions for the length of the East Coast (Tew, 2010).

As noted above, the Appalachian Highlands Region within Alabama is composed of three physiographic provinces: Piedmont, Valley and Ridge, and Appalachian Plateaus (USGS, 2003a).

[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] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding." (USGS, 2014h)
[28] The Rocky Mountains exceed 14,000 feet above sea level (NPS, 2004).

Piedmont Province – Alabama's Piedmont Province lies in the eastern portion of the state along the foothills of the Appalachian Highlands. The province is underlain largely by Precambrian (older than 542 MYA) and Paleozoic (542 to 251 MYA) crystalline metamorphic rocks[29] (GSA, 1988). Cheaha Peak (2,407 feet ASL), the highest point in Alabama, is in this province (FHWA, 2015f).

Valley and Ridge Province – The Valley and Ridge Province is within northeastern Alabama and is underlain by folded and faulted[30] sedimentary rocks (USGS, 2015b). The province's valleys and ridges trend in a northeasterly-southwesterly direction. Both the ridges and valleys are composed of sedimentary rocks from the Cambrian through Pennsylvanian Periods (542 to 299 MYA). Ridges are underlain by stronger sedimentary rocks including sandstone[31] and chert,[32] while valleys are underlain by weaker sedimentary rocks including shale[33] and carbonates[34] (GSA, 1988).

Appalachian Plateaus – Alabama's Appalachian Plateaus are within the north-central and northeastern portions of the state, to the northwest of the Valley and Ridge Province (GSA, 1988). Much of the Appalachian plateaus are composed of flat-lying sedimentary rocks (USGS, 2015b), such as sandstone[35] and shale. The southeastern portion of the province contain limestone[36] valleys and sandstone ridges. These rocks are generally Cambrian to Pennsylvanian (542 to 299 MYA) in age (GSA, 1988).

### Interior Plains

The Interior Plains Region extends across much of the interior of the United States, roughly between the western edge of the Appalachian Highlands (near states including Ohio, Tennessee, and Alabama), and the eastern edge of the Rocky Mountain System (including states such as Montana, Wyoming, and Colorado) (Fenneman, 1916). Metamorphic and igneous rocks dating to the Precambrian Era (older than 542 MYA) underlie the entire region. There is minimal topographic relief throughout the region, except for the Black Hills of South Dakota. During the Mesozoic Era, much of the Interior Plains were covered by the oceans, resulting in the formation of sedimentary rocks,[37] which lie on top of the Precambrian basement rocks. Erosion from the Rocky Mountains to the west and the Ozark/Ouachita Mountains to the east, also contributed to the formation of sandstone,[38] mudstone,[39] and clay (USGS, 2014a).

[29] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids." (NPS, 2000)
[30] Fault: "A fracture in the Earth along which one side has moved in relative to the other." (NPS, 2000)
[31] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (NPS, 2000)
[32] Chert: "A very fine-grained sedimentary rock made of quartz." (NPS, 2000)
[33] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks." (NPS, 2000)
[34] Carbonate Rocks: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$). Limestone and dolomite are common carbonate sedimentary rocks." (NPS, 2000)
[35] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (NPS, 2000)
[36] 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." (NPS, 2000)
[37] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding." (USGS, 2014h)
[38] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (NPS, 2000)
[39] Mudstone: "A very fine-grained sedimentary rock formed from mud." (NPS, 2000)

Interior Low Plateaus – Within Alabama, the Interior Low Plateaus Province comprised of the northwestern portion of the state. The Interior Low Plateaus are generally flat-lying and are "primarily a limestone plateau of moderate relief" (GSA, 1988). These rocks are tilted slightly to the southeast and are generally Cambrian to Pennsylvanian (542 to 299 MYA) in age (GSA, 1988).

#### *3.1.3.4 Surface Geology*

Surficial geology is characterized by materials such as till,[40] 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,[41] subsidence,[42] and erosion. (Thompson, 2015)

In Alabama, most surficial deposits are characterized as coastal sediments that range from 50 to 1,000 feet thick in the northern part of the state, to possibly more than 24,000 feet thick near the Gulf Coast (Raymond, Osborne, Copeland, & Neathery, 1988). Eroded sediments from nearby highlands and alluvial[43] deposits along the floodplains of present-day rivers are common throughout the Alabama landscape. Glacial deposits coming from the Pleistocene glaciation are not present in Alabama, as the terminal extent of the glaciers did not reach Alabama during that time (Ray, 1992).

Figure 3.1.3-2 depicts a generalized illustration of the surface geology for Alabama.

[40] 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, 2013b)
[41] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.
[42] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." (USGS, 2000)
[43] Alluvium: "Sand, gravel, and silt deposited by rivers and streams in a valley bottom." (NPS, 2000)

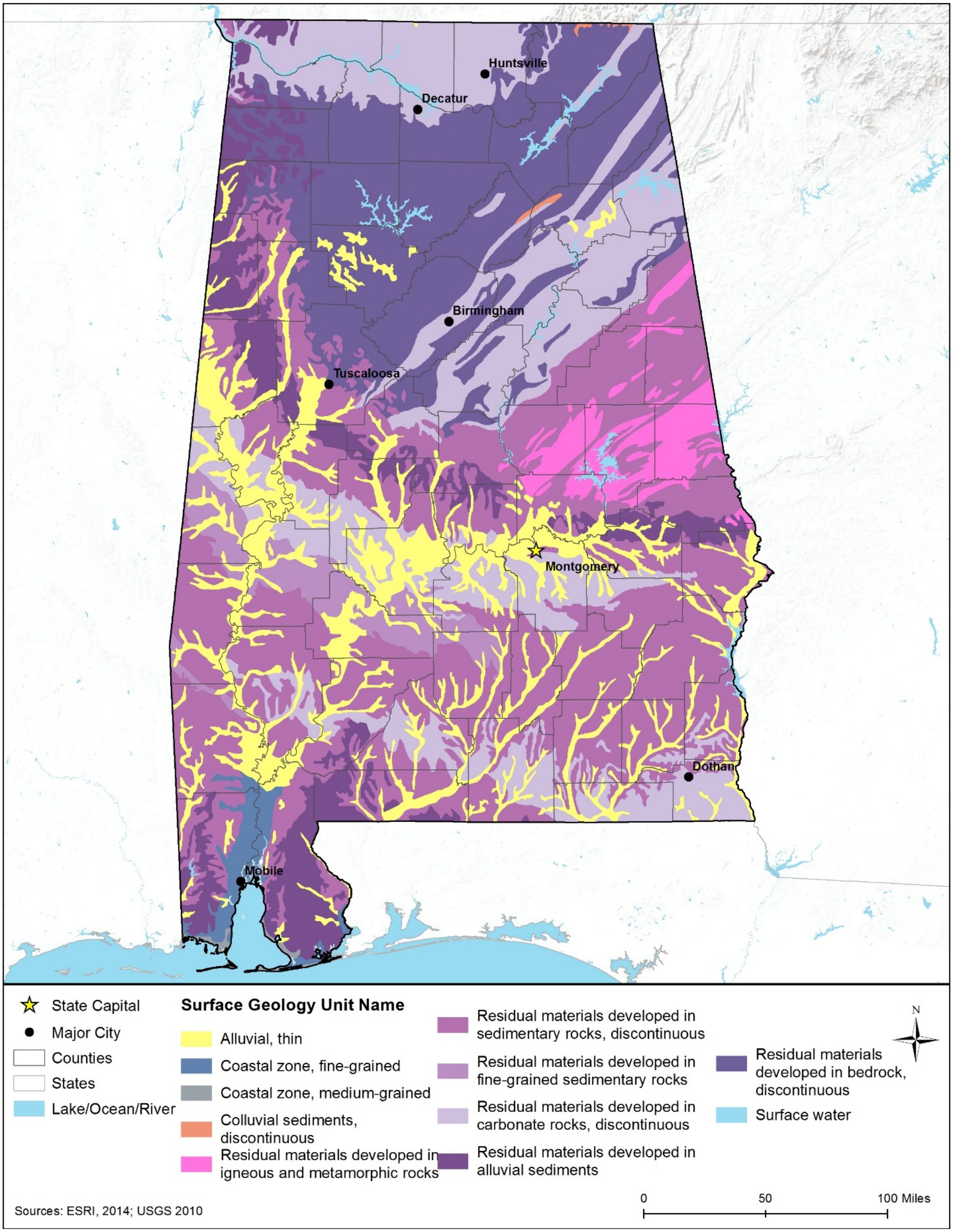



**Figure 3.1.3-2: Generalized Surface Geology for Alabama**

### *3.1.3.5 Bedrock Geology*

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015c) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[44] rock composition, and regional tectonism.[45] 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 bedrock of northern Alabama, including the Interior Low Plateaus Province, is composed of Mississippian Period (359 to 318 MYA) limestone. To the southeast, the Appalachian Plateaus Province contains Pennsylvanian Period (318 to 299 MYA) sandstone and shale interspersed with three linear anticlinal[46] limestone valleys (i.e., Murphrees, Wills, and Sequatchie Valleys). Central and northeastern Alabama's Valley and Ridge Province is characterized by northeast-southwest trending ridges and valleys are found that are underlain largely by faulted and folded Devonian sedimentary rocks. Valleys contain relatively weak shale and carbonate rock, while ridges are formed of sandstone. East central Alabama's Piedmont Province is characterized by regional faults and prominent ridges, including the Rebecca and Talladega mountains. Bedrock in the Piedmont Province is made up of Cambria (542 through 488 MYA) through Silurian (444 to 416 MYA) phyllite,[47] mica,[48] and schist,[49] as well as older Precambrian (older than 542 MYA) metamorphic rocks (Raymond, Osborne, Copeland, & Neathery, 1988). Figure 3.1.3-3 depicts the generalized bedrock composition of Alabama.

[44] 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)
[45] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2015j)
[46] Anticline: "A downward-curving (convex) fold in rock that resembles an arch. The central part, being the most exposed to erosion, display the oldest section of rock." (USGS, 2015j)
[47] Phyllite: "A very fine-grained, foliated metamorphic rock, generally derived from shale or fine-grained sandstone. Phyllites are usually black or dark gray; the foliation is commonly crinkled or wavy." (NPS, 2000)
[48] Mica: "Group of silicate minerals composed of varying amounts of aluminum, potassium, magnesium, iron and water." (NPS, 2000)
[49] Schist: "Metamorphic rock usually derived from fine-grained sedimentary rock such as shale. Individual minerals in schist have grown during metamorphism so that they are easily visible to the naked eye." (NPS, 2000)

**EXPLANATION**

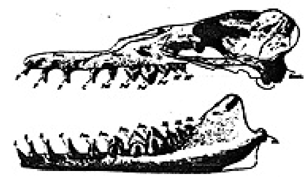
- Quaternary sedimentary rocks
- Pilocene and Miocene sedimentary rocks
- Oligocene and upper Eocene sedimentary rocks
- Middle Eocene through Paleocene sedimentary rocks
- Cretaceous sedimentary rocks
- Pennsylvanian sedimentary rocks
- Mississippian sedimentary rocks
- Devonian through Cambrian sedimentary rocks
- Upper Paleozoic cataciastic rocks
- Siberian through Cambrian phyllite, quartzite, and mica schist
- Cambrian metvolcanic rocks
- Lower Paleozoic and Precambrian felsic gneiss and schist
- Lower Paleozoic and Precambrian granite gneiss and schist
- Precambrian quartzite, mica schist, and gneiss
- Precambrian mica schist, and gneiss
- Contact
- Fault

**Figure 3.1.3-3: Generalized Bedrock Geology for Alabama**

Source: (USGS, 2015d)

### *3.1.3.6 Paleontological Resources*

**Alabama State Fossil**
***Basilosaurus cetoides***



Source: (ADAH, 2014)

Throughout much of the Cambrian (542 to 488 MYA), Ordovician (488 to 444 MYA), and Silurian (444 to 416 MYA) Periods, Alabama was under a warm, tropical ocean. Cambrian Period fossils are mainly found in northern Alabama and include marine fossils such as brachiopods[50] and trilobites.[51] Ordovician and Silurian Period marine fossils include brachiopods, clams, crinoids,[52] and trilobites. By the Devonian Period (416 to 359 MYA), portions of the state were above water, with both plant and marine fossil fragments documented. Devonian Period rocks have been found to contain traces of land plants, as well as marine animals. During the Cretaceous Period (146 to 66 MYA), the Gulf of Mexico shoreline was further inland than its present-day position, as evidenced by marine fossils found in the state. Alabama is among the most abundant locations worldwide for Cretaceous Period marine fossils. Plant fossils have also been found in Cretaceous Period sediment deposits, along with the marine fossils of ammonites, clams, nautiloids, snails, and skeletons of marine vertebrates such as fish, turtles, and mosasaurs (Paleontology Portal, 2015). One marine fossil in Alabama includes the state fossil of Alabama, the *Basilosaurus cetoides*, a carnivorous member of the whale family that ranged from 55 to 70 feet long (ADAH, 2014). Marine fossils from the Tertiary Period (66 MYA to 2.6 MYA) are also abundant in southern Alabama. Fossils from the Quaternary Period (2.6 MYA to present) are generally terrestrial animals, including mammoths, mastodons, and giant ground sloths as Alabama was generally covered by forestland (Paleontology Portal, 2015).

### *3.1.3.7 Fossil Fuel and Mineral Resources*

#### Oil and Gas

In 2014, Alabama produced more than 9.8M barrels of oil with 5 rotary rigs in operation, accounting for 0.3 percent of total nationwide production. Alabama's July 2015 production of 844,000 barrels of oil ranks 15th nationwide. (EIA, 2016a)

In 2014, Alabama produced about 181M cubic feet of natural gas from 6,118 natural gas producing wells. This accounts for 0.7 percent of the total nationwide natural gas production (EIA, 2016a). Coalbed methane and shale from the Cambrian through Mississippian (542 to 318 MYA) Periods have been sources of natural gas in Alabama (Pashin, 2008).

[50] Brachiopod: "Any member of a phylum of marine invertebrate animals called Brachiopoda. Brachiopods are sessile, bivalved organisms, but are more closely related to the colonial Bryozoa than the bivalved mollusks. Brachiopod diversity peaked in the Paleozoic, but some species survive." (Smithsonian Institution, 2016)
[51] 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 Institution, 2016)
[52] Crinoid: "The common name for any echinoderm of the class Crinoidea, including sea lilies, feather stars, etc. Crinoids are common fossils in the Paleozoic and persist to the present. Many species have stalks and radiating arms and feed on particles in the water column." (Smithsonian Institution, 2016)

**Minerals**

As of 2016, Alabama's total nonfuel mineral production was valued at $1.25B, ranking 22nd nationwide (in terms of dollar value), about 1.6 percent of the country's total nonfuel mineral production. Alabama's leading nonfuel mineral commodities were portland cement, crushed stone, lime, construction sand and gravel, and industrial sand and gravel (USGS, 2016a). In 2011, Alabama ranked second nationwide in the production of common clay, fourth for bentonite, and third for lime. In addition to these minerals, Alabama also produced dimension stone,[53] industrial sand and gravel, mica, iron oxide pigments, gypsum, perlite, and sulfur (USGS, 2015e).

Alabama has produced coal for more than 150 years. As of 2013, Alabama ranked 13th nationwide in total coal production, generating 18.6M short tons for that year (i.e., about 1.9 percent of total nationwide production for coal). Alabama is ranked 5th nationwide in bituminous coal production,[54] with the majority of this commodity coming from northern portion of the state (EIA, 2016a).

### *3.1.3.8 Geologic Hazards*

The three major geologic hazards of concern in Alabama are earthquakes, landslides, and subsidence. Volcanoes do not occur in Alabama and therefore do not present a hazard to the state (USGS, 2015f). The subsections below summarize current geologic hazards in Alabama.

**Earthquakes**

Since 1886, 332 earthquakes have been documented in Alabama (GSA, 2015a). 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 (USGS, 2012a).

The shaking due to earthquakes can be significant 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 happen where tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth" (NPS, 2015s). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014b). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale. (Oregon Department of Geology, 2015)

[53] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape." (USGS, 2016c)
[54] Bituminous coal: "Middle rank coal (between subbituminous and anthracite) formed by additional pressure and heat on lignite. Usually has a high Btu (British thermal unit) value and may be referred to as 'soft coal.'" (NPS, 2000)

Figure 3.1.3-4 depicts the seismic risk throughout Alabama; 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. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (USGS, 2010)

Areas of greatest seismic risk in Alabama are concentrated in the northern portions of the state (Figure 3.1.3-4). Earthquakes in Alabama generally occur as a result of the state's proximity to the Southern Appalachian Seismic Zone in the northern half of the state, and the Bahamas Fracture Seismic Zone in the southern portion of the state. The largest earthquake ever recorded in Alabama occurred in Jefferson County in 1916; the earthquake measured 5.1 on the Richter scale[55] (USGS, 2014c). The effects of this earthquake were felt as far east as Columbia, South Carolina, and as far north as Louisville, Kentucky (USGS, 2012b). More recently, in 2003, a magnitude 4.9 earthquake was recorded in DeKalb County in northeastern Alabama (GSA, 2015b).

[55] 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, 2014i)

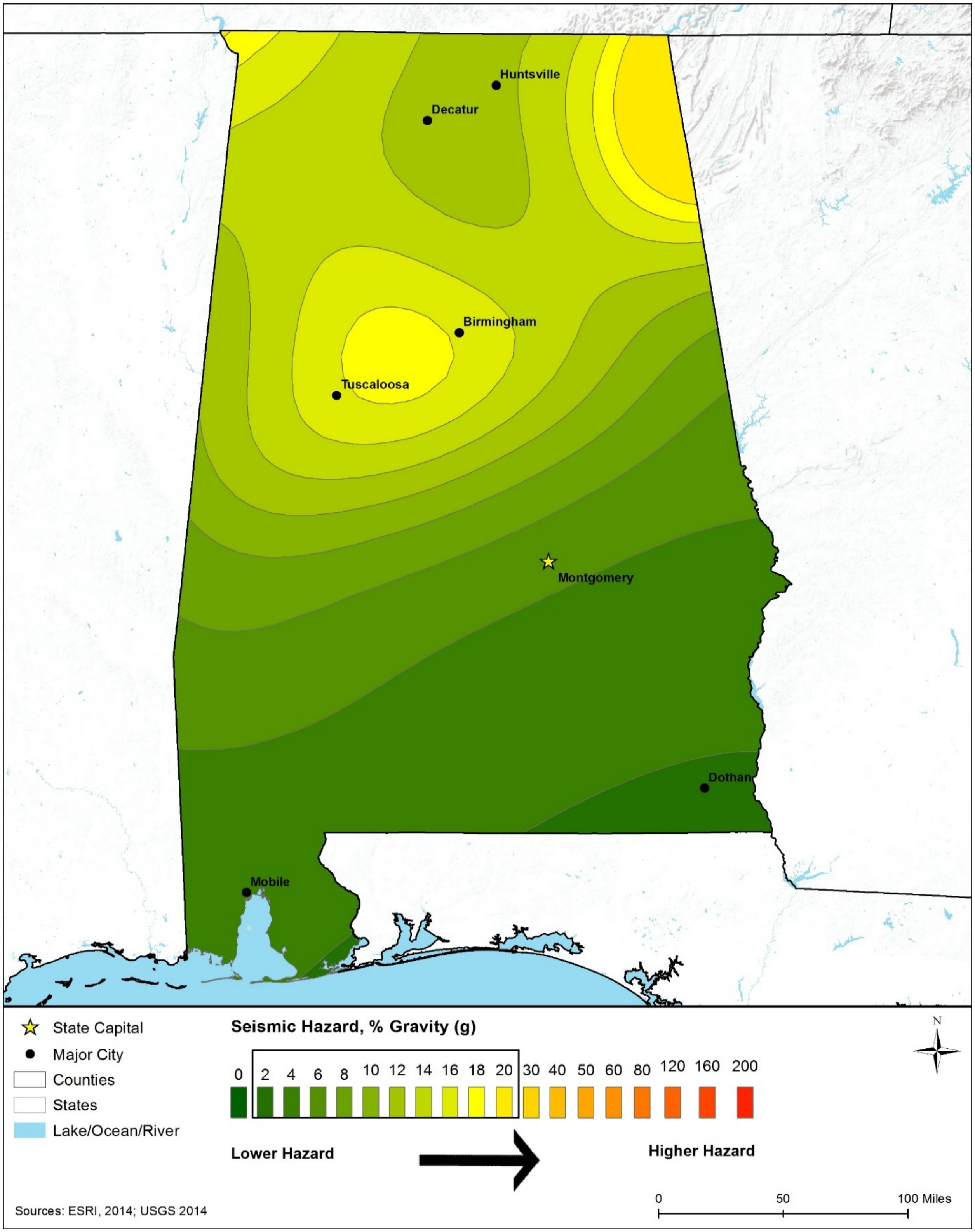



**Figure 3.1.3-4: Alabama 2014 Seismic Hazard Map**

**Landslides**

Though most parts of Alabama are at low to no risk of landslides. A few localized areas in the state are at moderate to high risk of landslides (Ebersole, Driskell, & Tavis, 2011).

"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, 2003b). 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, 2003b)

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, 2003b)

Though 50 of Alabama's 67 counties are vulnerable to landslides, this geologic hazard is most common in the northern part of the state (AEMA, 2013). In general, landslide susceptibility in Alabama is a function of two primary factors (Ebersole, Driskell, & Tavis, 2011):

- Rock strength: Terrain that is underlain by weaker rocks, such as shale and weakly cemented sandstone, is more likely to experience a landslide than areas that are underlain by stronger rocks.
- Slope: Areas with steeper slopes are more susceptible to landslides than are locations with flat topography. "While most of Alabama's topography is relatively low slope (left), areas such as the Valley and Ridge, Piedmont, and Cumberland Plateau have a number of steeper slopes. In addition to this, steep slopes in Alabama can also be found along river bluffs and roadcuts" (GSA, 2015c).

Other factors that increase the likelihood of landslides in a particular location include the occurrence of previous landslides, greater amounts of precipitation, and human disturbances (Ebersole, Driskell, & Tavis, 2011). In addition, erosion of steep slopes along Mobile Bay in southern Alabama also presents an increased risk of landslides (AEMA, 2013).

Several landslides have been documented in Alabama in recent years. A 2005 landslide in Autauga County (in the central portion of the state near Montgomery) resulted when heavy rains caused the mass movement of sediments beneath County Road 47. A 2010 landslide in a Union Springs neighborhood in Bullock County (in southeastern Alabama) has been attributed to weakly consolidated geology on a steep slope (GSA, 2015c). Figure 3.1.3-5 shows landslide incidence and susceptibility throughout Alabama.

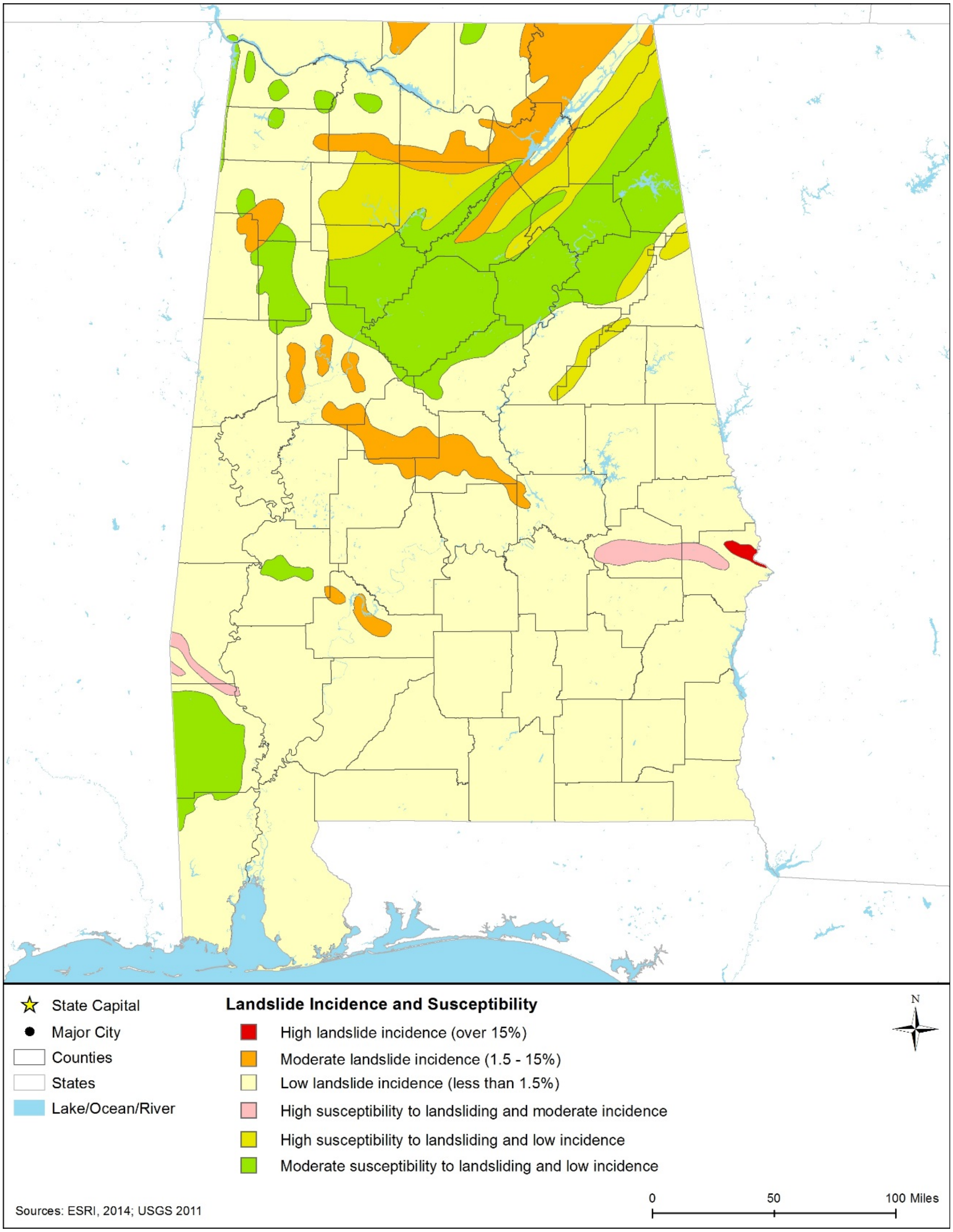



**Figure 3.1.3-5: Alabama Landslide Incidence and Susceptibility Hazard Map[56]**

[56] Susceptibility hazards not indicated in Figure 3.1.3-5 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

### Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000). Land subsidence due to sinkhole formation in karst topography[57] is a problem in parts of Alabama (AEMA, 2013). 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, 2000).

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, 2013a).

**Photo of a Sinkhole in Gadsden, AL (2002)**

Source: (AEMA, 2013)

In Alabama, land subsidence is a threat in 44 of 67 counties throughout the state. The main causes of land subsidence are dissolution of carbonate[58] rock layers, which can lead to the formation of sinkholes. "Periods of drought, excessive rainfall, well pumpage, and construction activities increase the potential for sinkhole formation." Sinkholes are most common in northern Alabama, particularly in the Appalachian Plateaus and Valley and Ridge physiographic provinces. Alabama cities that have been impacted by sinkholes include Auburn, Tuskegee, Birmingham, and Gadsden. The largest sinkhole to have ever been recorded nationwide was documented in Shelby County in December 1972. The sinkhole measured 425 feet (length) by 350 feet (width) by 150 feet (depth). (AEMA, 2013)

Figure 3.1.3-6 displays the areas of Alabama are susceptible to land subsidence due to karst topography.

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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, 2014j)

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

[58] Carbonate: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$). Limestone and dolomite are common carbonate sedimentary rocks." (USGS, 2015j)

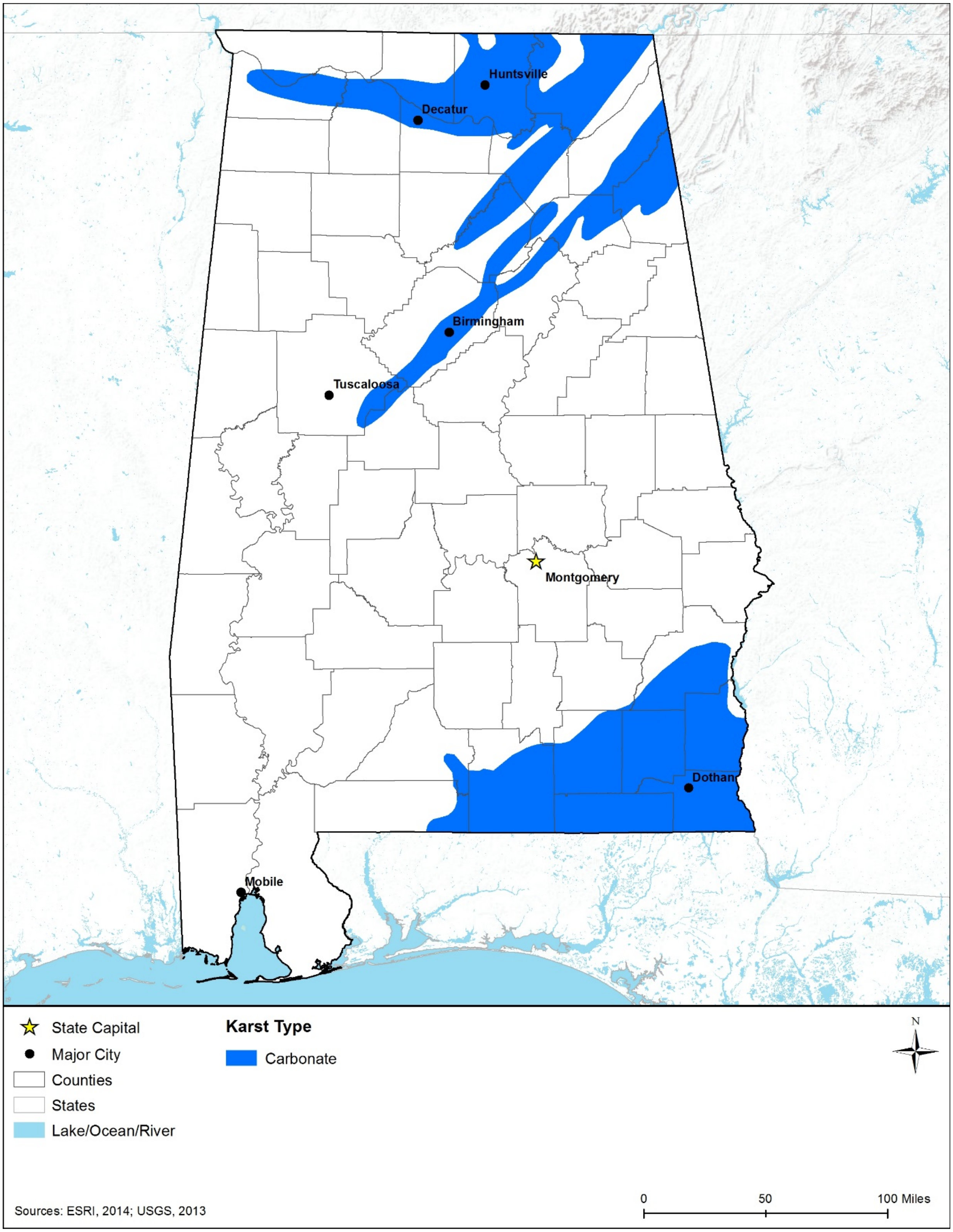


**Figure 3.1.3-6: Alabama Karst Topography**

## 3.1.4 Water Resources

### *3.1.4.1 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 3.1.5). 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 available 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 health, economic wellbeing, and ecological health. (USGS, 2014d)

### *3.1.4.2 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 3.1.4-1 summarizes the major Alabama laws and permitting requirements relevant to the state's water resources.

**Table 3.1.4-1: Relevant Alabama Water Laws and Regulations**

| State Law/Regulation | Regulatory Agency | Sub-Resource | Permit Name | Permit Requirements |
|---|---|---|---|---|
| Alabama Water Pollution Control Act | ADEM | Surface Water | Construction General Permit | Construction activities that disturb one or more acre (ADEM, 2015i). |
| CWA Section 401 permit | ADEM | Water Quality | ADEM Water Quality Certification under Section 401 of the CWA | 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 ADEM indicating that the proposed activity will not violate water quality standards (ADEM, 2015j). |

### *3.1.4.3 Environmental Setting: Surface Water*

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[59] and coastal waters. According to the ADEM, Alabama has approximately 77,274 miles of rivers and streams, 7,694 lakes, ponds, and reservoirs, 610 square miles of estuaries, and 337 miles of ocean coastline (ADEM, 2014b). Alabama's surface waters support a variety of uses and

[59] 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, 2015a)

activities including public water supply, industrial, livestock, irrigation, and thermoelectric power across the state (ADECA, 2010).

### 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). Alabama's waters (lakes, rivers, and streams) are divided into 13 major watersheds, or drainage basins (Figure 3.1.4-1). Alabama Appendix A, Table A-1 Characteristics of Alabama's Watersheds, provides detailed information on the state's major watersheds, as defined by ADEM. Visit www.adem.alabama.gov/programs/water/nps/files/NPS2011.pdf for information and additional maps about each ADEM watershed's location, size, and water quality. (ADEM, 2011)

The Upper and Lower Tombigbee River Basin lies along Alabama's western border with Mississippi and drains approximately 7,570 square miles (ADEM, 2011). The Tennessee River Basin is in northern Alabama and includes some of the state's largest lakes, such as Guntersville Lake and Wheeler Lake (ADEM, 2000). The Lower Coosa River, Middle Coosa River, and Upper Coosa/Weiss Lake River basins are in northeast Alabama and encompass a combined 5,400 square miles (ADEM, 2011). The Black Warrior River and Cahaba River basins lie to the west of these river basins and drain northcentral Alabama. The Alabama River and Coastal Alabama River Basins extend from southcentral Alabama to the far southwestern corner of the state. The Coastal Alabama River Basin includes the Mobile River and Mobile Bay Estuary (ADEM, 2004). The Talahoosa River and Chattahoochee/Chipola River basins extend along the eastern and southeastern Alabama border. To the west of these basins lie the Conecuh, Sepulga, and Blackwater River Basin and the Choctawhatchee/Pea/ Yellow River Basin, which encompass much of the southern Alabama coastline with a combined drainage area of approximately 7,634 square miles (ADEM, 2011).

### Freshwater

As shown in Figure 3.1.4-1, there are nine major rivers in Alabama: Alabama, Cahaba, Coosa, Black Warrior, Tombigbee, Tennessee, Tallapoosa, Chattahoochee, and Mobile. The Tennessee River flows southwest from Tennessee into Alabama and turns northwest to flow out of the state at the Alabama-Mississippi-Tennessee border. The Alabama River originates in southcentral Alabama and flows southwest to its confluence with the lower Tombigbee River to form the Mobile River, which drains into the Gulf of Mexico (USGS, 2014e). The Black Warrior River is formed in northcentral Alabama and flows southwest to join the upper Tombigbee River in west-central Alabama. The Coosa River enters Alabama in the northeast and flows south to join the Tallapoosa River and form the Alabama River (ADCNR, 2014a). Alabama also contains approximately 7,694 lakes, reservoirs, and ponds that cover over 766 square miles (ADEM, 2014b).

Major lakes in Alabama include Lewis Smith Lake, Martin Lake, and Guntersville Lake. Lewis Smith Lake is approximately 33 square miles in size and located in north Alabama within the Black Warrior River watershed on the Sipsey Fork. The reservoir was created with the

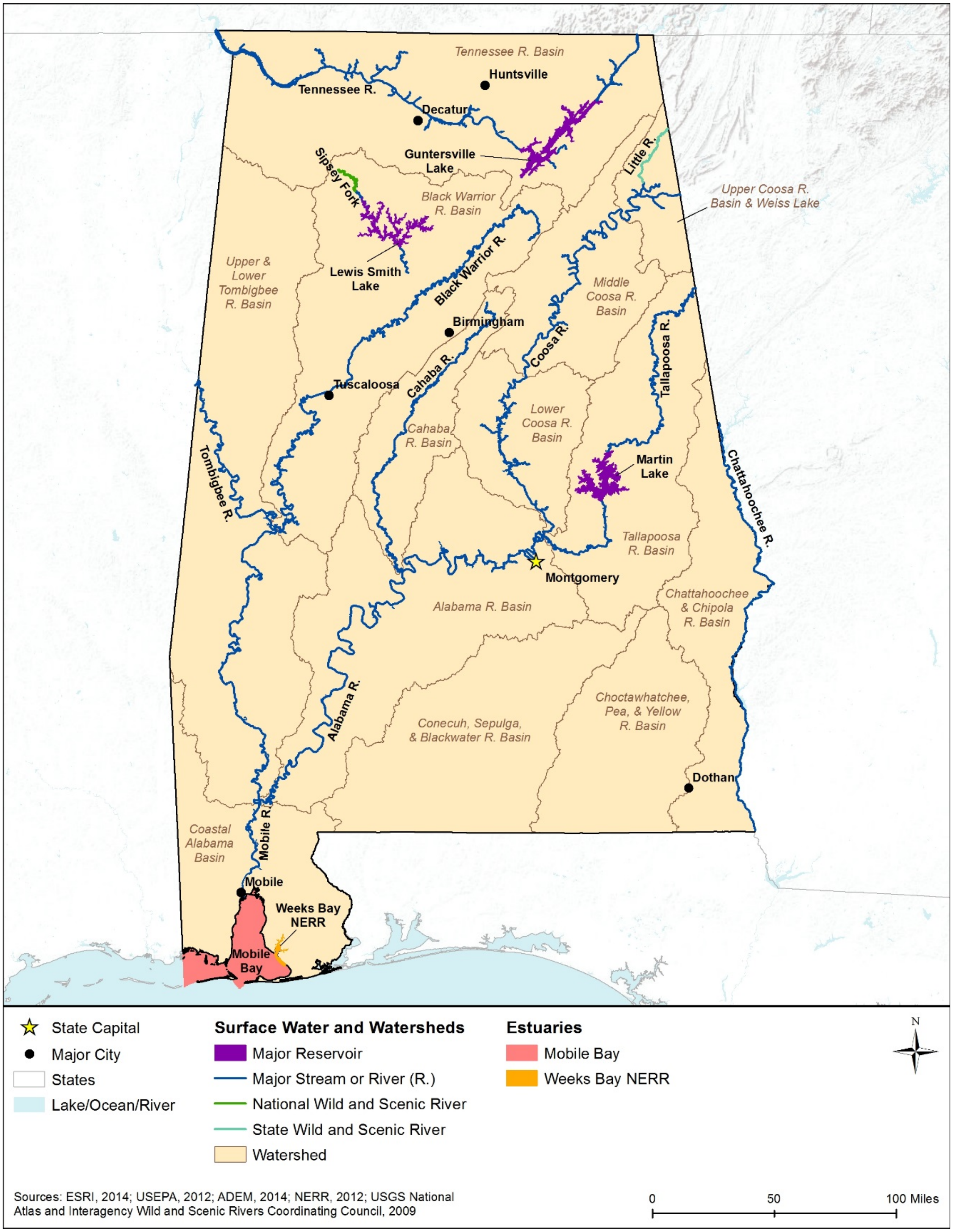


**Figure 3.1.4-1 Major Alabama Watersheds, defined by ADEM, and Surface Waterbodies**

construction of the Lewis Smith Dam by Alabama Power Company. Martin Lake is approximately 64 square miles and located in central Alabama. The reservoir was created with the construction of a dam across the Tallapoosa River for hydroelectric power, generation, and flood control. The reservoir is currently used for recreation, irrigation, drinking water, and fish and wildlife habitat (Alabama Power, 2015). Guntersville Lake occupies approximately 108 square miles in northeast Alabama along the banks of the Tennessee River. The reservoir was created by constructing Guntersville Dam across the Tennessee River. Guntersville Lake is used for flood control, navigation, and hydropower generation, as well as recreation, water supply, and fish and wildlife habitat enhancement. (TVA, 2015a)

### 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 Alabama, from ocean waves and storms. Alabama'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)

Alabama has approximately 53 miles of coastline along the Gulf of Mexico with approximately 607 miles of tidal shoreline (Jones & Patterson, 2006) and approximately 610 square miles of estuaries (ADEM, 2015k). Alabama includes two major estuaries in the southwestern portion of the state, as shown in Figure 3.1.4-1.

- The **Mobile Bay Estuary** watershed drains approximately 29,733 square miles within Alabama, and its surface waters cover 409 square miles (USEPA, 2007). The estuary includes waters within the Alabama coastal counties of Baldwin and Mobile and Mobile Bay. In 1996, the U.S. Environmental Protection Agency's (USEPA) National Estuary Program (NEP) identified Mobile Bay as an Estuary of National Significance (Mobile Bay NEP, 2015). In cooperation with USEPA and NEP, Mobile Bay released a Comprehensive Conservation Management Plan (CCMP) in 2002 to guide restoration and management actions in the estuary. Primary concerns in this estuary included habitat loss from development, natural erosion processes, sedimentation, dredge-and-fill practices, exotic species, and hydrologic modification[60] (USEPA, 2007). The Mobile Bay Estuary Reserve's CCMP addresses five areas of concern: water quality; living resources; habitat management; human uses; and education and public involvement (Mobile Bay NEP, 2002). More information on the Mobile Bay Estuary and CCMP is available at http://water.epa.gov/type/oceb/nep/.
- The **Weeks Bay Estuary Reserve** watershed is a 6,525-square mile estuary near Mobile Bay's eastern shore approximately 40 miles southeast of Mobile, Alabama. This diverse estuary provides productive habitats for a wide variety of plant and animal species. In 1986, Weeks Bay was designated as a National Estuarine Research Reserve and is currently

[60] Hydrologic modifications are "activities that disturb natural flow patterns of surface water and groundwater," (e.g., construction, dams and impoundments, channelization, dredging, and land reclamation activities) (USEPA, 1975).

managed by the Alabama Department of Conservation and Natural Resources (NOAA, 2015a). Primary concerns in this estuary included habitat loss from development, natural erosion processes, sedimentation, dredge-and-fill practices, exotic species, and hydrologic modification. The Gulf of Mexico Initiative for Weeks Bay Estuary addresses three core areas: reduce the amount of agricultural-related nitrogen, phosphorus, and sediment leaving the fields; reduce agricultural impacts on water quality; and enhance or maintain wildlife habitat. (NRCS, 2011) More information on the Weeks Bay Estuary Reserve is available at http://nerrs.noaa.gov/reserves/weeks-bay.html.

#### *3.1.4.4 Sensitive or Protected Waterbodies*

*Wild and Scenic Rivers*

The Sipsey Fork of the West Fork River (Figure 3.1.4-1) is a federally designated National Wild and Scenic River in Alabama (see Appendix C, Environmental Laws and Regulations, for more information). The designation includes 61.4 total miles with 36.4 miles designated as wild and 25 miles as scenic. The Sipsey Fork of the West Fork River consists of steep canyons and walls, blended with sandstone bluffs and waterfalls. The area supports a variety of plants, and is "highly dependent on rainfall occurrences." (National Wild and Scenic Rivers System, 2015)

A portion of the Little River (Figure 3.1.4-1) was designated a State Wild and Scenic River in 1969 by the Alabama Legislature. The river is unique in that it "forms and flows for almost all of its entire large sandstone bluffs." (NPS, 2015c)

*Outstanding National Resource Waters*

Alabama also contains Outstanding National Resource Waters, Outstanding Alabama Waters, and Treasured Alabama Lakes. These waters are listed in Alabama Appendix A, Table A-2 Alabama Outstanding National Resource Waters, Outstanding Alabama Waters, and Treasured Alabama Lakes. These waters are not included in the figures due to limited information on their location within Alabama.

#### *3.1.4.5 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 Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[61] the causes of impairment, and probable sources. Table 3.1.4-2 summarizes the water quality of Alabama's assessed major waterbodies by category, percent impaired, designated use,[62] cause, and probable sources. Figure 3.1.4-2 shows the Section 303(d) waters in Alabama as of 2014.

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[61] 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, 2015a)

[62] 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, 2015a)

As shown in Table 3.1.4-2, various sources affect Alabama's waterbodies, causing impairments. For example, naturally higher nutrient levels in the soils of the Coosa River Basin cause eutrophic[63] conditions in surrounding reservoirs. Additionally, nearly 75 percent of Alabama's assessed estuaries and bays are impaired due to pollutants from various sources, such as urban runoff and industrial point source discharges. Pathogens and mercury are pollutants of concern for many of the estuaries and bays within the state's coastal watersheds. Shallow water depths, variable freshwater inflow, and constricted tidal passes create for stressed water quality conditions. For example, Mobile Bay experiences these natural conditions and often has poorly oxygenated water in summer months. Designated uses include recreation and fishing, industrial and agricultural uses, aquatic life, and shellfishing. (ADEM, 2014b)

**Table 3.1.4-2: Section 303(d) Impaired Waters of Alabama, 2014**

| 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 | 16.4% | 25.3% | Recreation, drinking and food processing, fishing, industrial and agricultural uses, Outstanding Alabama water, aquatic life | Sediment, mercury, oxygen depletion, nutrients pathogens[c] | Atmospheric deposition,[d] animal feeding operations, urban runoff/storm sewers, agriculture, and municipal point source discharges |
| Lakes, Reservoirs, and Ponds | 88.8% | 47% | Recreation, drinking and food processing, fishing, industrial and agricultural uses, and aquatic life | Mercury, nutrients such as phosphorus, and pathogens | Agriculture, hydromodifications (e.g., impacts from hydrostructure flow regulations/modification), atmospheric deposition, industrial point source discharges, and legacy pollutants |
| Estuaries and Bays | 94.4% | 74.6% | Recreation, fishing, industrial and agricultural uses, aquatic life, and shellfishing | Pathogens, metals, mercury | Urban runoff/storm sewers, industrial point source discharges, municipal discharge/ sewage, and atmospheric deposition |
| Alabama Ocean and Near Coastal | Data Not Available | 100% | Recreation, fishing, fishing, industrial and agricultural uses, aquatic life, and shellfishing | Mercury | Atmospheric deposition |

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

[63] Eutrophic: high concentrations of nutrients, especially phosphates and nitrates, which can lead to excessive growth of algae (Rochester Academy of Science, 2015).

[d] Atmospheric deposition: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water. (USEPA, 2015a)

Source: (USEPA, 2015b)

ADEM works closely with federal agencies to implement programs to maintain and restore water quality across the state. One of the leading causes of impairment in Alabama's river and streams is sediment (USEPA, 2015b). ADEM and partnering agencies have established an Erosion and Sediment Control Program for urban areas and construction sites within the state to mitigate impacts from sedimentation. Agriculture is also a source of impairment for Alabama waters and a main focus for ADEM in improving water quality. ADEM and the National Oceanic and Atmospheric Administration (NOAA) work with the Gulf of Mexico Program on watersheds that directly impact the Gulf of Mexico waters. Weeks Bay Reserve and Mobile Bay NEP work with Alabama Department of Conservation and Natural Resources and ADEM to implement stream restoration and agricultural Best Management Practices (BMP) along Alabama coastal watersheds. Additionally, the U.S. Fish and Wildlife Service (USFWS) works with the State of Alabama to focus conservation and restoration efforts on river segments and selected watersheds, such as the Black Warrior River Basin. (ADEM, 2014c)

### *3.1.4.6 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) (FEMA, 2000).[64] 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)

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

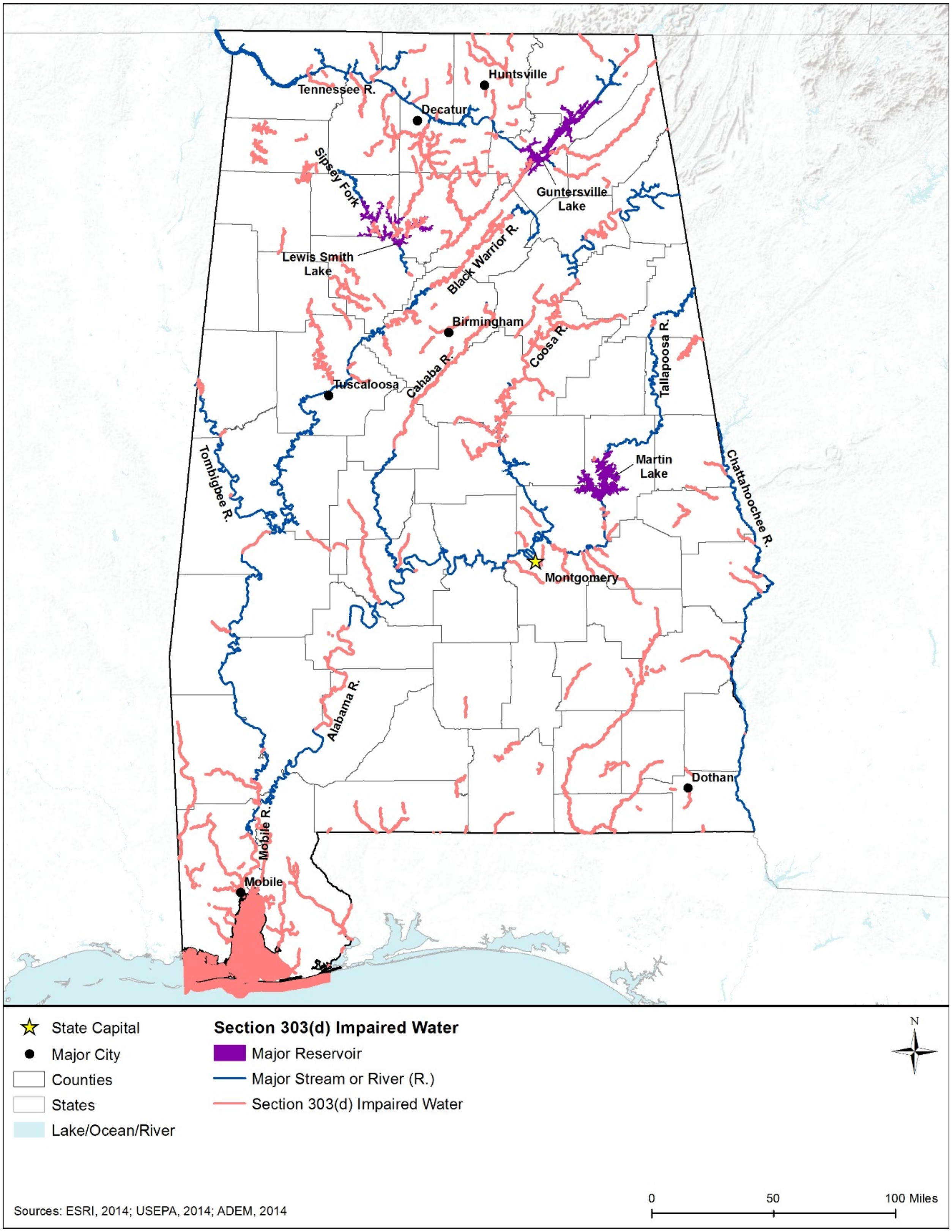


**Figure 3.1.4-2 Section 303(d) Impaired Waters of Alabama, 2014**

There are two primary types of floodplains in Alabama.

- **Riverine and lake floodplains** occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In steep river valleys found in hilly areas, floodwaters can floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014b)
- **Coastal floodplains** in Alabama occur in Mobile and Baldwin Counties located along the coast of the Gulf of Mexico. Coastal flooding can occur when strong wind and storms, usually nor'easters and hurricanes, increase water levels on the adjacent shorelines (AEMA, 2013). In addition, a storm surge event that takes place during high tide can cause floodwaters to exceed normal tide levels, resulting from strong winds preventing tidal waters to recede in conjunction with additional water pushed toward the shore, as was the case during Hurricane Ivan.

Flooding is the leading cause for disaster declaration by the President in the United States and results in significant damage throughout the state annually (NOAA, 2015b). There are several causes of flooding in Alabama, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, hurricanes, and dam failure. Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Since 1960, flooding from hurricanes and tropical storms has resulted in 15 presidential disaster declarations in Alabama. (AEMA, 2013)

**Hurricane Ivan**

In 2004, Hurricane Ivan made landfall in Gulf Shores, Alabama on the coast of Baldwin County. The hurricane had 130 mile per hour winds with an estimated storm surge between 10 and 13 feet high. The Gulf of Mexico spilled over the sand dunes, flooding Alabama's Baldwin and Mobile Counties. Massive damage to roads and infrastructure occurred with approximately 164 feet of beach washed away in some areas. Flash flooding occurred in inland counties throughout the state (AEMA, 2013). Overall, states impacted by Ivan incurred a total of $25 billion in damages (NOAA, 2014a).

Source: (USGCRP, 2014h)

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 428 communities in Alabama through the National Flood Insurance Program (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, Alabama had 17 communities participating in the CRS (FEMA, 2014d).[65]

#### *3.1.4.7 Groundwater*

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes 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.

Alabama's principal aquifers[66] consist of carbonate-rock[67] and sandstone aquifers[68] and unconsolidated coastal-plain aquifers. Approximately 40 percent of public water supplies in Alabama are from groundwater resources (GSA, 2015d). Generally, the water quality of Alabama's aquifers is suitable for drinking and daily water needs (ADEM, 2014b). Statewide, the most serious threats to groundwater quality include underground storage tanks and failing septic systems (ADEM, 2015l).

Table 3.1.4-3 provides details on aquifer characteristics in the state. Figure 3.1.4-3 shows Alabama's principal aquifers. There are no sole source aquifers in Alabama.

[65] A list of the 17 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/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)

[66] In this PEIS, the term principal aquifer refers to the USGS definition ("A regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.") for nationwide consistency (USGS, 2003c).

[67] 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, 1995a).

[68] Sandstone aquifers form from the conversion of sand grains into rock caused by the weight of overlying soil/rock. The sand grains are rearranged and tightly packed, thereby reducing or eliminating the volume of pore space, which results in low-permeability rocks such as shale or siltstone. These aquifer types are highly productive in many places and provide large volumes of water. (Olcott, 1995b)

## Table 3.1.4-3: Description of Alabama's Principal Aquifers

| Aquifer Type and Name | Location in State | Groundwater Quality |
|---|---|---|
| **Floridian Aquifer System**<br>Consists of a sequence of carbonate rocks. This is a carbonate rock aquifer. | Underlies the southeastern portion of the state. | Dissolved solid concentration are low. The aquifer contains salt water in some locations, especially near the coast. |
| **Pennsylvanian**<br>Consists of sandstone, shale, and coal. | Underlies the northern portion of the state roughly in a band extending from the northeast to the southwest. | Suitable for most uses, with high concentrations of iron and sulfate in some locations. At depths of 300 feet or greater, dissolved solid concentrations can exceed 1,000 milligrams per liter (mg/L). |
| **Coastal Lowlands Aquifer System**<br>Unconsolidated to poorly consolidated sediments (primarily clay, sand, and silt). | Underlies the southern coastal portion of the state including the area around Mobile Bay. | 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. |
| **Mississippi Embayment Aquifer System**<br>Composed of thick sands, clays, and shales. | Located in the southwestern portion of the state in a band that extends roughly from the northwest to the southeast. | High concentrations of minerals such as calcium bicarbonate, sodium bicarbonate, and sodium chloride. |
| **Southeastern Coastal Plain Aquifer System**<br>Consists of fine to coarse sand. | Run in a band from the southeastern portion of the state to the northwestern portion of the state. | Dissolved solid concentrations are usually less than 50 mg/L with concentrations up to 500 mg/L in areas where salt water mixes with freshwater. |
| **Surficial Aquifer System**<br>Consists of unconsolidated sand, shells, and shelly sand. | Run in a narrow band in the southeastern portion of the state. | Dissolved solid concentrations range up to 150 milligrams per liter. Water is slightly acidic. |
| **Mississippian**<br>Consists of limestone rocks. | Underlies the northern portion of the state. | Suitable for most uses, with high concentrations of iron and sulfate in some locations. At depths of 300 feet or greater, dissolved solid concentrations can exceed 1,000 milligrams per liter (mg/L). |
| **Valley and Ridge**<br>Consists of sedimentary rocks including limestone, sandstone, and shale, with some dolomite, siltstone, conglomerate, and coal. | Exists in discrete bands in the central to northeastern part of the state. | Water quality is generally high enough for public water supply with dissolved solids concentrations of about 140 mg/L, chloride concentrations of about 4 mg/L. Iron concentrations are high in some locations. |
| **Valley and Ridge Carbonate Rock**<br>Consists of Carbonate rocks. | Exists in discrete bands in the central to northeastern part of the state. | Generally suitable for drinking and other uses. Concentrations of fluoride, iron, manganese, and sulfate are high in some locations. |

| Aquifer Type and Name | Location in State | Groundwater Quality |
|---|---|---|
| **Piedmont and Blue Ridge Crystalline-Rock**<br>Consists of crystalline rock including mainly gneiss and schist and a variety of other metamorphic rocks | Exists in the eastern part of the state along the Georgia border. | Generally suitable for drinking and other uses. Concentrations of fluoride, iron, manganese, and sulfate are high in some locations. |

Sources: (USGS, 1995a) (USGS, 1995b) (USGS, 1995c)

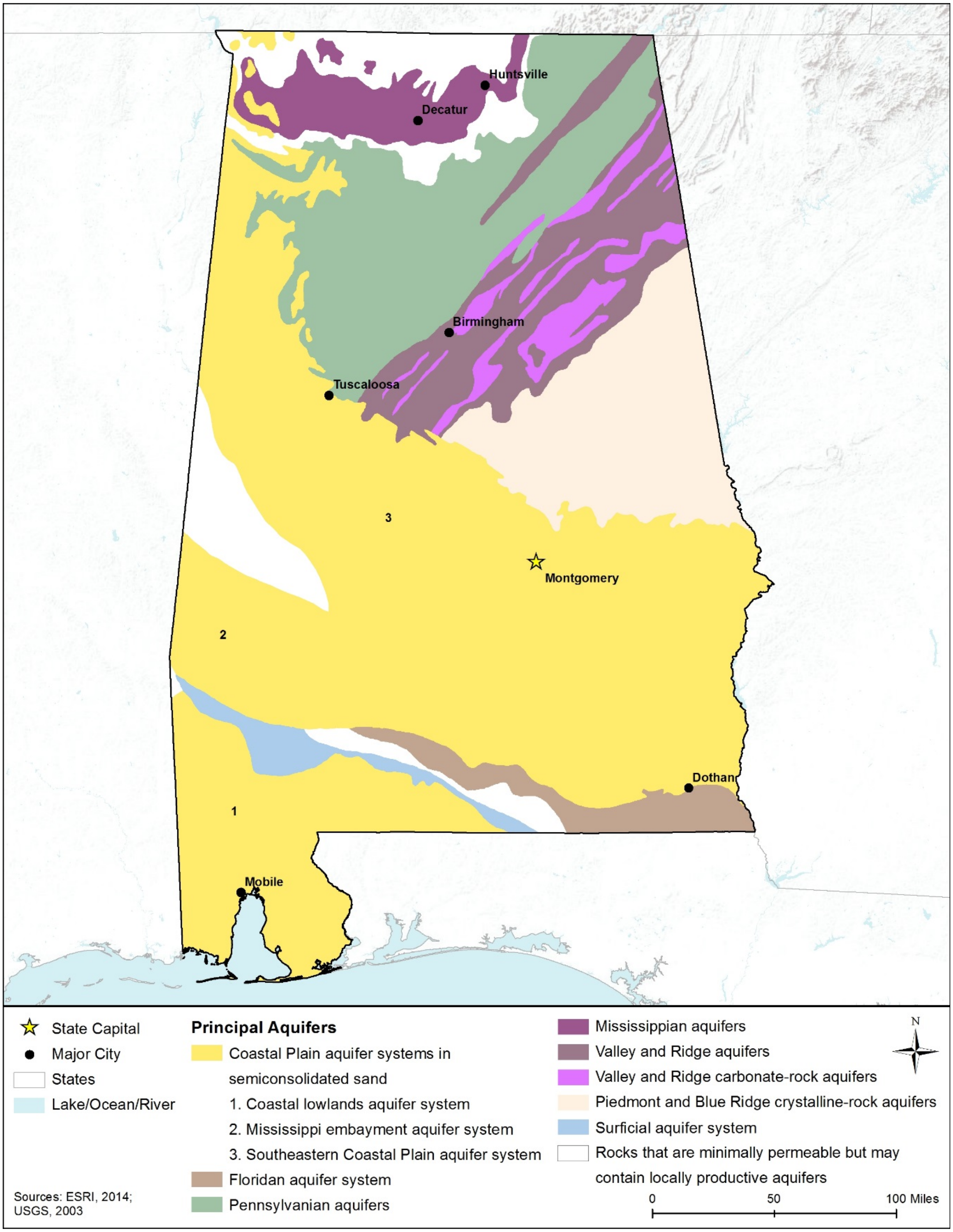


**Figure 3.1.4-3 Principal Aquifers of Alabama**

## 3.1.5 Wetlands

### *3.1.5.1 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)

### *3.1.5.2 Specific Regulatory Considerations*

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 3.1.5-1 summarizes the major Alabama state laws and permitting requirements relevant to the state's wetlands.

**Table 3.1.5-1: Relevant Alabama Wetlands Laws and Regulations**

| State Law/Regulation | Regulatory Authority | Permit Name | Applicability |
|---|---|---|---|
| Coastal Area Management Program | ADEM | ADEM Coastal Permit/Certification | Any activity permitted by a state agency within the coastal area must be reviewed to ensure that it is consistent with the provisions of the Coastal Management Program Regulations. The department will consider whether the permitted activity is 1) consistent with broad public benefits, 2) whether it occurs in a Special Management Area which includes the Port of Mobile, Mobile-Tensaw River Delta and 3) whether it occurs in an Area of Preservation and Restoration which includes: Point aux Pines Wetland System, Dauphine Island Audubon Sanctuary, Weeks Bay National Estuarine Research Reserve (ADEM, 2014b). |
| Alabama Water Pollution Control Act | ADEM | Construction General Permit | Construction activities that disturb one or more acre of surface soil (ADEM, 2015i). |

| State Law/Regulation | Regulatory Authority | Permit Name | Applicability |
|---|---|---|---|
| CWA Section 401 permit | ADEM | ADEM Water Quality Certification under Section 401 of the CWA | 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 ADEM indicating that the proposed activity will not violate water quality standards (ADEM, 2015j). |

### *3.1.5.3 Environmental Setting: Wetland Types and Functions*

The USFWS National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in Cowardin et al. (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 3.1.5-2). The first four of these include both wetlands and deepwater habitats, but the Palustrine includes only wetland habitats (USFWS, 2015ao).

- "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, Carter, Golet, & LaRoe, 1979) (FGDC, 2013)

In Alabama, the main type of wetlands is palustrine (freshwater) wetlands, found on river and lake floodplains across the state, and along the coast, as shown in Figure 3.1.5-1. Riverine (0.1 percent), lacustrine (1 percent), wetlands comprise approximately 44,000 acres of wetlands, or approximately 1 percent, of the total wetlands in the state, and therefore, are not discussed in this PEIS.

Table 3.1.5-2 uses 2014 NWI data to characterize and map Alabama wetlands on a broad-scale.[69] The data are not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 3.1.5-2 correspond to the wetland types in the figure.

**Table 3.1.5-2: Alabama 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 are at least 20 feet tall. Floodplain forests, hardwood swamps, and bottomland forests are examples of PFO wetlands. | Throughout the state, often on stream floodplains. | 3,132,677 |
| Palustrine scrub-shrub wetland | PSS | Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands. | | |
| Palustrine emergent wetlands | PEM | PEM wetlands 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] and sloughs.[d] | On river and lake floodplains. | 123,035 |
| Palustrine unconsolidated bottom | PUB | PUB and PAB wetlands 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%. | Abandoned fields, depressions (seeps), along hillsides and highways. | 131,320 |
| 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. | 197 |

[69] 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] |
|---|---|---|---|---|
| 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. | 3,505 |
| 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, but including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are less than 8.2 feet deep. | Throughout the state, mostly in the northern half. | 40,705 |
| 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 coast, in the southern part of the state. | 29,090 |
| | | | **TOTAL** | **3,460,529** |

[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, 2015u).
[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, 2014c)
[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, Carter, Golet, & LaRoe, 1979) (USFWS, 2015ao) (FGDC, 2013)


**Figure 3.1.5-1: Wetlands by Type, in Alabama, 2014**

### Palustrine Wetlands

In Alabama, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). Palustrine forested wetlands (PFO) wetlands are the most common type of wetlands within Alabama. Many swamps in the state are flooded forested areas, consisting of “cypress, tupelo, and wetland oaks often with substantial shrub or herbaceous vegetation.” Alabama’s largest wetland is the tidally influenced Mobile-Tensaw Delta north of Mobile Bay, which ranges from 5 to 10 miles wide along its 40-mile length. The Mobile-Tensaw Delta is an example of PFO, coastal swamp (ADCNR, 2005). Palustrine Scrub-shrub (PSS) wetlands in the state are a mixture of woody vegetation, usually many of the same trees as in PFO wetlands. PSS wetlands are mostly fragmented within the state, and occur along the coast or between houses. Palustrine emergent wetlands (PEM), or freshwater marsh, bog, fen, and slough, are relatively rare and infrequent in Alabama (refer to Figure 3.1.5-1), if high quality, these wetlands support diverse plant and animal populations. Common PEM marsh plants in Alabama include sedge and a variety of grasses. Alabama also supports several fire-maintained herbaceous seepage bogs, often containing a variety of carnivorous plants; these bogs occur in the southern sections of the state. (ADCNR, 2005)

Palustrine wetlands also include the shallow water zones of lakes, rivers, ponds, and aquatic beds formed by water lilies and other floating-leaved or free-floating plants. These are the easiest wetlands to recognize and occur throughout the state. (ADCNR, 2005)

Prior to European settlement, Alabama contained approximately 7.5 million acres of wetlands (ADCNR, 2005). Based on the USFWS NWI 2014 analysis, PFO/PSS wetlands are the dominant wetland type (92 percent), followed by PEM (4 percent), PUB/PAB (ponds) (4 percent), and other palustrine wetlands (less than 1 percent) (USFWS, 2014a). There are currently approximately 3.4 million acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a). Development, agriculture, and draining have destroyed more than one-half of all the wetlands within the state (ADCNR, 2005). There have not been any recent surveys to determine wetland acreage for submersed aquatics, tidal emergence, or swamp forest. However, due to Alabama’s wetlands regulations, permitting, and mitigation requirements, “it is believed that wetland losses that do occur are minimal for those wetlands regulated by the program and that other losses that may occur are due to natural erosion, unpermitted activities, and minimal losses due to nationwide permitting by the U.S. Army Corps of Engineers.” (ADEM, 2014d)

### Estuarine and Marine Wetlands

In Alabama, estuarine and marine wetlands occur along the coastal counties and are composed of salt marshes and seagrass meadows (ADCNR, 2005). These wetlands comprise approximately 1 percent (29,090 acres) of the total wetlands in the state. From 1955 to 1979, estuarine/marine wetlands declined 35 percent (10,000 acres) around Mobile Bay. Coastal population growth, municipal, industrial, and agricultural development are the biggest causes of estuarine/marine wetland loss. (ADCNR, 2005)

#### *3.1.5.4 Wetlands of Special Concern or Value*

- The Weeks Bay National Estuarine Research Reserve (NERR) is a small estuary approximately 40 miles from Mobile, AL. The Reserve encompasses more than 6,500 acres of high-quality tidal and forested wetlands. The Reserve provides habitat for rare and endangered species, including pitcher plant bogs (Figure 3.1.5-2). (NOAA, 2015a) (ADCNR, 2014b)

**Figure 3.1.5-2. A Pitcher Plant Bog at Weeks Bay NERR**

Source: (NOAA, 2015a)

- Seven National Natural Landmarks in Alabama range in size from 2 acres to nearly 185,000 acres, and are owned by Alabama Department of Conservation and Natural Resources, USFWS, and other conservation organizations and individuals (NPS, 2012a). Section 3.1.8, Visual Resources, describes Alabama's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including Natural Resources Conservation Service (NRCS) Agricultural Conservation Easement Program, and easements managed by natural resource conservation groups, such as, state land trusts, Ducks Unlimited, The Nature Conservancy, the Chattowah Open Land Trust, and Weeks Bay Foundation (NCED, 2015). According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds nearly 30,000 acres in conservation easements in Alabama (NCED, 2015).

## 3.1.6 Biological Resources

### *3.1.6.1 Definition of the Resource*

This section describes the biological resources of Alabama. Biological resources include terrestrial[70] vegetation, wildlife, fisheries and aquatic[71] habitats, and threatened[72] and endangered[73] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of the significant changes in elevation from the beginnings of the Appalachian Mountains in the

[70] Terrestrial: "Pertaining to land." (USEPA, 2015k)
[71] Aquatic: "Pertaining to water." (USEPA, 2015k)
[72] 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)) (USEPA, 2015k)
[73] 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)) (USEPA, 2015k)

northern portion of Alabama to the sandy beaches and estuarine habitats of Alabama's Gulf of Mexico coastline, the state supports a wide diversity[74] of biological resources. Each of these topics is discussed in more detail below.

#### *3.1.6.2 Specific Regulatory Considerations*

The federal laws relevant to the protection and management of biological resources in Alabama are summarized in detail in Section 1.8, Overview of Relevant Federal Laws and Executive Orders, and Appendix C, Environmental Laws and Regulations. Table 3.1.6-1 summarizes major state laws relevant to Alabama's biological resources.

**Table 3.1.6-1: Relevant Alabama Biological Resources Laws and Regulations**

| State Law/Regulation | Regulatory Agency | Summary |
|---|---|---|
| Noxious Weed Rules (Alabama Administrative Code [AAC] 80-10-14) | Alabama Department of Agriculture and Industries (ADAI) | Regulates certain plant species for the protection of Alabama's horticultural, agricultural, aquatic, forestry, wildlife, tourism and recreational industries. |
| Restrictions on Possession, Sale, Importation and/or Release of Certain Animals and Fish (AAC 220-2-.26) | Alabama Department of Conservation and Natural Resources (ADCNR) | Identifies animal species which may not be possessed, sold, offered for sale, imported, brought, released or caused to be brought or imported into the state. |
| Nongame Species Regulation (AAC 220-2-.92) | ADCNR | Identifies Alabama's protected, nongame fish, amphibians, reptiles, birds, and mammals. |

#### *3.1.6.3 Terrestrial Vegetation*

The distribution of flora within the state is a function of the characteristic geology,[75] soils, climate,[76] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[77] Ecoregions are broadly defined areas that share similar characteristics, such as climate,[78] 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) (USFS, 2015a) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic[79] regions of a state. In Alabama, the three main physiographic regions include the Interior Plains, the Appalachian Highlands, and the

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

[75] 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.

[76] Climate: "The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more." (USEPA, 2015k)

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

[78] 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, 2015k)

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

Atlantic Plain (Fenneman, 1916). The ecoregions mapped by the USEPA are the most 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. This section provides an overview of the terrestrial vegetation resources for Alabama at USEPA Level III. (USEPA, 2016a)

As shown in Figure 3.1.6-1, the USEPA divides Alabama into six Level III ecoregions (Table 3.1.6-2). In Northern Alabama, which includes the foothills of the Appalachian Mountains, there are four ecoregions, all with some degree of higher elevation. The boundary of the northernmost ecoregion (Interior Plateau) is generally aligned with the Interior Plains physiographic region and the three other ecoregions (Piedmont, Ridge and Valley, and Southwestern Appalachians) in Northern and Central Alabama are within the Appalachian Highland physiographic region. The entire western border and southern half of the state is within the lower-lying Southeastern Plains ecoregion and Alabama's relatively small coastline in the far southwestern portion of the state is part of the Southern Coastal Plain ecoregion. These two plains ecoregions are part of the Atlantic Plain physiographic region. The changes in elevation and latitude from the higher elevations in the northern areas of the state to the Gulf Coast provide for a diverse array of abiotic[80] conditions and vegetative communities (Griffith, et al., 2001).

[80] 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, 2015)

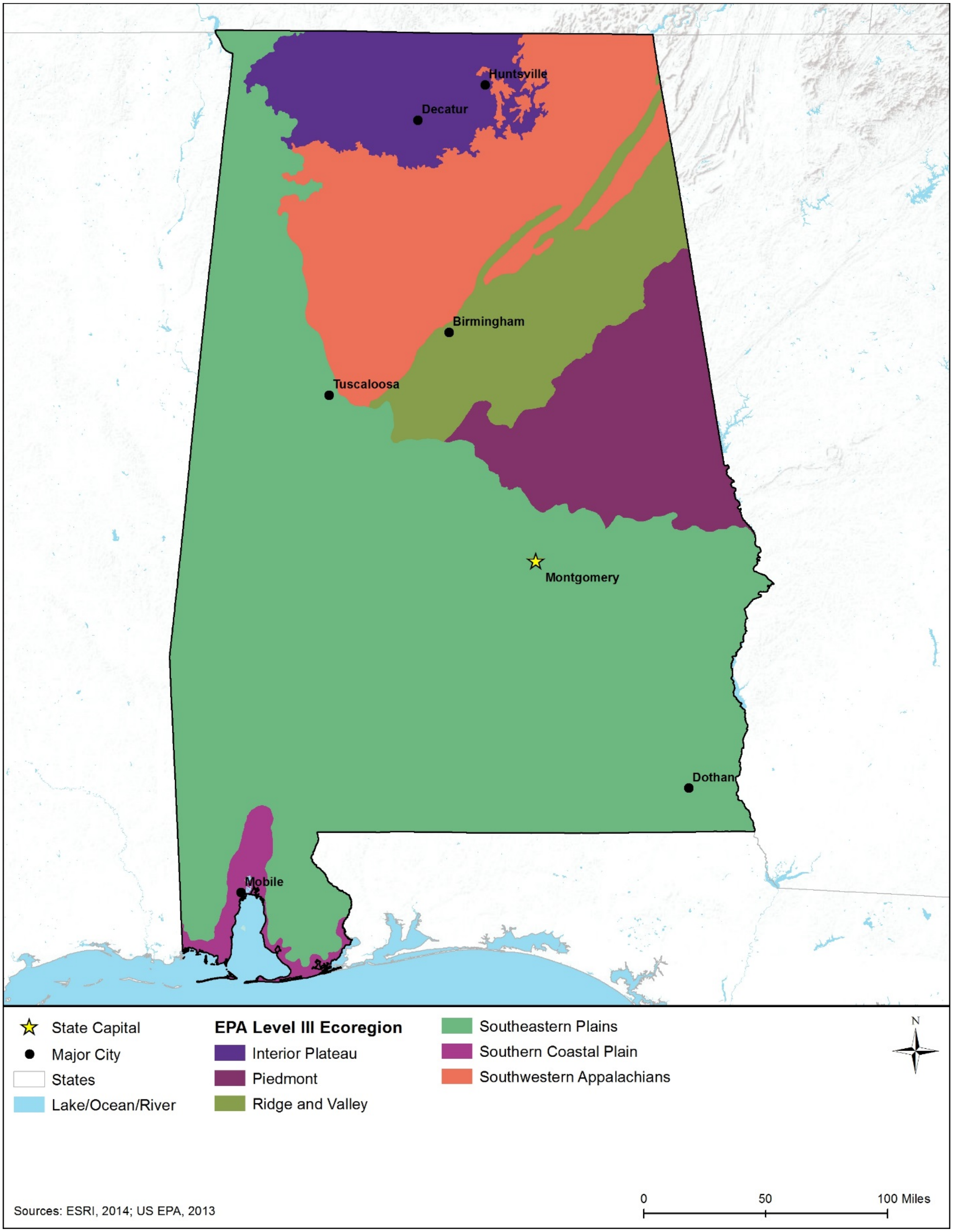


**Figure 3.1.6-1. USEPA Level III Ecoregions in Alabama**

## Table 3.1.6-2: USEPA Level III Ecoregions of Alabama

| Ecoregion Number | Ecoregion Description | Abiotic Characterization | General Vegetative Communities | Typical Dominant Vegetation |
|---|---|---|---|---|
| **Geographic Region: Northern Alabama** | | | | |
| 45 | Piedmont | Referred to as the non-mountainous area of the Appalachian Highlands and made up of plains and hills. Finer soil than coastal areas. | Pine and hardwood forests | • **Hardwood Trees –** oaks (*Quercus* spp.) and hickory (*Carya* spp.)<br>• **Conifer Trees –** pines (*Pinus* spp.), including loblolly pine (*Pinus taeda*) and shortleaf pine (*Pinus echinata*) |
| 67 | Ridge and Valley | Includes the Coosa Valley. Low lying area of parallel ridges and valleys compared to the higher elevation Southwestern Appalachian ecoregion. Numerous springs and caves. | Pine at higher elevations transitioning to hardwoods along streams | • **Hardwood Trees –** oaks (*Quercus* spp.) and hickory (*Pinus palustris)*<br>• **Conifer Trees –** longleaf pine (*Pinus palustris)* |
| 68 | Southwestern Appalachians | Low mountains with topography ranging from smoother areas in the east to rough, more extreme relief to the west. | Mixed mesophytic[81] forest and forests of mixed oaks-hickory and oak-pine. | • **Hardwood Trees –** oaks (*Quercus* spp.), sugar maple (*Acer saccharum*), and white ash (*Fraxinus americana*)<br>• **Conifer Trees –** shortleaf pine (*Pinus echinata*) and Virginia pine (*Pinus virginiana)*<br>• **Shrubs –** redbud (*Cercis canadensis*) and flowering dogwood (*Cornus florida*) |
| 71 | Interior Plateau | Lower elevations than Ridge and Valley and Southwestern Appalachians ecoregions. Springs and caves are found in this region. | Oak-hickory forest, mesophytic forests, cedar glades. | • **Conifer Trees –** Loblolly pine (*Pinus taeda*) and red cedar (*Juniperus virginiana*)<br>• **Hardwood Trees –** Sugar maple (*Acer saccharum*), ash (*Fraxinus* spp.), oaks (*Quercus* spp.), hickory (*Pinus palustris)*, and tuliptree (*Liriodendron* sp.) |

[81] Mesophytic: "A forest that generally receives a moderate amount of moisture." (NPS, 2016b)

| Ecoregion Number | Ecoregion Description | Abiotic Characterization | General Vegetative Communities | Typical Dominant Vegetation |
|---|---|---|---|---|
| **Geographic Region: Central and Southeastern Alabama** | | | | |
| 65 | Southeastern Plains | Less elevation and relief than in Piedmont. Soils composed of sands, silts, and clays, unlike the metamorphic and igneous rocks found ecoregions to the north. | Mixed forest and oak-hickory-pine. | • **Hardwood Trees –** turkey oak (*Quercus laevis*), red oak (*Quercus rubra*), water oak (*Quercus nigra*), and hickory (*Pinus palustris)*<br>• **Conifer Trees** - Longleaf pine (*Pinus palustris),* loblolly pine (*Pinus taeda*), and shortleaf pine (*Pinus echinata*) |
| **Geographic Region: Gulf Coast** | | | | |
| 65 | Southeastern Plains | Less elevation and relief than in Piedmont. Soils composed of sands, silts, and clays, unlike the metamorphic and igneous rocks found ecoregions to the north. | Mixed forest and oak-hickory-pine. | • **Hardwood Trees –** turkey oak (*Quercus laevis*), red oak (*Quercus rubra*), water oak (*Quercus nigra*), and hickory (*Pinus palustris)*<br>• **Conifer Trees** - Longleaf pine (*Pinus palustris),* loblolly pine (*Pinus taeda*), and shortleaf pine (*Pinus echinata*) |
| 75 | Southern Coastal Plain | This ecoregion is 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 savannas. | • **Conifer Trees** – longleaf pine (*Pinus palustris),* pond pine (*Pinus serotina*), slash pine (*Pinus elliottii*), and loblolly pine (*Pinus taeda*)<br>• **Hardwood Trees –** pond cypress (*Taxodium ascendens*), beech (*Fagus* spp.), sweetgum (*Liquidambar styraciflua),* southern magnolia (*Magnolia grandiflora*), and oaks (*Quercus* spp.) |

Sources: (Fenneman, 1916) (USEPA, 2015c) (Schotz A. , 2015) (CEC, 2011)

### Communities of Concern

Alabama 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 Alabama Natural Heritage Program (ALNHP) statewide inventory includes lists of all types of natural communities known to occur, or that 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 natural heritage programs, the ALNHP ranking system assesses rarity using a state rank (S1, S2, S3, S4, and S5) that indicates its rarity within Alabama. 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[82] that could result from implementation of an action. Communities ranked as an S1 by the ALNHP are of the greatest concern. This rank is typically based on the range of the community, the number of occurrences, the viability of the occurrences, recent trends, and the vulnerability of the community.

Alabama Appendix B, Table B-1 provides a description of 14 key habitat types (i.e., vegetative communities) designated for conservation purposes in Alabama, some of which may not be considered rare within the United States, but have been ranked as rare by ALNHP (ADCNR, 2015a). These communities occur throughout the state and are found in all of Alabama’s Level III ecoregions (Griffith, et al., 2001).

### Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive plants. Noxious weeds[83] 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. federal government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S. Code [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, 2016).

[82] 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, 2015k)

[83] Noxious weeds: “any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the U.S., and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the U.S. or the public health.” (Federal Noxious Weed Act of 1974)

In Alabama, noxious weeds are regulated by the Alabama Department of Agriculture and Industries under Alabama Administrative Code Chapter 80-10-14. The noxious weeds listed in Chapter 80-10-14 are divided into the following three classes (ADAI, 2000):

- **Class A –** "Any noxious weed on the Federal Noxious Weed List (USDA, 2014), or any noxious weed that is not native to the State, not currently known to occur in the State, and poses a serious threat to the State."
- **Class B –** "Any noxious weed that is not native to the State, is of limited distribution statewide, and poses a serious threat to the State."
- **Class C –** "Any other designated noxious weed which poses harm to Alabama's various industries."

In addition to the federally recognized noxious weeds incorporated in Class A, Alabama's state regulated noxious weeds include 10 aquatic plants (all Class C species), 3 shrubs (all Class C species), 9 terrestrial forbs and grasses (these include species in Classes A, B, and C), and 6 vines (these include species in Classes A, B, and C). These species are listed below, by vegetation type, with the Class designation included parenthetically:

- **Aquatic –** alligatorweed (*Althernanthera philoxeroides*; C); Brazilian elodea (*Egeria densa*; C); curlyleaf pondweed (*Potamgeton crispus*; C); Eurasian watermilfoil (*Myriophyllum spicatum*; C); floating waterhyacinth (*Eichornia crassipes*; C); parrotfeather, watermilfoil (*Myriophyllum aquaticum*; C); spinyleaf naiad (*Najas minor*; C); water chestnut (*Trapa natans*; C); water-aloe (*Stratlotes aloides*; C); and water-lettuce (*Pistia stratiotes*; C).
- **Shrubs –** Japanese knotweed, Japenese bamboo (*Polygonum cuspidatum*; C); multiflora rose (*Rosa multiflora*; C); and phragmites, common reed (*Phragmites australis*; C).
- **Terrestrial Forbs and Grasses –** chamberbitter, niuri (*Phyllanthus urinaria*; C); coltsfoot (*Tussilago farfara*; A); garlic mustard (*Alliaria petiolata*; A); hairy crabgrass, mulberry weed (*Fatoua villosa*; C); longstalked phyllanthus (*Phyllanthus tenellus*; C); Mary's grass, Japanese grass (*Microstegium vimineum*; C); purple loosestrife (*Lythrum salicaria*; B); Star of Bethlehem (*Ornithogalum umbellatum*; C); and torpedo grass (*Panicum repens*; C).
- **Vines –** air-potato (*Dioscorea bulbifera*; A); balloon vine (*Cardiospermum halicacabum*; C); Japanese climbing fern (*Lygodium japonicum*; B); mile-a-minute (*Polygonum perfoliatum*; A); old world climbing fern (*Lygodium microphyllum*; A); and skunk vine (*Paederia foetida*; B). (ADAI, 2000)

### *3.1.6.4 Terrestrial Wildlife*

This section discusses the terrestrial wildlife species in Alabama, divided among mammals,[84] birds,[85] reptiles and amphibians,[86] and invertebrates.[87] Terrestrial wildlife consist of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common game and nongame mammals, birds, including wading birds and migratory birds, and reptiles and amphibians. 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 the habitats they occupy. Currently, Alabama is home to 68 mammal species, 115 reptile species and subspecies, 79 amphibian species and subspecies, 256 regularly occurring bird species, 347 fish species and subspecies, and a diverse array of invertebrate species including 182 mussel species, 84 crayfish species, and 203 freshwater snail species (ADCNR, 2015a).

**Mammals**

Mammal species occurring in Alabama in recent times include 23 rodent species and subspecies, 15 bats, 13 carnivores, 7 insectivores, 4 rabbits, 3 ungulates, 1 opossum, 1 manatee, and 1 armadillo. Of these mammal species, the red wolf (*Canis rufus*), Florida panther/Eastern cougar (*Puma concolor*), American bison (*Bison bison*), and elk (*Cervus elaphus*) - have been extirpated[88] from Alabama. Common and widespread mammals in Alabama include the white-tailed deer (*Odocoileus virginianus*), armadillo (*Dasypus novemcinctus*), several bat species, beaver (*Castor canadensis*), and coyote (*Canis latrans*). Alabama is also home to more specialized mammals and mammals whose range has diminished in recent times. These less common mammals include the federally protected Alabama beach mouse (*Peromyscus polionotus ammobates*) (which is found only along the Gulf Coast) and the federally protected Indiana bat (*Myotis sodalis*) which is found in northern and central Alabama (see Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern), and black bears (*Ursus americanus*) were once found statewide, but now only occur in isolated areas (ADCNR, 2015a).

According to the Alabama Department of Conservation and Natural Resources (ADCNR), the following species comprise Alabama's designated game species: bear, beaver, coyote, white-tail deer, gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), opossum (*Didelphis virginiana*), wild rabbit (*Sylvilagus* sp.), raccoon (*Procyon lotor*), squirrel (*Sciurus* sp.), nutria (*Myocastor coypus*), mountain lion (*Puma concolor*), red wolf (*Canis rufus*), groundhog

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[84] 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, 2015k)

[85] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves." (USEPA, 2015k)

[86] 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, 2015k)

[87] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015k)

[88] Extirpated: "taxa that historically occurred in Alabama, but are now absent; may be rediscovered or be reintroduced from populations existing outside the state." (ADCNR, 2015a)

(*Marmota monax*), bobcat (*Lynx rufus*) and feral swine (*Sus scrofa*). However, there is no open season for bear or mountain lion, which are protected species. Furbearers[89] that may be trapped include beaver, bobcat, foxes, mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), nutria, opossum, otter (*Lontra canadensis*), raccoon, and striped skunk (*Mephitis mephitis*) (ADCNR, 2015b).

Alabama has identified 27 mammals as Species of Greatest Conservation Need (SGCN). The SGCN list consists of at-risk species that are rare or declining; state agencies can apply for grant funding for efforts to reduce the potential for species' listing as endangered.[90] This list includes four extirpated species: red wolf, Florida panther, elk, and bison. The 23 remaining SGCN mammal species are divided into two categories with 11 Priority One[91] and 12 Priority Two[92] species (ADCNR, 2015a). Notably, of the 16 bat species present in Alabama, 10 are considered SGCN (and therefore comprise nearly 40 percent of Alabama's SGCN mammals) (ADCNR, 2015a).

The threatened and endangered mammals found in Alabama are discussed in Section 3.1.6.6, Threatened and Endangered Species.

**Birds**

The number of native bird species documented in Alabama varies according to the timing of the data collection effort, changes in bird taxonomy,[93] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., mountains, large rivers and lakes, sandy beaches, coastal islands, etc.) found in Alabama support a large variety of bird species.

According to ADCNR, 256 species of birds breed or regularly winter in Alabama (ADCNR, 2015a). The 2000-2006 breeding bird atlas conducted in Alabama reports 168 species with evidence of breeding in the state (Haggerty, 2006). ADCNR also identified 29 SGCN bird species in Alabama, including 2 extirpated species (common raven [*Corvus corax*], and Ivory-billed woodpecker [*Campephilus principalis*]); 8 Priority One species; and 19 Priority Two species (ADCNR, 2015a).

Alabama is located within the Mississippi Flyway, which includes two other Gulf of Mexico coastal states (Mississippi and Louisiana) and extends northward into the Canadian provinces of Saskatchewan, Manitoba, and Ontario. Over 325 bird species migrate along the Mississippi Flyway while traveling between breeding grounds to the north and wintering grounds to the

[89] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.
[90] The current Alabama SGCN list is available at http://www.outdooralabama.com/sites/default/files/AL-SWAP-DRAFT-30JULY_0.pdf
[91] Priority One – "taxa critically imperiled and at risk of extinction/extirpation because of extreme rarity, restricted distribution, decreasing population trend/population viability problems, and specialized habitat needs/habitat vulnerability. Immediate research and/or conservation action required." (ADCNR, 2015a)
[92] Priority Two – "taxa imperiled because of three of four of the following: rarity; very limited, disjunct, or peripheral distribution; decreasing population trend/population viability problems; specialized habitat needs/habitat vulnerability. Timely research and/or conservation action needed." (ADCNR, 2015a)
[93] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2015k).

south (The Audubon Society, 2015a). Under the Migratory Bird Treaty Act (MBTA), it is "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, 2013a). 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, 2013a).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act as well as the MBTA. Bald eagles are generally found near large rivers and lakes in Northern Alabama and the Gulf Coast (eBird, 2015a). Golden eagles are found in a variety of habitat types; however, their range is limited to parts of northern Alabama (eBird, 2015b).

The Important Bird Area (IBA) program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. Many states have identified IBAs, but Alabama is relatively new to the program and identification of sites is ongoing. Currently, 16 IBAs have been identified in Alabama (6 global[94] IBAs and 10 state[95] IBAs) (Figure 3.1.6-2). One global IBA, the Dauphin Island IBA, is a coastal IBA designated in support of the piping plover (*Charadrius melodus*; a federally threatened species). Three global IBAs located in southern, central, and northern Alabama are identified in support of the red-cockaded woodpecker (*Leuconotopicus borealis*), a federally endangered species. (The Audubon Society, 2015b)

More information about piping plovers and red-cockaded woodpeckers, as well as Alabama's other threatened and endangered birds, is included in Section 3.1.6.6, Threatened and Endangered Species.

[94] Global IBAs include sites that meet at least one global criteria (i.e., sites with significant numbers of globally threatened species, sites supporting 1 percent or greater population of a waterbird simultaneously). (The Audubon Society, 2015b)
[95] State IBAs include areas important to species only according to state-specific criteria (e.g., state-listed species). (The Audubon Society, 2015b)

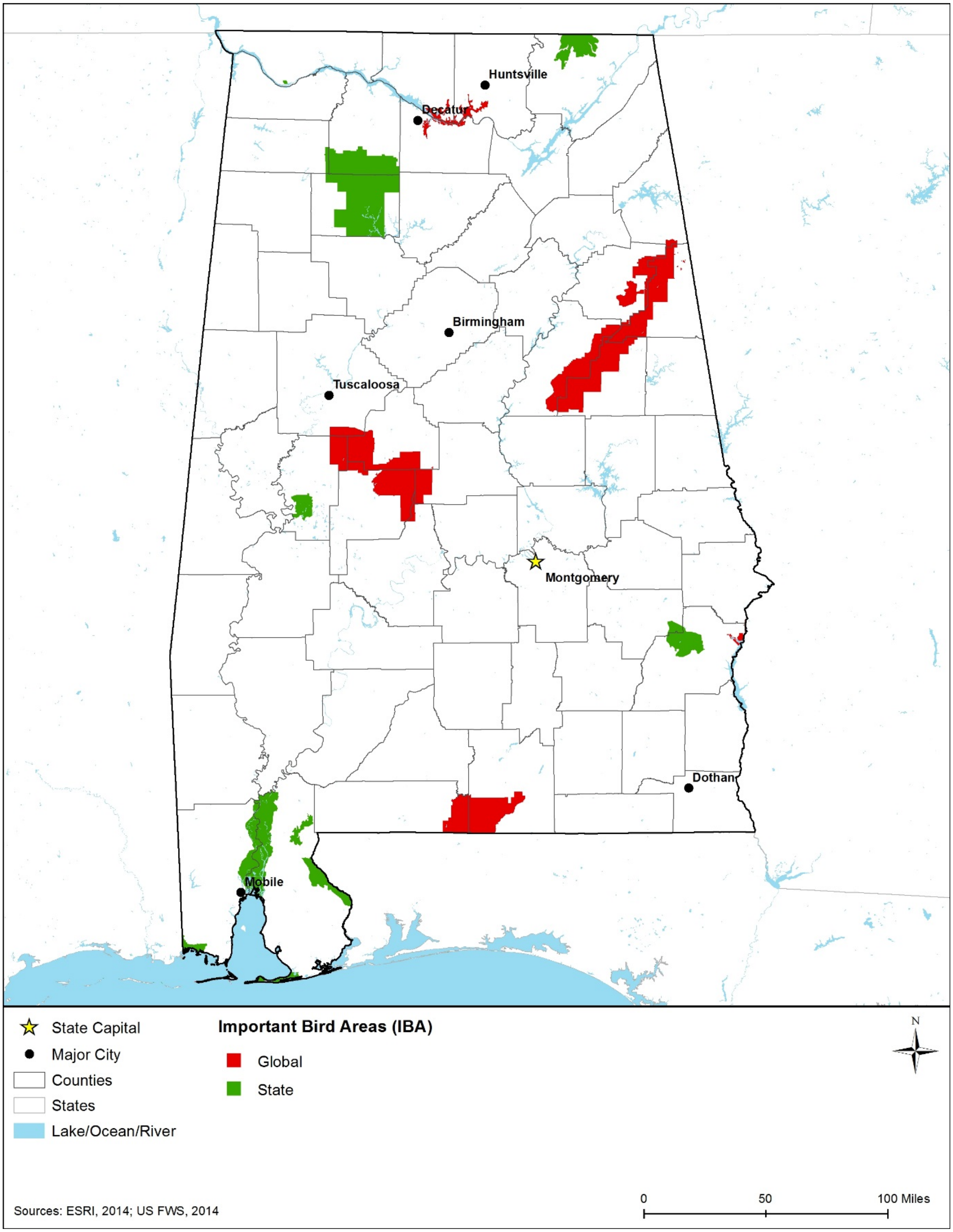



**Figure 3.1.6-2. Important Bird Areas in Alabama**

### Reptiles and Amphibians

There are 166 native reptiles and amphibian species in Alabama, with 30 frogs, 43 salamanders, 12 lizards, 49 snakes, and 31 turtles (ADCNR, 2015a). Some of Alabama's reptiles and amphibians are widespread throughout the state, while other species such as the wood frog (*Rana sylvatica*) are found in very specific environments. Other geographically restricted species include the Gulf Coast smooth softshell (*Apalone mutica calvata*), found in southern Alabama; the eastern speckled kingsnake (*Lampropeltis getula holbrooki*), which is most common in the Black Belt Prairie habitat in central Alabama; the Tennessee cave salamander (*Gyrinophilus palleucus*), which is found only in limestone caves in northern Alabama, and the Mississippi diamondback terrapin (*Malaclemys terrapin pileata*) around Dauphin Island (ADCNR, 2015a).

The American alligator (*Alligator mississippiensis*) is found in Alabama, primarily in the coastal and inland waters in the southern portion of the state. Alligators may be hunted in Alabama, as regulated by the ADCNR (ADCNR, 2016a).

Nineteen of Alabama's amphibians and 28 reptiles are SGCN (ADCNR, 2015a). The mimic glass lizard (*Ophisaurus mimicus*), once thought to be extirpated from the state, has been documented on two occasions in southern Alabama (Covington County) and the Eastern indigo snake (*Drymarchon couperi*; a federally threatened species) is being reintroduced in Alabama. There are 10 Priority One, and 9 Priority Two amphibian species in Alabama. There are 13 Priority One, and 15 Priority Two reptile species in Alabama (ADCNR, 2015a).

Threatened and endangered reptiles and amphibians found in Alabama are discussed in Section 3.1.6.6, Threatened and Endangered Species.

### Invertebrates

Alabama's diverse invertebrate groups include beetles and other insects, terrestrial snails, dragonflies, butterflies, and millipedes. However, most of Alabama's terrestrial invertebrates are not well documented. Some aquatic invertebrates, include mussels and crayfish, have been studied in more detail in Alabama, and are discussed in Section 3.1.6.5, Fisheries and Aquatic Habitat. According to ADCNR, future effort may be placed on the study of Alabama's terrestrial invertebrates, including pollinators (ADCNR, 2015a). One-third of U.S. agricultural output depends on pollinators.[96] 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).

### Invasive Wildlife Species

Alabama has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select terrestrial wildlife species. The ADCNR regulates specific animals via the AAC 220-2-.26: Restrictions on Possession, Sale, Importation and/or Release of Certain Animals and Fish; the following species may not be possessed, sold, offered

[96] Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015k)

for sale, imported, brought, released or caused to be brought or imported into the state: any fish in the genuses *Clarias*, *Serrasalmus*, *Mylopharyngodon*; any nonnative sturgeon species; and species of Chinese perch (*Siniperca* spp.), Snakehead fish (*Channa* spp.), Mud carp (*Cirrhinus* spp.), Blue back herring (*alsoa aestivalis*), fish "rudd" (*Scardinius erythrophthalmus*), fish "roach" (*Rutilus rutilus*); any species of nonindigenous venomous reptile; any species of mongoose; "San Juan rabbits, jack rabbits, or any other species of wild rabbit or hare"; or "any of the following from any area outside the state of Alabama; any member of the family Cervidae (to include but not be limited to deer, elk, moose [*Alces alces*], caribou [*Rangifer tarandus*]), species of coyote, species of fox, species of raccoon, species of skunk, wild rodent, or strain of wild turkey (*Meleagris gallopavo*), black bear, mountain lion, bobcat, pronghorn antelope (*Antilocapra americana*), any nondomestic member of the families *Suidae* (pigs), *Tayassuidae* (peccaries), or *Bovidae* (except bison)." Additionally, nutria may not be propagated or released within the state (ADCNR, 2012). Several terrestrial invertebrates are regulated by the ADAI, primarily for the protection of Alabama's agriculture and horticulture.

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.

### *3.1.6.5 Fisheries and Aquatic Habitat*

This section discusses the aquatic species in Alabama, including sea turtles, saltwater and freshwater fish, and invertebrates. Alabama's complex terrain and over 75,000 miles of freshwater streams, as well as marine and estuarine coastal waters, provides for a variety of aquatic habitats and a diverse population of aquatic species (ADCNR, 2015a). A summary of non-native and/or invasive aquatic species is also presented. No Essential Fish Habitat (EFH) Habitat Areas of Particular Concern (HAPC) designated under the Magnuson-Stevens Fishery Conservation and Management Act are in Alabama waters.

#### Marine Mammals

According to the ADCNR, Alabama's only two regularly occurring marine mammals are the bottlenose dolphin (*Tursiops* spp.) and West Indian manatee (*Trichechus manatus*), a federally protected species (NOAA, 2016a) (ADCNR, 2015a). Two species of whales, the finback (*Balaenoptera physalus*) and humpback (*Megaptera novaeangliae*), are federally protected in Alabama's waters (USFWS, 2015b). These two species, as well as the manatee, are discussed in Section 3.1.6.6, Threatened and Endangered Species.

#### Marine Reptiles

There are seven species of sea turtles in the world, four of which are known and federally protected in Alabama: loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), Kemp's Ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) (ADCNR, 2015a) (USFWS, 2015b):

- The loggerhead is Alabama's most common sea turtle and is known to nest on Alabama's beaches (Wibbels, T., 2015a);
- Atlantic leatherback occurs throughout the Gulf of Mexico and has been observed in Alabama's waters, although nesting has not been reported in Alabama (Wibbels, T., 2015c);
- At least one Kemp's Ridley nest has been recorded in Alabama in recent years (Wibbels, T., 2015d); and
- Within the continental U.S., Hawksbill turtles are found largely in Florida and Texas, but have been observed in waters offshore of other Gulf of Mexico states, including Alabama (NOAA, 2015d) (USFWS, 2015a).

These sea turtle species are discussed in Section 3.1.6.6, Threatened and Endangered Species.

**Fish**

Alabama is home to a diverse assemblage of fish from endemic cavefish and small darters to large sturgeon and sharks. There are 339 native fish species in Alabama, with over 100 marine species currently present in Alabama's waters. This includes 10 taxa that have been recognized as unique but have not been officially described, three recently discovered species, and 63 SGCN fish species (ADCNR, 2015a). The species distribution across Alabama's river systems are listed below (Mettee, 2015):

- Alabama portion of the Tennessee River system is home to approximately 170 fish species;
- Mobile Basin, which is composed of 8 river systems and drains most of Alabama, contains over 240 fish species; and
- Coastal river systems, which includes 7 river systems, have more than 130 fish species.

Although there are many species found in multiple systems within the state, endemic species are found in each of the above systems. For example, the Alabama cavefish (*Speoplatyrhinus poulsoni*) is currently found only in Key Cave, Lauderdale County (Mettee, 2015).

Some of the more commonly caught Alabama freshwater game fish are black bass (including largemouth [*Micropterus salmoides*] and smallmouth bass [*Micropterus dolomieu*]), crappie (*Pomoxis* spp.), rainbow trout (*Onchorhynchus mykiss*), and various perch species (ADCNR, 2016b). Many of these species are found throughout the southeastern states. Saltwater game fish regulated in the state include select species of shark, snapper, grouper, flounder, sheepshead, and tripletail (ADCNR, 2016c).

A number of threatened and endangered marine and freshwater fish species are located in Alabama, as identified in Section 3.1.6.6, Threatened and Endangered Species.

**Shellfish and Other Invertebrates**

Alabama is especially diverse in its mussel and crayfish populations, with more species of each than any other state, including a number of endemic species (ADCNR, 2015a) (Garner, 2013). Currently, there are 182 mussel species (53 Priority One and 21 Priority Two species) and 84 crayfish species (13 Priority One and 31 Priority Two species) in Alabama's freshwater environments. The majority of Alabama's SGCN mussel species are members of the Unionidae family, with two species from the Margaritiferidae family (ADCNR, 2015a). There are over 200 species of freshwater snails (25 Priority One species and 24 Priority Two species), as well as a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles) and exclusively freshwater invertebrates in Alabama (ADCNR, 2015a) (ADCNR, 2015c).

Mussels are one of the most imperiled groups in the United States (Galbraith, Maloney, Hamilton, & Puckett, 2013), and there are 54 federally protected species in Alabama (ADCNR, 2015a). Section 3.1.6.6, Threatened and Endangered Species, identifies these protected species. Invertebrate species found in coastal waters include clams, oysters, and shrimp, some of which are part of Alabama's commercially and recreationally valuable fisheries (ADCNR, 2015a).

**Essential Fish Habitat**

The Magnuson-Stevens Fishery Conservation and Management Act identifies and protects aquatic habitats necessary for spawning, breeding, feeding, or growth to maturity. These areas are designed as EFH. The National Oceanic and Atmospheric Administration (NOAA) operates a website and mapping tool,[97] which provides the public a means to obtain illustrative representations of EFH area (NOAA, 2015j) (NOAA, 2015k). This EFH Mapper was used to identify the existing conditions for a project location to identify sensitive resources.[98]

Also under the Magnuson-Stevens Act, National Marine Fisheries Service 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, and particularly susceptible to human-induced degradation, especially ecologically important, or 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 3.1.6-1 lists the HAPCs in the Gulf of Mexico.

[97] NOAA National Marine Fisheries Service EFH Mapper v3.0, http://www.habitat.noaa.gov/protection/efh/habitatmapper.html

[98] 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 October 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).

**Table 3.1.6-1: Gulf of Mexico EFH Habitat Areas of Particular Concern**

| Species | Gulf of Mexico HAPCs |
|---|---|
| Various ecologically and economically important fish species in the Gulf of Mexico | Alderice Bank, Bouma Bank, East Flower Garden Bank, West Flower Garden Bank, Florida Middle Grounds, Geyser Bank, Jakkula Bank, MacNeil, Madison-Swanson Marine Reserve, McGrail Bank, Pulley Ridge, Rankin Bight Bank, Rezak Sidner Bank, Stetson Bank, Sonnier Bank, Tortugas North, Tortugas South. The HAPC nearest Alabama is the Madison-Swanson Marine Reserve, which is about 60 miles south of Panama City, FL, and 150 miles southeast of Mobile Bay, AL. |

Source: (NOAA, 2005) (NOAA, 2009b) (NOAA, 2015k)

### Invasive Aquatic Species

As previously discussed, Alabama has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals. The following taxa may not be possessed, sold, offered for sale, imported, brought, released, or caused to be brought or imported into the state (ADCNR, 2012):

- fish of the genus *Clarias* (including walking catfish);
- fish of the genus *Serrasalmus* (piranha);
- black carp of the genus *Mylopharyngodon*;
- any species of sturgeon not native to Alabama;
- any species of Chinese perch (*Siniperca* spp.);
- any species of snakehead fish (*Channa* spp.);
- any species of mud carp (*Cirrhinus* spp.);
- blue back herring (*Alsoa aestivalis*); and
- common rudd (*Scardinius erythrophthalmus*) or roach (*Rutilus rutilus*) or hybrids.

### *3.1.6.6 Threatened and Endangered Species*

The U.S. Fish and Wildlife Service (USFWS) is responsible for administering the ESA (16 U.S.C. §1531 et seq.) in Alabama. The USFWS has identified 85 endangered and 43 threatened species known to occur in Alabama (USFWS, 2015b). Of these listed species, 45 have designated critical habitat[99] (Figure 3.1.6-3). Three candidate species[100] are identified by USFWS as occurring within the state (USFWS, 2015c). 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. The 127 federally listed species include 8 mammals, 4 birds, 10 reptiles, 16 fishes, 1 amphibian, 67

[99] 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))
[100] 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, 2014k)

invertebrates, and 22 plants (USFWS, 2015b) 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 maintained independently from the ESA. For future site-specific analysis on those lands, consultation with the appropriate land management agency would be required.

### Mammals

Seven endangered and one threatened mammals are federally listed for Alabama as summarized in Table 3.1.6-3. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Alabama is provided below.

**Table 3.1.6-3: Federally Listed Mammal Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| **Marine Mammals** | | | | |
| Finback Whale | *Balaenoptera physalus* | E | No | Deep offshore water in all major oceans. |
| Humpback Whale | *Megaptera novaeangliae* | E | No | Coastal waters during migration. |
| West Indian Manatee | *Trichechus manatus* | E | No | Coastal waters, estuaries, and warm water outfalls; found in Baldwin and Mobile Counties off the coast of Alabama. |
| **Terrestrial Mammals** | | | | |
| Alabama Beach Mouse | *Peromyscus polionotus ammobates* | E | Yes; along the coast of the Fort Morgan Peninsula, Baldwin County. | Along coastal dunes between Mobile Bay and Perdido Bay in Baldwin County, Alabama. |
| Gray Bat | *Myotis grisescens* | E | No | Found in caves in limestone karst regions and near rivers; found in 26 counties throughout Alabama, mostly in the northern portion. |
| Indiana Bat | *Myotis sodalis* | E | No | Trees and snags, caves, and abandoned mines; found in 34 counties in northern and eastern Alabama. |
| Northern Long-eared Bat | *Myotis septentrionalis* | T | No | Trees and snags, caves, and abandoned mines; found in 33 counties in northern Alabama. |
| Perdido Key Beach Mouse | *Peromyscus polionotus trissyllepsis* | E | Yes; Baldwin County. | Coastal dunes and high areas above the dunes along Perdido Key, Baldwin County, Alabama. |

[a] E = Endangered T = Threatened
Source: (USFWS, 2015b)

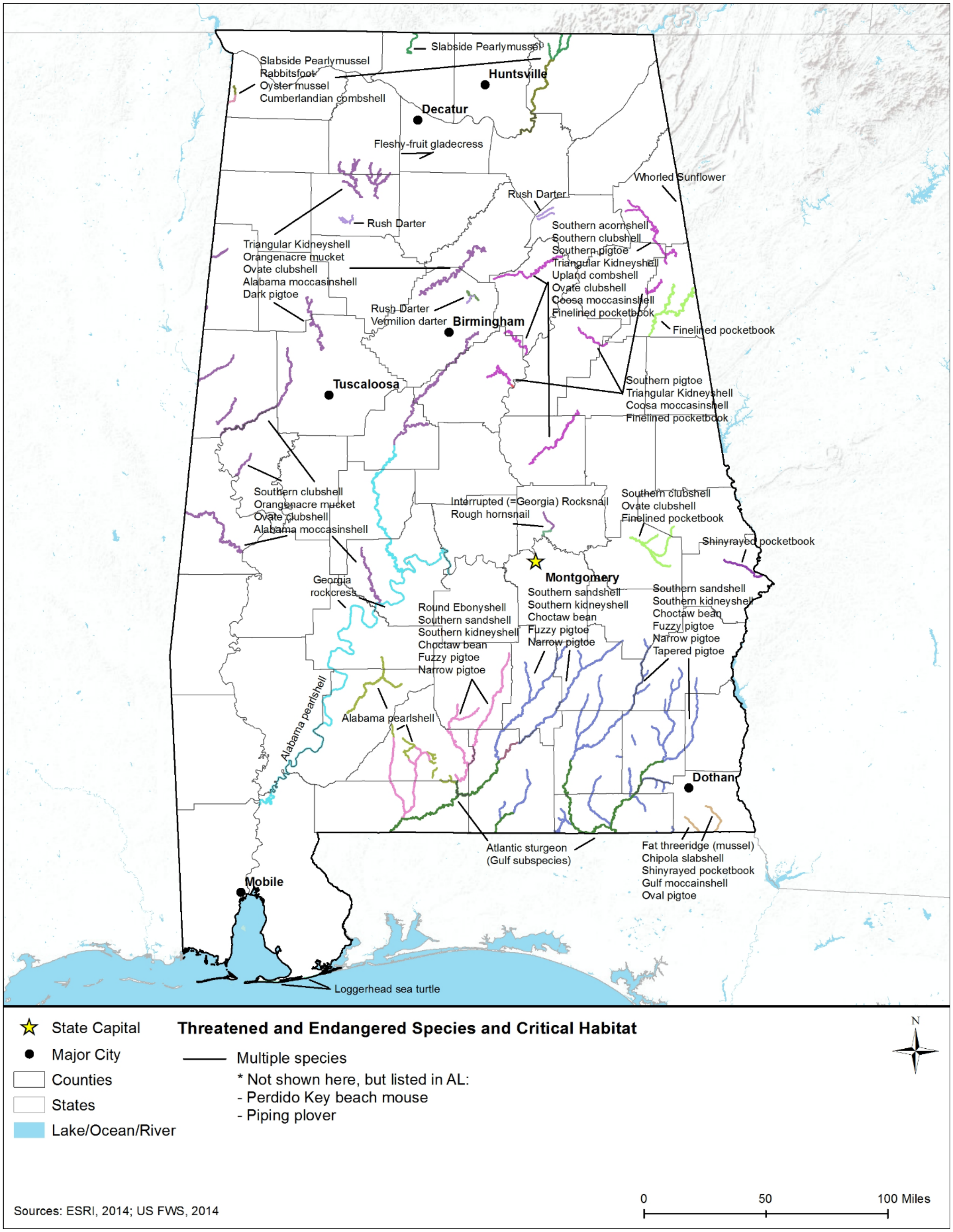



**Figure 3.1.6-3. ESA Designated Critical Habitat in Alabama**

## Marine Mammals

***Finback Whale.*** The endangered finback whale (*Balaenoptera physalus*), also referred to as the fin whale, is the second largest whale in the world, reaching a length from 75 to 85 feet and weighing between 80,000 and 160,000 pounds (NOAA, 2013a). The species was first federally listed as endangered under early endangered species legislation in 1970 (35 Federal Register [FR] 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.) (USFWS, 2015d). Finback whales are found in all of the world's oceans, are highly nomadic, move in social groups of two to seven individuals, and prefer high latitudes and cold currents where food concentrations are high (NOAA, 2013a). In Alabama, they are found off the coast of Baldwin and Mobile Counties (USFWS, 2015d).

Finback whales primarily feed on krill, small fish, and squid, moving through the water at a fast speed averaging 15 miles per hour with bursts of speed reaching 35 miles per hour. In the North Atlantic Ocean, finback whales are often seen in large feeding groups that include humpback whales, minke whales, and Atlantic white-sided dolphins. In the late summer, finback whales migrate to equatorial waters where they spend the winter fasting and living off of their fat reserves. After an 11-12 month gestation period, birthing and nursing occurs (NOAA, 2013a) (NECWA, 2007).

The finback whale population had declined as a result of whaling. Commercial whaling ended in the Northern Pacific Ocean in 1976, the Southern Ocean by 1977, and Northern Atlantic Ocean by 1987; however, finback whales are still hunted in Greenland. Additional current threats to this species include vessel collisions, entanglement in fishing gear, reduced food supply, habitat degradation, and underwater noise disturbance (NOAA, 2013a).

***Humpback Whale.*** The humpback whale (*Megaptera novaeangliae*) reaches 30 to 60 feet in length and is distinguished from other whales by its robust, thick, and chunky body shape and very long (up to 15 feet) white flippers (GADNR, 2009a) (NOAA, 2015e). The humpback whale was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.) (USFWS, 2015e). Humpback whales are found in all of the world's oceans. In the North Atlantic Ocean, feeding populations are found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland, and western Greenland during the spring, summer, and fall as they feed and build up their fat reserves to live off of all winter. These populations all combine to migrate to their winter breeding and calving grounds in tropical and subtropical waters in the West Indies. Humpbacks travel near the water surface during migrations, and prefer shallow waters during feeding and calving (NOAA, 2015e). They can be found off the coast of Baldwin and Mobile Counties in Alabama (USFWS, 2015e).

While humpback whales are federally listed as an endangered species with an estimated 10,400 individuals in the western North Atlantic, they have shown signs of an increasing population size (NOAA, 2013b). Current threats to this species include entanglement in fishing gear, ship strikes,[101] harassment from recreational whale watching, habitat degradation, and harvesting for scientific research (NOAA, 2016b).

[101] Ship strikes: Collisions between whales and vessels (IWC, 2016).

**West Indian manatee** Photo credit: USFWS

***West Indian Manatee.*** The West Indian Manatee (*Trichechus manatus*) averages 9 feet in length and weighs about 1,000 pounds (USFWS, 2015f). The manatee was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). The West Indian manatee is also protected under the Marine Mammal Protection Act (MMPA). The USFWS proposed to reclassify the West Indian manatee from endangered to threatened with a public comment period starting on January 8, 2016 (81 FR 1000 1026, January 8, 2016). The manatee has a large, seal-shaped body with flippers and a large tail, and is typically gray in color (USFWS, 2015f). 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 manatees are found in tropical and subtropical coastal and river waters. The Florida manatee (*Trichechus manatus latirostris*) is found along the southeast U.S. coast, while the Antillean subspecies (*Trichechus manatus manatus*) is typically encountered along the Caribbean coast of Central and South America, and locally throughout the West Indies (USFWS, 2001a). In Alabama, they are found off the coast of Baldwin and Mobile Counties (USFWS, 2015d). "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).

Threats to West Indian manatees include death or serious injury from vessel strikes and habitat loss or fragmentation leading to decreased availability of warm-water refuges (USFWS, 2001a) (USFWS, 2016a).

### Terrestrial Mammals

***Alabama Beach Mouse.*** The Alabama beach mouse is brown, with some individuals having a dark dorsal stripe. As a juvenile, it has a gray and white belly which changes to a white belly in adulthood. Its body length can be up to 3.5 inches, with a short tail of about 2 inches in length. The Alabama beach mouse was federally listed as endangered in 1985 (50 FR 23872 23889, June 6, 1985). (USFWS, 2015g)

This species can be found only along coastal dunes between Mobile Bay and Perdido Bay in Baldwin County, Alabama. Critical habitat was originally designated in 1985 and updated in 2007, along the coast of the Fort Morgan Peninsula, Baldwin County, Alabama (72 FR 4330 4369, January 30, 2007) (USFWS, 2015g). Threats to the Alabama beach mouse include habitat loss due to the alteration of beaches and sand dunes, coastal development and recreational use of sand dunes, predation by feral cats, and tropical storms (USFWS, 1987a).

***Gray Bat.*** The gray bat is an insectivorous[102] bat that weighs approximately 7 to 16 grams and is longer than any other species in the genus *Myotis*. Gray bats have dark gray fur after molting 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, 1997a) (USFWS, 2015h). In Alabama, the gray bat is known to occur in 31 counties throughout the state, mostly in the northern portion (USFWS, 2015h).

Gray bats live in caves all year, hibernating in deep vertical caves in the winter and roosting 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 from flooding, and commercialization of caves (e.g., adding gates that alter air flow, humidity, and temperature in caves) (USFWS, 1982a).

***Indiana Bat.*** The Indiana bat is a small, insectivorous mammal measuring approximately 3 to 3.5 inches in length with a wingspan of 9.5 to 10.5 inches. Indiana bats have dull grayish chestnut fur and strongly resemble the more common little brown bat (*Myotis lucifugus)* (GADNR, 2009b) (USFWS, 2015j). The Indiana bat was originally federally listed as "in danger of extinction" under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). In 2009, only 387,000 Indiana bats were known to exist in its range, less than half of the population of 1967 (USFWS, 2014l). Regionally, this species is currently found in the central portion of the eastern United States, from Vermont west to Wisconsin, Missouri, and Arkansas, and south and east to northwest Florida. In Alabama, the Indiana bat is known to occur in 38 counties in the northern and eastern portions (USFWS, 2015j). Critical habitat has been designated for the Indiana bat in several caves in the region, but none are located in Alabama (42 FR 184, September 22, 1977).

In the fall, the Indiana bats migrate to their hibernation sites in caves and abandoned mines in order to mate and build up fat reserves for hibernation season in the winter. Upon emerging from hibernation, the bats feed near their hibernation sites (within 10 miles) before migrating to their summer habitats where the females roost. Some of these summer habitats can be as far as 300 miles away from their hibernation sites (USFWS, 2004a). Indiana bats roost in trees during the day and feed at night in a variety of habitats, although streams, floodplain forests, ponds, and reservoirs are preferred. Females roost together in maternity colonies under the loose bark of dead or dying trees, or under the loose bark of shaggy-barked trees, although the physical characteristics of individual trees appear to be more of a factor than the species of tree. Nevertheless, tree species that have been noted as preferred by the Indiana bat include shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), and American elm (*Ulmus rubra*) (USFWS, 2012a).

[102] Insectivorous: "An animal that feeds on insects." (USEPA, 2015k)

The threats to this species include the disturbance and intentional killing of hibernating and maternity colonies, habitat fragmentation and degradation, use of pesticides or other contaminants, White Nose Syndrome, and commercialization of caves (e.g., adding gates that alter air flow, humidity, and temperature in caves) (GADNR, 2009b) (USFWS, 2004a) (USFWS, 2015k). White Nose Syndrome is a rapidly spreading fungal disease that afflicts hibernating bats (USGS, 2015g) (USFWS, 2015k).

***Northern Long-eared Bat.*** The Northern long-eared bat is a medium-sized, brown furred, insectivorous bat. This bat is medium-sized, reaching a length of 3 to 3.7 inches, with long ears relative to other members of the genus *Myotis* (USFWS, 2015l). The Northern long-eared bat was listed as endangered in 2013 (78 FR 72058 72059, December 2, 2013) and was relisted as threatened in 2015 (80 FR 17973 18033, April 2, 2015). Its range includes most of the eastern and north central United States. In Alabama, the Northern long-eared bat is known to occur in 40 counties in the northern portion of the state (USFWS, 2015m).

Northern long-eared bats hibernate during winter in caves and mines that exhibit constant temperatures and high humidity, which do not have air currents. In the summer, they roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs after hibernation. Pregnant females then migrate to summer areas to roost in small colonies (USFWS, 2015l).

White Nose Syndrome is the leading cause for the decline of this species. The numbers of Northern long-eared bats in hibernacula has decreased by 99 percent in the northeast United States (USFWS, 2015m). Other threats include hibernacula impacts (e.g., temperature or air flow restrictions), habitat loss or fragmentation, habitat forest management practices that are incompatible with this species' habitat needs, and strikes with wind turbines (USFWS, 2015l).

***Perdido Key Beach Mouse.*** The Perdido Key beach mouse is a subspecies of the small old-field mouse (*Peromyscus polionotus*). The Perdido Key beach mouse is noted for its gray fur, with white cheeks, tail, feet, and belly. This species generally grows to a length of 5.5 inches with a tail that measures up to 2 inches long (USFWS, 1987b). The Perdido Key beach mouse was federally listed as endangered in 1985 (50 FR 23872 23889, June 6, 1985) (USFWS, 2015n).

Perdido Key beach mice inhabit coastal dunes along Baldwin County, Alabama and Perdido Key in Escambia County, Florida (USFWS, 2016b). These mice eat dune plant seeds and insects. Alternative habitat for the Perdido Key beach mouse include high areas behind the dunes (USFWS, 2015n).

The main threat facing the Perdido Key beach mouse is from residential and commercial development along the beach causing a loss of habitat. Additional threats to the beach mouse are from hurricanes or attacks from feral and free-ranging cats, foxes, raccoons, and coyotes. Conservation measures include the construction of boardwalks over dunes, banning the practice of driving vehicles on dunes, and removal of feral cats (USFWS, 2006).

## Birds

One endangered and three threatened birds are federally listed for Alabama as summarized in Table 3.1.6-4. The piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*) can be found in Baldwin and Mobile Counties in southern Alabama (USFWS, 2015o) (USFWS, 2016c). The red-cockaded woodpecker *(Picoides borealis*) can be found throughout Alabama (USFWS, 2015s), and the wood stork *(Mycteria americana*) can be found throughout the southern portion of Alabama (USFWS, 2015t). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Alabama is provided below.

**Table 3.1.6-4: Federally Listed Bird Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Piping Plover | *Charadrius melodus* | T | Yes; along the coast of Mobile County. | Open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers; found in Baldwin and Mobile Counties, south Alabama. |
| Red Knot | *Calidris canutus rufa* | T | No | Intertidal marines, estuaries, and bays in Baldwin and Mobile Counties, Alabama. |
| Red-cockaded Woodpecker | *Picoides borealis* | E | No | Mature pine forests; found in 20 counties throughout Alabama. |
| Wood Stork | *Mycteria americana* | T | No | Primarily feed in fresh and brackish wetlands and nest in cypress or other wooded swamps; found in 40 counties throughout southern Alabama. |

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015b)

***Piping Plover.*** The piping plover is a small, pale brown-colored shorebird with a short beak and black band across its 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 (50 FR 50726 50734, December 11, 1985). Piping plovers are known to occur in Baldwin and Mobile Counties in Alabama (USFWS, 2015o).

Critical habitat for the piping plover has been designated within Mobile and Baldwin Counties in Alabama. 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. 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, 2015p) (USFWS, 2015q).

**Red knot** Photo credit: USFWS

***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, 2013c). 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 migrations, the red knot travels in "nonstop flights of 1,500 miles and more, converging on critical stopover areas to rest and refuel along the way" (USFWS, 2013c). Some red knots have been documented to migrate 9,300 miles from south to north in the spring (USFWS, 2013c) (USFWS, 2014b). Red knots are known to occur in Baldwin and Mobile Counties along the coast of Alabama (USFWS, 2016c).

The preferred habitat for the red knot is intertidal marines, estuaries, and bays. Mussel beds are important food sources for the red knot. Red knots eat mussels and other mollusks almost all year; however, during migration season red knots eat "juvenile clams and mussels and horseshoe crab eggs" (USFWS, 2013c). 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, 2014b) (USFWS, 2016d).

***Red-cockaded Woodpecker.*** The red-cockaded woodpecker is a small black and white bird that grows approximately 7 inches with a wingspan of about 15 inches. It is characterized by its black cap and white cheek patches (USFWS, 2015r). Male red-cockaded woodpeckers have red marking on the side of their neck (USFWS, 2015s). The red-cockaded woodpecker was listed as endangered in 1970 under early endangered species legislation (35 FR 16047 16048, October 13, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). Regionally, this species is known to occur in pine forests from Virginia south to Florida and west to Oklahoma and Texas. The red-cockaded woodpecker can be found in 23 counties in Alabama (USFWS, 2015s).

The preferred habitat for the red-cockaded woodpecker is mature pine forests, preferring longleaf pines (*Pinus palustris*). Red-cockaded woodpeckers forage on insects by pecking pine trunks and branches and flaking away bark. Its diet is primarily composed of insects, with occasional wild fruits and pine seeds. Current threats to the red-cockaded woodpecker include lack of suitable habitats (USFWS, 2003a).

***Wood Stork.*** The wood stork is a tall (about 50 inches) long-legged wading bird having a wingspan of 60 to 65 inches. This large wading bird is primarily white feathered with some black feathers and a black tail. With no feathers on its head or neck, the wood stork has a dark gray head and a black slightly curved bill. Younger wood storks have gray coloring and a yellow bill (USFWS, 2015t). The bird was federally listed as a threatened species in 1984 (49 FR 7332 7335, February 28, 1984). The wood stork is the only stork regularly occurring in the United States with a breeding range extending from the southeastern United States through Mexico and

Central America, Cuba and Hispaniola, and South America to western Ecuador, eastern Peru, Bolivia, and northern Argentina (USFWS, 1997b). Wood storks are found in 40 counties throughout the southern half of Alabama (USFWS, 2015t).

Wood storks inhabit freshwater and estuarine wetlands used to nest, forage, and roost. Freshwater wetland colony sites must remain inundated with water throughout the nesting cycle to protect the eggs and juveniles against predation and abandonment. Wood storks forage in shallow, open water for prey within freshwater marshes, narrow tidal creeks or shallow tidal pools, and depressions in cypress heads or swamp sloughs, in addition to manmade areas such as roadside and agricultural ditches and managed impoundments. 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 in prey (USFWS, 1997b) (USFWS, 2007f).

### Reptiles

There are four endangered and six threatened reptile species that are federally listed for Alabama as summarized in Table 3.1.6-5. All four sea turtles - hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*), are found along the Gulf coast of Alabama (USFWS, 2015a) (NOAA, 2015f) (NOAA, 2015g) (USFWS, 2015y) (USFWS, 2008a). The Alabama red-belly turtle (*Pseudemys alabamensis*), black pine snake (*Pituophis melanoleucus lodingi*), eastern indigo snake (*Drymarchon corais couperi*), and gopher tortoise *(Gopherus polyphemus)* are found in southern parts of the state while the flattened musk turtle *(Sternotherus depressus)* may be found in the Black Warrior River system of northwestern Alabama (USFWS, 2015ac) (USFWS, 2015ad) (USFWS, 2015ag) (USFWS, 2015af). The Eastern Gopher Tortoise (*Gopherus polyphemus*) has been identified a candidate species in Alabama. Information on the habitat, distribution, and threats to the survival and recovery of the listed species in Alabama is provided below.

**Table 3.1.6-5: Federally Listed Reptile Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| **Marine Reptiles** | | | | |
| Green Sea Turtle | *Chelonia mydas* | T | 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. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Leatherback Sea Turtle | *Dermochelys coriacea* | E | No | Coastal waters and the open sea environment. |
| Loggerhead Sea Turtle | *Caretta caretta* | T | Yes; along the coast of Baldwin County, Alabama. | Open sea environment and inshore area such as salt marshes, creeks, bays, and lagoons. |
| **Terrestrial Reptiles** | | | | |
| Alabama Red-belly Turtle | *Pseudemys alabamensis* | E | No | It inhabits streams, lakes, and sloughs in the lower part of the Mobile Bay Drainage in Baldwin and Mobile Counties, Alabama. |
| Black Pine Snake | *Pituophis melanoleucus lodingi* | T | No | Sandy, well-drained soils with an open-canopied overstory of longleaf pine, a reduced shrub layer, and a dense herbaceous ground cover. |
| Eastern Indigo Snake | *Drymarchon corais couperi* | T | No | High pineland, flatwoods, dry glades, tropical hammocks, and muckland fields; found in 9 counties in the southern portion of Alabama. |
| Flattened Musk Turtle | *Sternotherus depressus* | T | No | Free-flowing large creeks or small rivers with vegetated shallows and pools in the upper Black Warrior River system in 11 counties in Alabama. |
| Western Gopher Tortoise | *Gopherus polyphemus* | T | No | Natural arid communities, mostly of the longleaf-pine-scrub oak type, located on sand ridges; found in Choctaw, Mobile, and Washington Counties in southern Alabama. |

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015b)

## Marine Reptiles

***Green Sea Turtle.*** The green sea turtle is "the largest of all of the hard-shelled sea turtles" (NOAA, 2016d). It was listed as threatened in 2016 (81 FR 20057 20090, May 6, 2016) (NOAA, 2016c). "Their top shell is smooth with shades of black, gray, green, brown, and yellow; their bottom shell is yellowish white." 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" (NOAA, 2016d). 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.” “They feed primarily on seagrasses and algae.” Nesting season typically occurs between June and September, with females laying eggs in 2 to 4 year cycles (NOAA, 2016d). 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, 2016d) (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. Its shell is dark brown with faint yellow streaks with a yellow coloring on its under shell. Adults range in size from 30 to 36 inches and weigh up to 300 pounds. The hawksbill sea turtle is found throughout all of the oceans of the world (NOAA, 2015d) (USFWS, 2015a). Even though in the Atlantic Ocean they range along the Atlantic seaboard of the United States to northern Brazil, they are more infrequently found offshore of Mid-Atlantic and New England states (NOAA, 2015d). The waters surrounding Culebra, Mona, and Monito Islands, Puerto Rico are designated as critical habitat for the continued survival and recovery of hawksbill turtles (63 FR 46693 46701, September 2, 1998).

Hawksbill sea turtles prefer warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation. As an omnivore, hawksbill sea turtles feed primarily on sponges, algae, and invertebrates. Nesting for hawksbill sea turtles occurs on remote beaches in the Gulf of Mexico and the Caribbean Sea in two to three year cycles, where females lay between 140 to 200 eggs (USFWS, 2015a).

Current threats to the hawksbill sea turtle include accidental capture in fishing lines, vessel strikes, contaminants and oil spills, disease, and habitat loss or destruction in coral reef communities. Outside of the U.S., an additional threat to the species is the harvest of their meat and eggs (NOAA, 2015d).

***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 (NOAA, 2015f) (USFWS, 2015w). 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 and incorporated into the ESA in 1973 (USFWS, 2015x). Their range includes the Gulf of Mexico and the U.S. Atlantic seaboard, from New England to Florida. They prefer nearshore habitats with muddy or sandy bottoms in waters rarely greater than 160 feet deep where their prey items—such as crabs, jellyfish, fish, and mollusks—are found (NOAA, 2015f).

Kemp’s Ridley sea turtles gather in large groups in Tamaulipes, 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 two years (NOAA, 2015f). Historically, the decline of this species was the harvesting of their sea turtle eggs during nesting. Current threats to this species include the direct harvest of adults and eggs, accidental capture in fishing lines, recreational activities on beaches, and pollution (USFWS, 2015w).

**Leatherback sea turtle** credit: USFWS

***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 2,000 pounds (USFWS, 2015y). The leatherback sea turtle was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and incorporated into the ESA of 1973 (USFWS, 2015z). The leatherback sea turtle is capable of tolerating a wide range of water temperatures; hence, its wide global distribution, 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, 2015g) (USFWS, 2015y). Designated critical habitat is located in Sandy Point Beach on St. Croix; there is no critical habitat is designated in Alabama (USFWS, 2015z).

Leatherback sea turtles are found in ocean waters and nearshore coastal waters. Their main diet includes jellyfish, salps (a transparent barrel-shaped tunicate[103]), and other soft-bodied animals (NOAA, 2015g). For reproduction, female leatherback sea turtles nest at two to three year intervals during March to July. Nest-building occurs during the night. Each female leatherback sea turtle can create up to 11 nests per nesting season (USFWS, 2015y). Current threats to the species include harvesting of turtles and their eggs, hunting, incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NOAA, 2015g).

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

This turtle is known to occur throughout temperate and tropical regions in the Atlantic, Pacific, and Indian Oceans with most nesting areas located in the western Atlantic Ocean. Nesting by the loggerhead sea turtle occurs from Texas to Virginia along the southeastern coast of the United States (USFWS, 2008a). Loggerhead sea turtles nest on coastal sand beaches near the dune line, or in areas with coral reefs; they prefer to feed in rocky places (NOAA, 2014b). Hatchlings use offshore floating sargassum mats and juveniles frequent coastal bays, inlets, and lagoons. Critical habitat has been designated in Alabama along the coast of Baldwin County (NMFS, 2014).

[103] Tunicate: "Commonly known as 'sea squirts.' The body of an adult tunicate is quite simple, being essentially a sack with two siphons through which water enters and exits. Water is filtered inside the sack-shaped body." (University of California Museum of Paleontology, 2006)

Loggerhead sea turtles are found in the open sea and in inshore areas such as salt marshes, creeks, bays, and lagoons. Current threats to the loggerhead sea turtle include incidental captures in fishing gear, direct harvesting of eggs, and habitat loss and degradation (NOAA, 2014b) (USFWS, 2008a).

### Terrestrial Reptiles

***Alabama Red-belly Turtle.*** The Alabama red-belly turtle is a large, freshwater turtle that can reach a length of 8 to 10 inches. As it is named, it has an orange to reddish color on its under shell. Its arched upper shell is brown to olive color typically with yellow, orange, or reddish streaks. The Alabama red-belly turtle's skin is olive to black color with yellow to light orange stripes. This turtle has a notch at the tip of its upper jaw with a toothlike projection surrounding it on either side (USFWS, 2016e). The Alabama red-belly turtle was federally listed as endangered in 1987 (52 FR 22939 22943, June 16, 1987).

This species can be found in Baldwin, Clarke, Mobile, and Washington Counties in Alabama (USFWS, 2015ac). "[It] inhabits streams, lakes, and sloughs[104] associated with the lower part of the Mobile Bay Drainage in Baldwin and Mobile Counties, Alabama." This turtle lives in large, vegetated areas of shallow water in the backwater areas of bays and river channels. It uses snags and vegetation for habitat, foraging, and to bask in the sun. Threats to the Alabama red-belly turtle include habitat disturbance due to dredged material disposal and predation (USFWS, 1990a).

***Black Pine Snake.*** The black pine snake is a large, non-venomous, egg-laying constricting snake with keeled scales (scales having a center ridge), a disproportionately small head, and a pointed snout. Black pine snakes are distinguished from other pine snakes by their uniform darker brown to black coloring. There is considerable individual variation in adult black pine snakes; some adults have russet-brown snouts, white scales on their throat, or blotches on the end of its body near the tail. Adult black pine snakes range from 48 to 76 inches long. The black pine snake was federally listed as threatened in 2015. (USFWS, 2015ad) (80 FR 60467 60489, October 6, 2015)

This species is currently known to be found in Mississippi and Alabama; in Alabama, it can be found in Choctaw, Clarke, Mobile, and Washington Counties in the southwestern part of the state (USFWS, 2015ad). A proposed rule to designate critical habitat for the species was published in 2015 for areas in Forest, Greene, George, Harrison, Jones, Marion, Perry, Stone, and Wayne Counties, Mississippi, and Clarke County, Alabama (USFWS, 2015ae).

Black pine snakes were widespread in longleaf pine forests that once covered the southeastern United States. These snakes are known to occur in sandy, well-drained soils in longleaf pine forests, a reduced shrub layer, and a dense herbaceous ground cover. Threats to the species include loss of longleaf pine habitat through conversion to densely stocked pine plantations or agriculture, habitat fragmentation, and impacts from urbanization. (USFWS, 2015ad) (80 FR 60467 60489, October 6, 2015)

[104] A wetland, usually a swamp or shallow lake, often a backwater to a larger body of water.

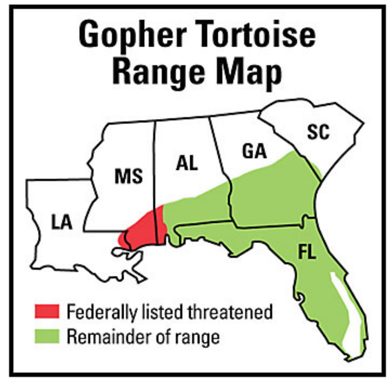
***Eastern Indigo Snake.*** "Adults are large and thick bodied. The body is glossy black and in sunlight has iridescent blue highlights. The chin and throat is reddish or white, and the color may extend down the body. The belly is cloudy orange and blue-gray. The scales on its back are smooth, but some 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, 2015ag). 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 Alabama, the Eastern indigo snake is known to occur in 13 counties in the southern portion of the state (USFWS, 2015ag).

**Eastern indigo snake** Photo credit: USFWS

Preferred habitat of this snake includes high pineland, flatwoods, dry glades, tropical hammocks, and muck fields (nutrient rich fields). 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 to 10 eggs during May or June; snakes place these eggs in moist sand of tortoise burrows (GADNR, 2009c). Major threats to the Eastern indigo snake include fire suppression, habitat conversion to agriculture or pine plantation, and human predation for the pet trade (USFWS, 1982b).

***Flattened Musk Turtle.*** The flattened musk turtle is a small aquatic turtle which can grow up to five inches long, with a flattened upper shell. This flattened upper shell is dark brown to orange in color with dark bordered seams, and a lower shell of pink to yellow color. This turtle had a green head with a dark spotted pattern on the top of its snout. "Males have thick, long, spine-tipped tails" (USFWS, 2012b). The flattened musk turtle was federally listed as threatened in 1987 (52 FR 2242 2243, June 11, 1987) (USFWS, 2015ah).

This species can be found in the upper Black Warrior River system in 15 counties in Alabama (USFWS, 2015ah). Its preferred habitat is "free-flowing large creeks or small rivers with vegetated shallows and pools" (USFWS, 2012b). "Factors that indicate good habitat quality for this turtle include abundant molluscan fauna, low silt load and deposits, low nutrient and bacterial counts, moderate temperature, and minimal pollution" (USFWS, 2012b). The biggest threat to the flattened musk turtle is siltation from coal mine operations, and runoff from agriculture, forestry, and construction. Other threats include habitat loss due to development, over collecting, and disease (USFWS, 2012b).



Source: USFWS

***Western Gopher Tortoise.*** The western gopher tortoise (*Gopherus polyphemus*) is dark-brown to grayish-black colored terrestrial turtle that digs deep borrows in dry sandy habitat. Adult tortoises have a shell length between 6 and 15-inches long. Distinctive morphology include, "elephantine hind feet, shovel-like forefeet, and a gular projection beneath the head on the yellowish, hingeless plastron or undershell."

The species is listed as threatened west of the Mobile and Tombigbee Rivers, and as a candidate species east of those rivers (USFWS, 1990b) (USFWS, 2015af), and was federally listed as threatened in 1987 (52 FR 25376 25380, July 7, 1987). Western gopher tortoises occur in the Coastal Plain in southern South Carolina, Georgia, Florida, Alabama, Mississippi, and eastern Louisiana. In Alabama, the species is found in Baldwin, Choctaw, Clarke, Marengo, Mobile, Sumter, and Washington Counties (USFWS, 2015af).

Preferred habitats of the western gopher tortoise are sand ridges in longleaf pine savannas. The species is also found "ruderal[105] habitats such as fence rows, pastures, and field edges and power lines." Breeding occurs between February and September (USFWS, 1990b). The major threat to gopher tortoise is habitat destruction, followed by "habitat fragmentation and degradation, predation, inadequacy of regulatory mechanisms, and incompatible use of herbicides in forest management and some silvicultural activities (USFWS, 2016f)."

### Fish

There are eight endangered and eight threatened fish species that are federally listed for Alabama (Table 3.1.6-6). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Alabama is provided below.

**Table 3.1.6-6: Federally Listed Fish Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Alabama Cavefish | *Speoplatyrhinus poulsoni* | E | Yes; Key Cave in Lauderdale County, northwestern Alabama. | The cave it inhabits is relatively stable, with low temperature and no visible sunlight; found in Key Cave in Lauderdale County, Alabama. |
| Alabama Sturgeon | *Scaphirhynchus suttkusi* | E | Yes; the lower Alabama River, and where the Alabama River meets the Tombigbee River and Cahaba River. | Main channel of large coastal plain rivers in the Mobile River Basin. Observed in moderate to swift current over sand, gravel, or mud bottom; found in the lower Alabama River, and where the Alabama River meets the Tombigbee River and Cahaba River in nine Alabama counties. |

[105] Growing where the natural vegetational cover has been disturbed by humans.

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Blue Shiner | *Cyprinella caerulea* | T | No | Pool areas with flowing water and substrates of rubble, gravel, and sand; found in 6 counties in the northeast portion of Alabama. |
| Boulder Darter | *Etheostoma wapiti* | E | No | It inhabits warm water river environments and is only found in moderate to fast current over boulder or slab rock substrate in water over 2 feet deep; found in Limestone County, northern Alabama. |
| Cahaba Shiner | *Notropis cahabae* | E | No | It inhabits large sandbar areas in the main channel of the Cahaba River, and is found in the quieter clear, well oxygenated waters, less than 2 feet deep, just below swift, coarse-bedded areas; found in the Cahaba River, in six counties in central Alabama. |
| Goldline Darter | *Percina aurolineata* | T | No | Moderate to swift current over sand or gravel substrate interspersed among cobble and small boulders; found in Bibb, Jefferson, and Shelby Counties in central Alabama. |
| Gulf Sturgeon (Gulf subspecies of Atlantic sturgeon) | *Acipenser oxyrinchus desotoi* | T | Yes; Escambia, Yellow, and Choctawhatchee River systems, and Lake Borgne. | Migrates from marine environment to fresh water coastal rivers to spawn. Rest near the bottom of riverbeds and oceans. Found in 12 counties in southern Alabama. |
| Palezone Shiner | *Notropis albizonatus* | E | No | Clean, clear water in flowing pools and runs of upland streams that have permanent flow, with a substrate of bedrock, pebble, and gravel mixed with clean sand; found in large creeks and small rivers in the Tennessee River system in Jackson County, northeastern Alabama. |
| Pygmy Sculpin | *Cottus paulus* | T | No | Found in Coldwater Spring and its run in Calhoun County, eastern Alabama. The spring forms a large pool, and the spring run is up to 60 feet wide and 500 feet long. The bottom is gravel and sand with large rocks. There are large mats of vegetation in the spring pool and along the edges of the spring run. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Rush Darter | *Etheostoma phytophilum* | E | Yes; tributaries and spring systems of the Turkey Creek (Jefferson County), Clear Creek (Winston County), and Little Cove-Bristow Creek watersheds (Etowah County) in north-central Alabama. | Habitat with shallow, clear, cool water with moderate current and a substrate of a combination of sand with silt, gravel, or bedrock. Found in tributaries and spring systems of the Turkey Creek (Jefferson County), Clear Creek (Winston County), and Little Cove-Bristow Creek watersheds (Etowah County) in north-central Alabama. |
| Slackwater Darter | *Etheostoma boschungi* | T | Yes; Buffalo River and its tributaries in Lauderdale County. | Found in gentle riffles and slackwater areas of small to medium size shallow, upland tributary streams in Lauderdale, Limestone, and Madison Counties, in northern Alabama. |
| Snail Darter | *Percina tanasi* | T | No | Larger creeks and small rivers, where it occurs in areas with moderate to swift flow over mixed sand and gravel; found in 4 counties in the northern portion of Alabama. |
| Spotfin Chub | *Erimonax monachus* | T | No | Clear large creeks or medium size rivers up in mountain areas; found in five counties in northern Alabama. |
| Spring Pygmy Sunfish | *Elassoma alabamae* | T | No | Found in spring pools in Limestone County, northern Alabama. |
| Vermilion Darter | *Etheostoma chermocki* | E | Yes; within its habitat in Jefferson County, central Alabama. | Its habitat is streams with pools of moderate current alternating with riffles of moderately swift current, and low water cloudiness. Found in parts of the upper mainstem of Turkey Creek and 4 tributaries in Jefferson County, central Alabama. |
| Watercress Darter | *Etheostoma nuchale* | E | No | It inhabits deeper, slow moving backwaters of springs that are crowded with aquatic vegetation such as watercress. Found in springs in Jefferson County, central Alabama. |

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015b)

***Alabama Cavefish.*** The Alabama cavefish appears pinkish-white in color with transparent fins and head. It is a little less than 2.5 inches in length and has no eyes. It has a very large, long head and no eyes; the head is over a third of its length with a bill-like snout (USFWS, 1990c). The Alabama Cavefish was federally listed as endangered in 1977 (42 FR 45526 45530, September 9, 1977) (USFWS, 2015ai).

This species can only be found in Key Cave, Lauderdale County, in northwestern Alabama, although it is also believed to occur in Colbert County (USFWS, 2016g). This cave was designated as critical habitat for the Alabama cavefish in 1977. Key Cave is relatively stable, with low water temperature and no visible sunlight. Water levels can change due to rain and flood events, which changes the water level, temperature, food availability, cloudiness of water, and water chemistry. In Key Cave, the main source of organic matter is guano from a gray bat colony. Threats to the Alabama cavefish include unsuccessful reproduction, groundwater degradation, change in drainage and hydrology, collecting, and diminished organic matter inputs (USFWS, 1990c).

***Alabama Sturgeon.*** The Alabama sturgeon grows up to 31 inches in length, with a broad head and a flattened shovel-like snout and tubular mouth. The Alabama sturgeon has four “whiskers” on the bottom of its snout in front of its mouth; these whiskers are used to locate prey. The body has five rows of bony plates along the back, side, and lower sides and covering its head. The upper body is a light tan to golden color, with a creamy white colored belly (USFWS, 2013b). The Alabama sturgeon was federally listed as endangered in 2000 (65 FR 26438 26461, May 5, 2000) (USFWS, 2015aj).

Alabama sturgeon can be found in the lower Alabama River, and where the Alabama River meets the Tombigbee River and Cahaba River in nine Alabama counties. Critical habitat was designated in 2009 in these areas (74 FR 26488, June 2, 2009), and it is believed to occur in an additional four counties. This species is one of the rarest fish in the United States and could be close to extinction; the last observed Alabama sturgeon was seen in 2009. “The Alabama Sturgeon occupies relatively stable river channels with flowing water. Little is known of its life history, although they are believed to migrate upstream during late winter and early spring to spawn…It inhabits the main channel of large coastal plain rivers of the Mobile River Basin. Most specimens have been taken in moderate to swift current at depths of [20 to 46 feet], over sand, gravel or mud bottom” (USFWS, 2013b). Threats to the Alabama sturgeon include reduced range, habitat loss due to development, and extremely low population numbers (USFWS, 2013b).

***Blue Shiner.*** The blue shiner is a medium-sized minnow up to 4 inches in length. It is dusky blue in color with pale yellow fins and a distinct lateral line with diamond-shaped scales. This species was listed as threatened in 1992 (57 FR 14786 14790, April 22, 1992). In Alabama, it is known to occur in seven counties in the northeastern part of the state (USFWS, 1992a) (USFWS, 2015ak).

The preferred habitat for the blue shiner is “sand and gravel substrate among cobble in cool, clear waters” (USFWS, 1992a). Blue shiners are sometimes associated with submerged tree roots and fallen branches. They also occur near water willow (*Justicia americana*) beds, especially in eddy currents downstream from the beds. Current threats to this species include water quality degradation, point- and non-point source water pollution, excessive turbidity, and dam construction (USFWS, 1995a).

***Boulder Darter.*** The Boulder darter is a small fish, reaching a length of up to about 3 inches. Males are olive to gray in color, and females are slightly lighter in color. Both have a gray to black stripe below their eyes and a black spot behind the eyes. Unlike closely related species, the Boulder darter does not have red spots (USFWS, 1989a). The Boulder darter was federally listed as endangered in 1988 (53 FR 33996 33998, September 1, 1988). The population in Alabama is listed as endangered (USFWS, 2015al).[106]

This species can be found in fast-water runs in the Elk River system (a Tennessee River tributary) in Limestone County, northern Alabama and Giles and Lincoln Counties, southern Tennessee. "The Boulder darter inhabits warm-water riverine environments and has been found only in moderate to fast current over boulder/slab rock substrate in water over [two] feet deep" (USFWS, 1989a). Threats to the Boulder darter include high or increased silt levels, pesticides, toxic chemical spills, and mining (USFWS, 1989a).

***Cahaba Shiner.*** The Cahaba shiner is a small, silver colored fish about 2.5 inches long with a peach colored stripe over a dark stripe on its sides (USFWS, 1992b). The Cahaba shiner was federally listed as endangered in 1990 (55 FR 42961 42966, October 25, 1990).

This species can be found in the Cahaba River, in 10 counties in central Alabama (USFWS, 2015am). It inhabits sandbar areas in the main channel of the Cahaba River, in quiet clear, well oxygenated waters less than 2 feet deep, located below swift, coarse-bedded areas. It prefers sandy patches in gravel beds or downstream of large rocks and boulders. The main threat to the Cahaba shiner is water quality degradation from land use development and pollution (USFWS, 1992b).

***Goldline Darter.*** The goldline darter is a slender, small-sized fish, about 3 inches long with brownish-red stripes. It differs from other members of the subgenus *Hadropterus* in the golden color pattern of its back, which is pale to dusky. This species was listed as threatened in 1992 (57 FR 14786 14790, April 22, 1992). In Alabama, it is found or believed to occur in Bibb, Chilton, Jefferson, Perry, Shelby, and Tuscaloosa Counties in the central portion of the state (USFWS, 1992a) (USFWS, 2015an).

"The goldline darter prefers a moderate to swift current and water depths greater than 2 feet" (USFWS, 1992a). Current threats include water quality degradation resulting from urbanization, mining, land use, and sewage (GADNR, 2016).

***Gulf Sturgeon.*** The Gulf sturgeon (Gulf subspecies of Atlantic sturgeon) can grow up to 9 feet long and weigh up to 300 pounds (USFWS, 2015ap). A bony fish with a long bladelike snout, this species is light to dark brown with a pale belly in coloring (USFWS, 1995b). The Gulf sturgeon was federally listed as threatened in 1991 (56 FR 49653 49658, September 30, 1991) (USFWS, 2015aq). The Gulf sturgeon migrates in the spring from salt water to spawn in freshwater rivers in the summer. Individual Gulf sturgeons often return to the river they were born in to spawn. When not migrating, Gulf sturgeon prefer to rest near the bottom of riverbeds and oceans (USFWS, 2015ap).

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 freshwater rivers from the Suwannee River, Florida to Pearl River, Louisiana (USFWS, 2015ap). It is known to occur in 14 counties in

[106] The Boulder darter is also listed as endangered in Tennessee. A nonessential experimental population is found in Tennessee as well.

Alabama (USFWS, 2015aq). Critical habitat for the Gulf sturgeon in Alabama includes the Escambia, Yellow, and Choctawhatchee River systems, and Lake Borgne (NMFS, 2003). Major threats to the Gulf Sturgeon are barriers (such as dams) to historical spawning habitats, loss of habitat, poor water quality, and overfishing for sturgeon eggs and meat (USFWS, 1995b).

***Palezone Shiner.*** The palezone shiner is a small, slender minnow that reaches a little over 2 inches in length. It is a light, translucent yellow color with a narrow, dark stripe on its back and on its upper lip. It has a pigmentless stripe on its sides with a darkly pigmented border (USFWS, 1997c). The palezone shiner was federally listed as endangered in 1993 (58 FR 25758 25763, April 27, 1993) (USFWS, 2015ar).

This species can be found in large creeks and small rivers in the Tennessee River system in Jackson County, northeastern Alabama, and is also believed to occur in Madison and Marshall Counties (USFWS, 2016h), as well as two counties in southern Kentucky. The palezone shiner inhabits clean, clear water in flowing pools and upland streams with permanent flow having sandy substrates of bedrock, pebble, and gravel. Threats include habitat alteration and deteriorated water quality (USFWS, 1997c).

***Pygmy Sculpin.*** The pygmy sculpin is a small freshwater fish, reaching less than 2 inches in length, with spotted fins and dark dorsal saddles. Juveniles sport a black head that change to white when adults (USFWS, 1991a). The pygmy sculpin was federally listed as threatened in 1989 (54 FR 39846 39850, September 28, 1989) (USFWS, 2015as).

The Pygmy sculpin is "known only from Coldwater Spring and its run in Calhoun County, Alabama (USFWS, 1991a)," although it is also believed to occur in Talladega County (USFWS, 2016o). Coldwater Spring forms a large shallow pool, and the spring run is up to 60 feet wide and 500 feet long with a gravel and sand bottom. There are large mats of vegetation in the spring pool and along the edges of the spring run. The greatest threat to the pygmy sculpin is groundwater degradation from contamination (USFWS, 1991a).

***Rush Darter.*** The rush darter is a small-sized fish that reaches about 2 inches in length. It is brown colored with a faint thin golden stripe along its heavily mottled sides (USFWS, 2011a). The rush darter was federally listed as endangered in 2011 (76 FR 48722 48741, August 9, 2011) (USFWS, 2015at).

This species is found in tributaries and spring systems of the Turkey Creek (Jefferson County), Clear Creek (Winston County), and Little Cove-Bristow Creek watersheds (Etowah County) in north-central Alabama. Critical habitat was designated in these areas in 2012 (77 FR 63603 63668, October 16, 2012). These areas have riffles, runs, pools, transition zones, and aquatic vegetation. Rush darters prefer habitat with shallow, clear, cool water having a moderate current and a substrate sand with silt, gravel, or bedrock. The rush darter is also believed to occur in seven other counties in Alabama (USFWS, 2016p). Threats to the rush darter include stream alteration and channelization, stormwater management, habitat loss and description, and agriculture (USFWS, 2012c).

***Slackwater Darter.*** The slackwater darter is a small-sized fish reaching less than 2 inches in length. It has predominantly orange scales with a blue-black bar below its eye and spotted fins

(USFWS, 1984a). The slackwater darter was federally listed as threatened in 1977 (42 FR 45526 45530, September 9, 1977) (USFWS, 2015au).

Slackwater darters "typically inhabit gentle riffles and slackwater areas of small to medium-size shallow, upland tributary streams" in Lauderdale, Limestone, and Madison Counties, in northern Alabama (USFWS, 1984a). Critical habitat has been designated for Cypress Creek and its tributaries upstream from the junction with Burcham Creek (including Burcham Creek) in Lauderdale County, Alabama (42 FR 48740 47845, September 22, 1977). The slackwater darter has distinct breeding and nonbreeding habitats. The nonbreeding habitat is typically small to moderately large streams with slow current, over silty gravel or mud. The breeding habitat is seepage water in open fields and woods that flows slowly into an adjacent stream. Threats to the slackwater darter include habitat loss due to urbanization, surface and groundwater degradation, and conversion of breeding habitat to fish ponds (USFWS, 1984a).

***Snail Darter.*** The snail darter is approximately 3 inches long. "Background color above the lateral line is brown with occasional faint traces of green" (USFWS, 1983a). Four dark brown saddle-like marks cross the back of the fish and the lower part of its sides are lighter with dark blotches. Snail darters have a white belly, with dark brown coloring for the upper portion of their head. "The cheeks are mottled brown interspersed by traces of yellow" (USFWS, 1983a). This species was originally listed as endangered in 1975 (40 FR 47505 47506, October 9, 1975) but was reclassified as threatened in 1984 (49 FR 27510 27514, July 5, 1984) (USFWS, 2015aw). The species occurs in Tennessee River tributaries in Alabama, Georgia, and Tennessee. In Alabama, it is found in six counties in the northern portion of the state (USFWS, 2015av).

The preferred habitat for the snail darter is cold water streams with rock shoals, small boulders, and areas of mixed sand and gravel (USFWS, 1983a). "Extensive impoundment of the upper Tennessee River system has removed suitable habitat from most of the snail darter's native range. Isolated populations survive in larger tributaries where the principal threat is stream habitat degradation resulting from failure to employ Best Management Practices (BMPs) for forestry and agriculture, failure to control soil erosion from construction sites and bridge crossings, and increased stormwater runoff from developing urban and industrial areas" (GADNR, 2009d).

***Spotfin Chub.*** The spotfin chub is a medium-sized fish with an elongated body that grows to almost 3.5 inches in length. It has an olive colored body with silver on its sides and white at the bottom (USFWS, 1983b). This species was listed as threatened in 1977 (42 FR 45526 45530, September 9, 1977). It is known to occur in Alabama, North Carolina, and Virginia with multiple non-essential experimental populations also in Tennessee. In Alabama, it was previously known to occur in six counties in the northern portion of the state but has not been found for some time in the state (ADCNR, 2016d).

Suitable habitats for the spotfin chub consist of clear large creeks or medium size rivers in mountain areas having cool and warm water with moderate gradients and bottoms of gravel. The spotfin chub uses the gravel as protection when they lay their eggs between the rocks. Current threats to the survival of this species include dams or stream channelization that disrupt natural flow, temperature changes, overcollecting, competition with other species, and water quality degradation from siltation or industrial and urban runoff (USFWS, 1983b) (IUCN, 2014).

***Spring Pygmy Sunfish.*** The spring pygmy sunfish is the smallest member of the *Ellassoma* genus, reaching less than 1 inch in length. Males are smaller than females; both have dark to black coloring with iridescent blue-green markings on the sides, cheeks, and gill covers. Both have vertical bars on their flanks (USFWS, 2012d). The spring pygmy sunfish was federally listed as threatened in 2013 (78 FR 60766 60783, October 2, 2013) (USFWS, 2015ax).

This species can be found in spring pools in Limestone County, northern Alabama; it is also believed to occur in Madison County (USFWS, 2016i). Its preferred habitat is colorless to slightly stained spring water in the spring head or pool, containing submerged and emerged vegetation. Threats to the spring pygmy sunfish include habitat modification from development, groundwater and surface water withdrawals, and water contamination (USFWS, 2012d).

***Vermilion Darter.*** The vermilion darter is a medium-sized darter reaching almost 3 inches in length. It is distinguished by its reddish-orange (vermilion) coloring on the lower sides and belly. Males have a bright red spot between the first spines of the upper fin (USFWS, 2007a). The vermilion darter was federally listed as endangered in 2001 (66 FR 59367 59373, November 28, 2001) (USFWS, 2015ay).

This species can only be found in parts of Jefferson County in central Alabama, including the upper mainstem of Turkey Creek and four tributaries (USFWS, 2016j). Critical habitat was designated in Jefferson County in 2010 (75 FR 75913 75931, December 7, 2010). Its habitat is characterized by streams with pools of moderate current alternating with riffles of swift current, and low water cloudiness. Threats to the vermilion darter include water quality degradation from sedimentation and other pollutants, altered flow from construction and maintenance activities, impoundments, gravel extractions, off-road vehicle usage, and inadequate stormwater management (USFWS, 2010a).

***Watercress Darter.*** The watercress darter is a small fish, growing to just over 2 inches in length. Breeding males have red-orange and blue colored fins, and red-orange coloring on the lower part of the body (USFWS, 1993a). The watercress darter was federally listed as endangered in 1970 (35 FR 16047 16048, October 13, 1970) (USFWS, 2015az).

This species occurs in springs in Jefferson County in central Alabama. It inhabits deep, slow moving springs that are crowded with aquatic vegetation such as watercress. The greatest threat to the watercress darter is loss of water quality and quantity due to nearby development (USFWS, 1993a).

### Amphibians

There is one federally listed threatened species for Alabama summarized in Table 3.1.6-7. The Red Hills Salamander (*Phaeognathus hubrichti*) occurs in six counties in southern Alabama (USFWS, 2010b). The Black Warrior Waterdog (*Necturus alabamensis*) has been identified a candidate species in Alabama. Information on the habitat, distribution, and threats to the survival and recovery of the listed species in Alabama is provided below.

**Table 3.1.6-7: Federally Listed Amphibian Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Red Hills Salamander | *Phaeognathus hubrichti* | T | No | Relatively mature, undisturbed hardwood forest located on steep slopes and moist ravines. Found within the Red Hills region of southern Alabama in portions of six counties. |

[a] T = Threatened
Source: (USFWS, 2015b) (USFWS, 2015c)

***Red Hills Salamander.*** The Red Hills salamander is a large, burrowing salamander that grows to a length of 11 inches. This dark brown colored salamander has no distinct markings. Without lungs, this salamander breathes through its moist skin (USFWS, 2010b). The Red Hills salamander was federally listed as threatened in 1976 (41 FR 53032 53034, December 3, 1976) (USFWS, 2015bb).

This species can only be found within the Red Hills region of southern Alabama in portions of seven counties (USFWS, 2010b) (USFWS, 2016q). This species prefers mature, undisturbed hardwood forest found along steep slopes and wet ravines. Living in small burrows, this species only leaves to prey on nearby invertebrates. The greatest threat to this species is severe soil disturbance from logging, conversion of deciduous forest to pine plantations, and intensive site preparation (USFWS, 2010b).

### Invertebrates

There are 52 endangered and 15 threatened invertebrate species that are federally listed for Alabama as summarized in Table 3.1.6-8. Further information on the habitat, distribution, and threats to the survival and recovery of each of these species in Alabama is provided below.

**Table 3.1.6-8: Federally Listed Invertebrate Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Alabama Cave Shrimp | *Palaemonias alabamae* | E | No | Silt-bottomed cave pools, with moderate stable temperatures and no visible light. Found in 5 caves in Madison County, northern Alabama. |
| Alabama Heelsplitter | *Potamilus inflatus* | T | No | Inhabits sand, mud, silt, and sandy-gravel substrates. Occurs in Tombigbee and Black Warrior Rivers in 14 counties in western Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Alabama Lampmussel | *Lampsilis virescens* | E/XN | No | Inhabits sand and gravel substrates in small to medium sized streams, preferring tributary streams. Found in the Paint Rock River system in Jackson, Madison, and Marshall Counties, northeastern Alabama. Experimental population is found in Tennessee River system in Colbert and Lauderdale Counties, northwestern Alabama. |
| Alabama Moccasinshell | *Medionidus acutissimus* | T | Yes; in Alabama, portions of the Buttahatchee River, Sucarnoochee River, North River, Cahaba River, and Lower Coosa River tributaries and drainages. | Sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers. Found in 23 counties throughout Alabama. |
| Alabama Pearlshell | *Margaritifera marrianae* | E | Yes; Big Flat Creek, Burnt Corn Creek, Murder Creek, and Sepulga River. | Small streams with mixed sand and gravel substrates, sometimes sandy mud, in slow to moderate currents. Found in a few tributaries of the Alabama and Escambia River drainages in 5 counties. |
| Anthony's Riversnail | *Athearnia anthonyi* | E/XN | No | Usually found on large submerged objects or gravelly substrate in shallow, moderately to fast-flowing waters. Found in the Tennessee River in Jackson County, and Limestone Creek in Limestone and Morgan Counties in northern Alabama. |
| Armored Snail | *Pyrgulopsis pachyta* | E | No | Inhabits submerged tree roots and mosses along streams in areas of slow to moderate flow. Found in Piney and Limestone Creeks, Limestone and Madison Counties in northern Alabama. |
| Chipola Slabshell | *Elliptio chipolaensis* | T | Yes; in Alabama, the Chipola River in Houston and Russell Counties. | Silty sand sloping banks of large creeks and the main channel of the Chipola River in slow to moderate currents. Found in Houston County in southwestern Alabama. |
| Choctaw Bean | *Villosa choctawensis* | E | Yes; Lower Escambia River Drainage, Yellow River Drainage, Florida, Alabama. | Medium creeks and rivers with moderate currents in stable substrates of silty sand to sandy clay; in Escambia, Yellow, and Choctawhatchee River drainages of southern Alabama and Florida. |
| Coosa Moccasinshell | *Medionidus parvulus* | E | Yes; in Alabama, within the Coosa River and several of its tributaries. | Sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers. Found in 9 counties in east-central Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Cracking Pearlymussel | *Hemistena lata* | E/XN | No | Medium-sized rivers with swift-moving, turbulent water over gravel and cobble bottoms; found in the Tennessee River in Limestone County, northern Alabama. |
| Cumberland Bean (pearlymussel) | *Villosa trabalis* | E/XN | No | Small rivers and streams with clean fast flowing water and sand and gravel substrates in riffle and shoal areas; found in Jackson County, northern Alabama. |
| Cumberland Monkeyface (pearlymussel) | *Quadrula intermedia* | E/XN | No | Rivers of swift currents with sand and gravel substrates in riffle and shoal areas; found in a section of the Tennessee River in Colbert and Lauderdale Counties, northwestern Alabama. |
| Cumberlandian Combshell | *Epioblasma brevidens* | E/XN | Yes; a portion of the Tennessee River in Colbert and Lauderdale Counties. | Rivers of swift currents with sand and gravel substrates in riffle and shoal areas; found in Bear Creek, Colbert County, northwestern Alabama. |
| Cylindrical Lioplax (snail) | *Lioplax cyclostome-formis* | E | No | Inhabits isolated mud deposits found under large rocks in the rapid flowing sections of shoals of the Cahaba River above the Fall Line in 4 counties of central Alabama. |
| Dark Pigtoe | *Pleurobema furvum* | E | Yes; Sipsey Fork, North River, and Locust Fork, northwest Alabama. | Sand or gravel shoals and rapids in small rivers and large streams; found in 9 counties in northwestern Alabama. |
| Dromedary Pearlymussel | *Dromus dromas* | E/XN | No | Shoal areas in rivers within moderately moving water, and with sand and gravel bottoms; found in Colbert and Lauderdale Counties in the northwestern corner of Alabama. |
| Fanshell | *Cyprogenia stegaria* | E | No | Moderate flowing large rivers with sand and gravel; found in Colbert and Lauderdale Counties in northwestern Alabama. |
| Finelined Pocketbook | *Lampsilis altilis* | T | Yes, in Alabama, within the Cahaba River, Tallapoos River, and Coosa River drainage and tributaries. | Stable sand/gravel/cobble substrate in moderate to swift currents in small streams above the Fall Line in east-central Alabama. |
| Finerayed Pigtoe | *Fusconaia cuneolus* | E/XN | No | Silt-free sand, gravel, and cobble substrates of free-flowing smaller streams; found in Jackson, Madison, and Marshall Counties, northern Alabama. |
| Flat Pebblesnail | *Lepyrium showalteri* | E | No | Shoals and rapids of the Cahaba River above the Fall Line in Bibb and Shelby Counties, central Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Flat Pigtoe | *Pleurobema marshalli* | E | No | Sand and gravel shoals in rivers and streams; found in the Tombigbee River in Pickens County, western Alabama. |
| Fuzzy Pigtoe | *Pleurobema strodeanum* | T | Yes; Lower Escambia River Drainage, Yellow River Drainage, Choctawhatchee River and Lower Pea River Drainages, Florida and Alabama. | Medium creeks to rivers with slow to moderate currents in stable substrates of sand and silty sand; found in the Escambia, Yellow, and Choctawhatchee River drainages in southern Alabama and Florida. |
| Georgia Pigtoe | *Peurobema hanleyianum* | E | Yes; in Alabama, Terrapin Creek and the Coosa River, and Hatchet Creek. | Shallow runs and riffles of strong to moderate currents and sand/gravel/cobble bottoms. Found in Cherokee, Clay, and Coosa Counties, eastern Alabama. |
| Gulf Moccasinshell | *Medionidus penicillatus* | E | Yes; in Alabama, the Chipola River in Houston County. | Channels of small to medium-sized creeks to large rivers with sand and gravel or silty sand in slow to moderate currents. Found in Houston County, southeastern Alabama. |
| Heavy Pigtoe | *Pleurobema taitianum* | E | No | Streams and rivers on sand and gravel shoals; found in 7 counties in western and central Alabama. |
| Interrupted Rocksnail | *Leptoxis foremani* | E | Yes; 63 miles of stream channels in the Coosa River drainage. | Shoal habitats with a sand and boulder substrate, minimal sediment and algae growth, and flowing water. Found in the Lower Coosa River of eastern and central Alabama. |
| Lacy Elimia (snail) | *Elimia crenatella* | T | No | Highly oxygenated waters on rock shoals and gravel bars. Found in tight clusters or colonies on larger rocks. Found in the Coosa River drainage in Talladega County, central Alabama. |
| Littlewing Pearlymussel | *Pegias fabula* | E | No | Medium-sized rivers and streams with high gradient and cool clear water; found in Lauderdale and Limestone Counties, northwestern Alabama. |
| Mitchell's Satyr Butterfly | *Neonympha mitchellii* | E | No | Low nutrient wetlands that receive carbonate rich groundwater; found in 4 counties in southwestern Alabama. |
| Narrow Pigtoe | *Fusconaia escambia* | T | Yes; Lower Escambia River Drainage, Yellow River Drainage, Florida and Alabama. | Medium creeks to rivers with slow to moderate current in stable substrates of sand, sand and gravel, or silty sand; found in Escambia River drainage in 9 counties in southeastern Alabama and Florida. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Orangefoot Pimpleback (pearlymussel) | *Plethobasus cooperianus* | E | No | Sand and gravel substrate of rivers; found in Colbert and Lauderdale Counties in the northwestern corner of Alabama. |
| Orangenacre Mucket | *Lampsilis perovalis* | T | Yes; Buttahatchee River, Sipsey River, Sucarnoochee River, North River, Cahaba River, and Alabama River and their creeks and tributaries. | Stable sand, gravel, and cobble substrate in moderate to swift currents in streams and small rivers. Found in the Alabama River and tributaries, streams of the Tombigbee and Black Warrior Rivers, and the Cahaba River and tributaries in 26 counties in Alabama. |
| Oval Pigtoe | *Pleurobema pyriforme* | E | Yes; in Alabama, the Chipola River. | Small to medium-sized creeks to small rivers usually in slow to moderate current and in silty sand to sand and gravel. Found in 9 counties in eastern Alabama. |
| Ovate Clubshell | *Pleurobema perovatum* | E | Yes; Buttahatchee River, Sipsey River, Sucarnoochee River, North River, Cahaba River, and the Coosa River and their streams and tributaries. | Sand and gravel shoals and runs of small rivers and large streams. Found in 39 counties throughout Alabama. |
| Oyster Mussel | *Epioblasma capsaeformis* | E/XN | Yes; Tennessee River in Colbert County. | Medium-sized to larger rivers in areas with coarse sand; found in the Tennessee River in Colbert County, northwestern Alabama. |
| Painted Rocksnail | *Leptoxis taeniata* | T | No | Attaches to cobble, gravel, or other hard substrates in strong currents of riffles and shoals. Found in the lower reaches of 3 Coosa River tributaries in four counties in central Alabama. |
| Pale Lilliput (pearlymussel) | *Toxolasma cylindrellus* | E | No | Small rivers and streams in shallow, fast-flowing water with a stable, clean substrate. Found in the Paint Rock River drainage in Jackson County, northeastern Alabama. |
| Pink Mucket (pearlymussel) | *Lampsilis abrupta* | E | No | Major rivers and their tributaries with mud and sand in shallow riffle areas; found in 8 counties in northern Alabama. |
| Plicate Rocksnail | *Leptoxis plicata* | E | No | Shallow gravel and cobble shoals in flowing water. Found in the Locust Fork of the Black Warrior River, Blount and Jefferson Counties, central Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Purple Bankclimber (mussel) | *Elliptoideus sloatianus* | T | No | Inhabits small to large river channels in slow to moderate currents of sand or sand mixed with mud or gravel. Found in Lee and Russell Counties, eastern Alabama. |
| Rabbitsfoot (mussel) | *Quadrula cylindrica* | T | Yes; inhabited streams in northern Alabama. | Shallow area of streams and rivers with sand and gravel along the banks; found in 5 counties in northern Alabama. |
| Ring pink (mussel) | *Obovaria retusa* | E | No | Inhabits shallow waters over silt-free sand and gravel bottoms of large rivers. |
| Rough Hornsnail | *Pleurocera foremani* | E | Yes; 17 miles of stream channels in the Coosa River drainage; Lower Coosa River in Elmore County, Alabama, and Yellowleaf Creek in Shelby County. | Gravel, cobble, bedrock, and mud substrates in moderate currents. Found in the Coosa River system in 5 counties in central Alabama. |
| Rough Pigtoe | *Pleurobema plenum* | E | No | Shoal areas of medium to large rivers with sand and gravel river bottoms; found in 7 counties in northern Alabama. |
| Round Rocksnail | *Leptoxis ampla* | T | No | Cobble, gravel or other hard substrates in the strong currents of riffles and shoals in the Cahaba River drainage in Bibb, Jefferson, and Shelby Counties, central Alabama. |
| Round Ebonyshell | *Fusconaia rotulata* | E | Yes; Lower Escambia River Drainage, Florida, and Alabama. | Small to medium rivers with slow to moderate currents, usually in firm substrates of sand, small gravel, or sandy mud; found only in the main channel of the Escambia-Conecuh River drainage in southern Alabama and Florida. |
| Sheepnose Mussel | *Plethobasus cyphyus* | E | No | Large rivers and streams with moderate to swift currents and shallow shoal habitats; found in 7 counties in northern Alabama. |
| Shiny Pigtoe | *Fusconaia cor* | E/XN | No | Large streams with silt-free substrates of sand, gravel, and cobble; found in 3 counties in northern Alabama. |
| Shinyrayed Pocketbook | *Lampsilis subangulata* | E | Yes; in Alabama, the Chipola River. | Small to medium-sized creeks or rivers in clean or silty sand in slow to moderate currents. Found in 4 counties in eastern Alabama. |
| Slabside Pearlymussel | *Pleuronaia dolabelloides* | E | Yes; stream channels in 5 counties in northern Alabama. | Large creeks and rivers with sand and gravel bottoms and moderate currents; found in 5 counties in northern Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Slender Campeloma | *Campeloma decampi* | E | No | Found burrowing in soft sand or mud sediments, or dead organic material in creeks and rivers in Lauderdale, Limestone, and Madison Counties in northern Alabama. |
| Snuffbox Mussel | *Epioblasma triquetra* | E | No | Small to medium-sized creeks, lakes, and rivers with shoal habitats and swift currents; found in 8 counties in northern Alabama. |
| Southern Acornshell | *Epioblasma othcaloogensis* | E | Yes; in Alabama, the Cahaba River and Coosa River and their creeks and tributaries. | Gravel or sand substrates in medium to large rivers with moderate currents. Found in the upper Coosa River drainage and the Cahaba River in 11 counties in east-central Alabama. |
| Southern Clubshell | *Pleurobema decisum* | E | Yes; in Alabama, the Buttahatchee River, Sucarnoochee River, Cahaba River, Alabama River, and Coosa River tributaries and drainages. | Sand/gravel/cobble substrate in shoals and runs of small rivers and large streams. Found in 39 counties throughout the state. |
| Southern Combshell | *Epioblasma penita* | E | No | Rivers and streams with sand and gravel beds. Found in Lamar and Marion Counties in northwestern Alabama. |
| Southern Pigtoe | *Pleurobema georgianum* | E | Yes; in Alabama, the critical habitat is within the Coosa River and its tributaries and creeks. | Sand/gravel/cobble substrate in shoals and runs of small rivers and large streams. Found in 13 counties from central to eastern Alabama. |
| Southern Kidneyshell | *Ptychobranchus jonesi* | E | Yes; in Alabama, Upper Escambia River, Lower Escambia River, Patsaliga Creek, Choctawhatchee River, Upper Pea River, and Lower Pea River. | Medium creeks to small rivers with slow to moderate currents in firm sand substrates, preferably near bedrock outcroppings; found only in the Choctawhatchee River drainage in southern Alabama and Florida. |
| Southern Sandshell | *Hamiota australis* | T | Yes; in Alabama, Upper Escambia River, Lower Escambia River, Patsaliga Creek, Choctawhatchee River, Upper Pea River, Lower Pea River, and Yellow River. | Small creeks and rivers with slow to moderate currents in stable substrates of sand or mixtures of sand and fine gravel; found in the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee River drainages in southern Alabama and Florida. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Spectaclecase (mussel) | *Cumberland-ia monodonta* | E | No | Found in 7 counties in northern Alabama.<br>Suitable habitat for the spectaclecase mussel includes sheltered areas in large rivers. This species seeks out areas that are sheltered from the force of the river current such as beneath rock slabs, firm mud banks, and in-between tree roots. Spectaclecase mussels spend their entire lives partially or completely buried in river bottom substrate, and some specimens have been recorded up to 70 years old. |
| Stirrupshell | *Quadrula stapes* | E | No | Rivers and streams with sand and gravel beds. Found throughout Alabama. |
| Tapered Pigtoe | *Fusconaia burkei* | T | Yes; Choctawhatchee River and Lower Pea River Drainages, Florida and Alabama. | Medium creeks to rivers with slow to moderate currents in stable substrates of sand, small gravel, or sandy mud; found in the Choctawhatchee River drainage in southern Alabama and Florida. |
| Triangular Kidneyshell | *Ptychobranchus greenii* | E | Yes; in Alabama, within North River, Cahaba River, Coosa River, and associated creeks and tributaries. | Sand/gravel/cobble substrate in shoals and runs of small rivers and large streams. Found in 19 counties in north-central Alabama. |
| Tulotoma Snail | *Tulotoma magnifica* | T | No | Found grouped in colonies under large rocks or boulders in shoals and runs with moderate to swift currents. Found only in the Coosa River drainage in 11 counties in central Alabama. |
| Upland Combshell | *Epioblasma metastriata* | E | Yes; in Alabama, parts of the Coosa and Cahaba River and their creeks and tributaries in the Mobile River Basin. | Stable sand, gravel, or cobble substrate in moderate to swift currents on shoals in rivers and large streams. Found in 20 counties in the Mobile River Basin in central Alabama. |
| White Wartyback (pearlymussel) | *Plethobasus cicatricosus* | E | No | Gravel and sand substrate free of silt, in clean, fast-flowing water in large rivers. Found in Colbert and Lauderdale Counties, in the northwestern corner of Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Yellow Blossom (pearlymussel) | *Epioblasma florentina florentina* | E/XN | No | Shallow areas of rivers with a sand or gravel substrate and rapid current. Found in the Tennessee River and its tributaries throughout Alabama; experimental population in Colbert and Lauderdale Counties in northwestern Alabama. |

[a] E = Endangered, T = Threatened, XN = Non-Essential Experimental Population
Source: (USFWS, 2015b) (USFWS, 2015c)

***Alabama Cave Shrimp.*** The Alabama cave shrimp is a translucent, freshwater crustacean of about 1 inch in length. It is distinguishable from other shrimp as its first and second legs are the same length (USFWS, 1997d). The Alabama cave shrimp was federally listed as endangered in 1988 (53 FR 34696 34698, September 7, 1988) (USFWS, 2015bc).

This species can be found in five caves in Madison County, northern Alabama; but is also believed to occur in Jackson, Limestone, Marshall, and Morgan Counties (USFWS, 2016aa). Its habitat within these caves consists of silt-bottomed pools having moderate stable temperatures, calm waters, and no visible light. The shrimp depend on organic material carried into the caves by flowing water. The main threats to the Alabama cave shrimp are nonpoint source groundwater contamination, habitat destruction, predation, and collecting (USFWS, 1997d).

***Alabama Heelsplitter.*** The Alabama heelsplitter, or inflated heelsplitter, has an oval, thin shell and grows up to about 5.5 inches in length. The shell is brown to black in color; young specimens sometimes have green rays. The inner shell has a pink to purple color. The Alabama heelsplitter was federally listed as threatened in 1990 (55 FR 39868 39872, September 28, 1990) (USFWS, 2015bd).

This species can be found regionally in rivers throughout Alabama, Louisiana, and Mississippi. In Alabama, it occurs in the Tombigbee and Black Warrior Rivers in 14 counties in the western part of the state. It inhabits sand, mud, silt, and sandy-gravel substrates. This species is found on soft, stable substrate within waters of slow to moderate currents. Threats to the Alabama heelsplitter include habitat destruction due to sand and gravel mining, impoundments, and channel maintenance (dredge disposal) (USFWS, 1993b).

***Alabama Lampmussel.*** The Alabama lampmussel is a freshwater mussel that grows to less than 3 inches in length with a moderately thick tawny to greenish yellow shell, with an inner white shell. The Alabama lampmussel was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976) and a non-essential experimental population was established in 2001 (66 FR 32250 32264, June 14, 2001) (USFWS, 2015be).

The endangered population can be found in the Paint Rock River system in Jackson, Madison, and Marshall Counties, located in northeastern Alabama. The experimental population can be found in the Tennessee River system in Colbert and Lauderdale Counties, northwestern Alabama. This species inhabits sand and gravel substrates of tributary streams. Threats to the

Alabama lampmussel include channelization, pollution (e.g., pesticides and fertilizers), dredging, impoundments, siltation, and habitat loss resulting from development (USFWS, 1985a).

***Alabama Moccasinshell.*** "The Alabama moccasinshell is a small, delicate species, approximately 30 mm (1.2 in) in length. The shell is narrowly elliptical, and thin, with a well-developed acute posterior ridge that terminates in an acute point on the posterior ventral margin. The posterior slope is finely corrugated. The periostracum is yellow to brownish yellow, with broken green rays across the entire surface of the shell. The thin nacre is translucent along the margins and salmon-colored in the umbos (beak cavity)" (USFWS, 2003c). The species was federally listed as threatened in 1993 (58 FR 14330 14340, March 17, 1993). Historically, the species is known to occur in Alabama, Mississippi, Georgia, and Tennessee within the Alabama River and tributaries, the Tombigbee River and tributaries, the Black Warrior River and tributaries, the Cahaba River, and the Coosa River and tributaries. In Alabama, the species is known or believed to occur in 25 counties in Alabama (USFWS, 2015bf). Critical habitat for the Alabama moccasinshell has been designated in Alabama, Mississippi, Georgia, and Tennessee; in Alabama, the critical habitat includes portions of the Buttahatchee River, Sucarnoochee River, North River, Cahaba River, and Lower Coosa River tributaries and drainages (USFWS, 2015bf) (69 FR 40084 40171, July 1, 2004).

The Alabama moccasinshell inhabits sand/gravel/cobble shoals having moderate to strong currents within streams and small rivers (USFWS, 2015bf). Sedimentation, habitat modification, eutrophication, and degraded water quality are the primary causes of the decline of the Alabama moccasinshell (USFWS, 2015ba).

***Alabama Pearlshell.*** The Alabama pearlshell is an oblong freshwater mussel up to 3.8 inches in length. With a smooth and shiny outer shell, the Alabama pearlshell has a whitish or purplish inner shell that is slightly iridescent (USFWS, 2012e). The Alabama pearlshell was federally listed as endangered in 2012 (77 FR 61663 61719, October 10, 2012).

This species can be found in a few tributaries of the Alabama and Escambia River drainages in Conecuh, Crenshaw, Escambia, Monroe, and Wilcox Counties in southern Alabama. Critical habitat was designated in Big Flat Creek, Burnt Corn Creek, Murder Creek, and Sepulga Rivers in Alabama at the time of listing. It inhabits small streams with mixed sand and gravel substrates, sometimes sandy mud, in slow to moderate current. Threats to the Alabama pearlshell include habitat modification resulting from land use and pollution (USFWS, 2012e) (USFWS, 2015bg).

***Anthony's Riversnail.*** The Anthony's riversnail is a freshwater snail that grows a shell of about 1 inch in size. The shell is olive green to yellowish brown in color, with a shell whorl of purple or brown bands. Juveniles are equal in width and length, with the shell elongated as the snail gets older (USFWS, 1997e).

Anthony's riversnail was federally listed as endangered in Alabama in 1994 (59 FR 17994 17998, April 15, 1994). A non-essential experimental population was established in Alabama and Georgia in 2001 (66 FR 32250 32264, June 14, 2001). The endangered population occurs in the Tennessee River in Jackson County and Limestone Creek in Limestone and Morgan

Counties, northern Alabama; it is also believed to occur in Madison County. This species is found on large submerged objects, such as rocks, or gravelly substrate in shallow waters with moderate to fast currents. Main threats to the Anthony's riversnail include habitat fragmentation and water quality deterioration resulting from impoundments, sedimentation, pollutants, and channelization (USFWS, 1997e) (USFWS, 2015bh).

***Armored Snail.*** The armored snail reaches no more than 0.2 inches in length. It can be identified by its cone shape, thick shell, and "complete peristome (edge of the opening)"next to the main body of the shell (USFWS, 2000a). The armored snail was federally listed as endangered in 2000 (65 FR 10033 10039, February 25, 2000).

This species can only be found in Piney and Limestone Creeks and Limestone and Madison Counties in northern Alabama (USFWS, 2000a). The armored snail inhabits submerged tree roots and mosses along streams in areas of slow to moderate currents. Threats include habitat loss and water quality degradation, siltation, and pollution (USFWS, 2000a) (USFWS, 2015bi).

***Chipola Slabshell.*** The Chipola slabshell is a mussel about 3 inches in length. Its shell is smooth with light brown coloring, with alternating dark and light stripes or bands (USFWS, 2003d). The Chipola slabshell was federally listed as threatened in 1998 (63 FR 12664 12687, March 16, 1998). This species is found in the middle portion of the Chipola River system in Houston County, southwestern corner of Alabama; it is also believed to occur in Geneva County. The Chipola River in Houston and Russell Counties is designated as critical habitat for the Chipola slabshell (USFWS, 2015bk) (72 FR 64286 64340, November 15, 2007).

Adult chipola slabshells are ideally found in contained patches in streams and almost completely burrowed in the sediment. The Chipola slabshell inhabits sloping banks of large creeks and the main channel of the Chipola River in slow to moderate currents in sandy areas. Threats to the Chipola slabshell include habitat loss, population fragmentation, impoundments, water quantity (withdrawals), and nonnative (invasive) species. (FFWCC, 2012) (72 FR 64286 64340, November 15, 2007)

***Choctaw Bean.*** The Choctaw bean is an oval shaped freshwater mussel about 2 inches in length. This greenish-brown mussel has thin green rays on its outer shell and a bluish white or brownish iridescent inner shell. The Choctaw bean was federally listed as endangered in 2012 (77 FR 61663 61719, October 10, 2012).

This species is found in medium creeks to rivers with moderate current in sand to sandy clay substrates. Its current range is the Escambia, Yellow, and Choctawhatchee River drainages of Alabama and Florida; it is known or believed to occur in 16 counties in Alabama (USFWS, 2016s). Critical habitat was designated at the time of listing within the Lower Escambia River Drainage and Yellow River drainages in Florida and Alabama. The greatest threat to the Choctaw bean is habitat loss and degradation from sedimentation, water quality degradation, and environmental contaminants (USFWS, 2016k) (77 FR 61663 61719, October 10, 2012).

***Coosa Moccasinshell.*** The Coosa moccasinshell is a think elongated mussel occasionally exceeding 1.6 inches in length. The outer shell is yellow to dark brown with green rays, with a blue inner shell typically. Historically, the species range included rivers and creeks across

Alabama, Georgia, and Tennessee. Presently in Alabama, the species is believed to occur in 13 counties in the east-central portion of the state (USFWS, 2016w). Critical habitat in Alabama is designated within the Coosa River and several of its tributaries. The species was federally listed as endangered in 1993. (USFWS, 2015bl) (58 FR 14330 14340, March 17, 1993) (69 FR 40084 40171, July 1, 2004)

The Coosa moccasinshell inhabits small creeks and rivers with sand/gravel/cobble shoals having moderate to strong currents. Threats to this species include habitat modification, sedimentation, eutrophication, and water quality degradation (Alabama Power Company, 2007).

***Cracking Pearlymussel.*** The cracking pearlymussel is a freshwater mussel with a flattened, stretched shell. The outer shell is dark green to brown with green bands, and a light blue to purple inner shell (USFWS, 1991b). The cracking pearlymussel was federally listed as endangered in 1989 (54 FR 39850 39853, September 28, 1989). A non-essential experimental population was established in Alabama in 2001 (66 FR 32250 32264, June 14, 2001). Regionally, the endangered population is found from the western stretch of Virginia to the northeastern area of Alabama (USFWS, 2015bm). The cracking pearlymussel is only known to occur in the Tennessee River in Limestone County, northern Alabama (USFWS, 1991b).

Habitat for this species includes medium-sized swift, turbulent rivers over bottoms of sand, gravel, mud, and cobble. Threats to the species include habitat degradation, damming, water quality and degradation, and water flow rates (USFWS, 1991b).

***Cumberland Bean (pearlymussel).*** The Cumberland bean is a long, oval shaped freshwater mussel that grows to approximately 2.2 inches. Its shell is smooth and olive green, yellowish to brown, or blackish colored with dark green rays (USFWS, 2011b). The Cumberland bean was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976) and an experimental population was established in Alabama in 2001 (72 FR 52434 52461, September 13, 2007). Regionally, this species is known to occur in Alabama, Kentucky, North Carolina, and Virginia. The Cumberland bean is known to occur in Jackson County, in the northern portion of Alabama (USFWS, 2015bn).

Suitable habitats for the Cumberland bean consist of small rivers and streams having clean fast-flowing water over sand and gravel substrates. Similar to other mussels, this species' reproduction cycle is tied to the fantail darter (*Etheostoma flabellare*) and striped darter (*Etheostoma virgatum*) as their host fish. Current threats to this species include channelization, impoundments, siltation, and pollution (USFWS, 1984b) (USFWS, 2011b).

***Cumberland Monkeyface (pearlymussel).*** The Cumberland monkeyface is a freshwater mussel of approximately 3 inches in length. This mussel has a green yellow outer shell with dark green dots and chevrons. Similar to the Appalachian monkeyface mussel, the Cumberland mussel is only differentiated by carefully comparing shell features, markings, and valve sizes (USFWS, 1984c). The species was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976) and was introduced as an experimental population in portions of Alabama in 2001 (72 FR 52434 52461, September 13, 2007) (USFWS, 2015bo). Historically, the species was found across the Cumberland and Tennessee River basins. In Alabama, it is found in a section of the

Tennessee River in Colbert and Lauderdale Counties, in the northwest corner of the state (USFWS, 2007b).

Suitable habitats for this species include swift flowing rivers with sand and gravel bottoms in riffle and shoal areas (USFWS, 1984c). Threats include water quality degradation, pollution, sedimentation, water flow alterations, and nonnative (invasive) species, such as the Asian Clam (*Corbicula fluminea*) and Zebra mussel (*Dreissena polymorpha*) (Terwilliger, Tate, & Woodward, 1995) (USFWS, 1984c).

***Cumberlandian Combshell.*** The Cumberlandian combshell is a freshwater mussel approximately two to three inches long. Its yellow shell is marked by lines of fine green broken dots and dashes (USFWS, 2004b). The species was federally listed as endangered in 1997 (62 FR 1647 1658, January 10, 1997) and designated with critical habitat in 2004 (69 FR 53136 53180, August 31, 2004). In 2001, experimental populations were introduced in portions of the Tennessee River valley of Alabama (66 FR 32250 32264, June 14, 2001). It is known to occur in Alabama, Kentucky, Mississippi, and Virginia (USFWS, 2015bp). In Alabama, it is found in a short reach of Bear Creek, Colbert County, in the northwestern corner of the state (USFWS, 2004b). Designated critical habitat in Alabama is along 25 miles of Bear Creek in Alabama and Mississippi (69 FR 53136 53180, August 31, 2004).

Suitable habitats for the Cumberlandian combshell are shoals in fast moving rivers having sand and gravel substrates (USFWS, 2004b) (USFWS, 2015bp). Historically, the species experienced significant challenges to water quality degradation from coal mining, construction activities, riverine development (such as channelization and building of dams), and collection by pearl hunters (USFWS, 2004b).

***Cylindrical Lioplax (snail).*** The cylindrical lioplax is a gill-breathing snail that grows up to 1.1 inches in length. Its elongated outer shell is a light to dark olive-green color with an inner bluish colored shell (USFWS, 2015bq). The cylindrical lioplax was federally listed as endangered in 1998 (63 FR 57610 57620, October 28, 1998).

This species can only be found in Bibb, Jefferson, Shelby, Talladega, and Tuscaloosa Counties in central Alabama (USFWS, 2015bq). It inhabits isolated mud deposits under large rocks of the Cahaba River above the Fall Line in Alabama. This species needs hard substrates, such as boulders, and clean water quality. Threats to the cylindrical lioplax include water quality degradation, sedimentation, and habitat loss (impoundments) (USFWS, 2005a).

***Dark Pigtoe.*** The dark pigtoe is a freshwater mussel, reaching up to 2.4 inches in length, having an oval outer dark reddish brown shell and a white iridescent inner shell (USFWS, 2000b). The dark pigtoe was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993).

This species only occurs in 11 counties in northwest Alabama. Critical habitat was designated in 2004 for the dark pigtoe in Sipsey Fork, North River, and Locust Fork, Alabama (69 FR 40084 40171, July 1, 2004) (USFWS, 2004d) (USFWS, 2015br). It inhabits sand or gravel shoals in small fast-flowing rivers and large streams. Threats to the dark pigtoe include habitat alterations, sedimentation, and water quality degradation (USFWS, 2000b) (USFWS, 2015br).

***Dromedary Pearlymussel.*** The dromedary pearlymussel is a freshwater mussel named for its mid-shell hump observed on larger specimens, reaching a length of approximately 3.5 inches long. The shell is mostly round, with a lighter brown color interspersed by green discolorations and streaks, whose growth lines are often bumpy. The dromedary pearlymussel was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). The species is found regionally in Virginia and Alabama, with a non-essential experimental population established in Tennessee in 2007 (72 FR 52434 52461, September 13, 2007). It is found in Colbert, Franklin, and Lauderdale Counties in northwestern Alabama (USFWS, 1983c) (USFWS, 2015bs).

Suitable habitat for the species consists of shoals in moderately moving rivers having sand and gravel bottoms, and it has also been found in deeper, slower moving portions of rivers. Threats to the dromedary pearlymussel include pollution, habitat degradation, and nonnative (invasive) species, such as the Asian clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*) (USFWS, 1983c)(Terwilliger, Tate, & Woodward, 1995).

***Fanshell.*** The fanshell is a freshwater mussel having a light green to yellow shell with green rays (USFWS, 1991c). It was federally listed as endangered in 1990 (55 FR 25591 25595, June 21, 1990). This species is known to occur in Alabama, Illinois, Indiana, Kentucky, Ohio, Virginia, and West Virginia with a non-essential experimental population established in Tennessee in 2007 (72 FR 52434 52461, September 13, 2007). In Alabama, it is found in Colbert and Lauderdale Counties in the northwestern corner of the state (USFWS, 1991c) (USFWS, 2015bt).

Suitable habitat for the fanshell consists of large moderate flowing rivers with sand and gravel bottoms. This species needs a stable substrate to bury itself in, leaving only its feeding siphons and the edge of its shell exposed. Fanshells require a host fish to complete their larval development as the fanshell larvae attach to the host’s gill. Threats to the fanshell include habitat alteration from dams and reservoirs, water quality degradation, siltation, pollution, and industrial runoff (USFWS, 1997f).

***Finelined Pocketbook.*** The finelined pocketbook is a mussel approximately 4 inches in length. The outer shell is yellow-brown with black fine rays, with a white iridescent inner shell. The species was federally listed as threatened in 1993 (58 FR 14330 14340, March 17, 1993). Historically, its range included Alabama, Mississippi, Georgia, and Tennessee. In Alabama, the species is known to occur in 25 counties in the east-central portion of the state. Designated critical habitat in Alabama is within the Cahaba River, Tallapoos River, and Coosa River drainages and tributaries (69 FR 40084 40171, July 1, 2004) (USFWS, 2015bu).

The finelined pocketbook was historically found in large rivers to small creeks. Threats include habitat modification, sedimentation, eutrophication, and water quality degradation. This species cannot tolerate impoundments. Remaining populations are threatened by runoff from urban and agricultural practices, channel degradation, and drainage from mining, impoundment projects, and discharges from industrial and sewage treatment plants. (USFWS, 2008c) (USFWS, 2015bu)(NatureServe, 2009a)

***Fineraγed Pigtoe.*** The finerayed pigtoe is a pearly mussel, distinguishable by its thin outer shell with green rays over a yellow-green to brown coloration (USFWS, 1984d). The finerayed pigtoe was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). In 1984, only seven populations were known to exist within its range in Virginia, Tennessee, and Alabama. Since then, two of the seven populations have been considered extirpated.[107] In Alabama, nonessential experimental populations were created in 2001 in the Tennessee River (66 FR 32250 32264, June 14, 2001) (USFWS, 2007c) (USFWS, 2015bv). Despite its continued decline, the finerayed pigtoe is considered a stable species given a population in Clinch River, Virginia population (USFWS, 2013d). In Alabama, this species can be found in Jackson, Madison, and Marshall Counties in the northern portion of the state (USFWS, 2015bv).

Suitable habitat for the finerayed pigtoe consists of silt-free sand, gravel, and cobble substrates in small streams (USFWS, 2015bv). Since the early 1900s, land use changes from industrial and agricultural development caused declines in this species. Threats to this species are habitat alteration and pollution (USFWS, 2013d).

***Flat Pebblesnail.*** The flat pebblesnail has a relatively large and distinct shell that can grow from 0.1 to 0.2 inches long and up to 0.2 inches wide. The dark colored shell is egg-shaped and has a depressed spire and expanded, flattened whorl. The flat pebblesnail was federally listed as endangered in 1998 (63 FR 57610 57620, October 28, 1998).

This species can be found in the Cahaba River in Bibb and Shelby Counties, located in central Alabama, although it is also believed to occur in Jefferson and Tuscaloosa Counties (USFWS, 2015bw). It inhabits shoals and rapids of the Cahaba River above the Fall Line in Alabama. It is found attached to "clean, smooth stones in rapid currents of river shoals" in clean, unpolluted water. Threats to the flat pebblesnail are water and habitat degradation due to runoff and pollution, and sedimentation (USFWS, 2005b).

***Flat Pigtoe.*** The flat pigtoe, also known as Marshall's mussel, is a bivalve[108] freshwater mollusk that grows to about 2.4 inches long, 2 inches high, and 1.2 inches wide. The shell has a shallow cavity, rounded egg-shaped outline, and a white interior (USFWS, 1989b). The flat pigtoe was federally listed as endangered in 1987 (52 FR 11162 11169, April 7, 1987).

This species is known to occur regionally in the Tombigbee River in Alabama and Mississippi. In Alabama, it is believed to be found in Pickens County in the western portion of the state (USFWS, 2015bx). It inhabits sand and gravel shoals in rivers and streams. Shells of the flat pigtoe were found during a 1984 survey of the Tombigbee River tributaries, but it has not been found alive since 1980 and may be extinct. Threats to the flat pigtoe include sedimentation, water diversion, and pollution from runoff (USFWS, 1989b).

***Fuzzy Pigtoe.*** The fuzzy pigtoe is an oval shaped mussel reaching about 3 inches in length. It has a dark brown to black outer shell, and a bluish white iridescent inner shell (USFWS, 2012g).

[107] Locally extinct.
[108] Bivalves: "A mollusk with a soft body enclosed by two distinct shells that are hinged and capable of opening and closing." (Smithsonian Institution, 2016)

The fuzzy pigtoe was federally listed as threatened in 2012 (USFWS, 2016l) (77 FR 61663 61719, October 10, 2012).

This species is found in medium creeks to rivers with slow to moderate current having sand and silty sand substrate. Its range is the Escambia, Yellow, and Choctawhatchee River drainages in southern Alabama and Florida and it is known or believed to occur in 16 counties in Alabama (USFWS, 2016m) (USFWS, 2012g). 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 (77 FR 61663 61719, October 10, 2012). The greatest threat to the fuzzy pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants (USFWS, 2012g).

***Georgia Pigtoe.*** The Georgia pigtoe grows 2 to 2.5 inches in length is oval and somewhat inflated. The surface of the shell is yellowish-tan to reddish-brown and may have concentric green rings, whereas the inner shell is white to light bluish-white (USFWS, 2015by). The species was federally listed as endangered in 2010 (75 FR 67512 67550, November 2, 2010). The Georgia pigtoe was historically found in large creeks and rivers of the Coosa River drainage of Alabama, Georgia, and Tennessee. In Alabama, the species is known from Cherokee, Clay, and Coosa Counties in the eastern portion of the state, and also believed to occur in Etowah and Tallapoosa Counties. Critical habitat for the Georgia pigtoe was designated at the time of listing in Alabama, Georgia, and Tennessee; in Alabama, the critical habitat is Terrapin Creek and the Coosa River, and Hatchet Creek (USFWS, 2015by).

Georgia pigtoe is found in shallow runs and riffles with strong to moderate current and coarse sand/gravel/cobble substrates. Threats to the species include range curtailment, the species currently only inhabits 27 river miles, dams and impoundments, water and habitat quality, and climate change. The 2014 Recovery Plan for the Georgia pigtoe, interrupted rocksnail, and rough hornsnail, reports that the “[s]mall population sizes and limited distribution… make [these species] more vulnerable to drought, severe storm events, and other potential effects of climate change.” (USFWS, 2014c).

***Gulf Moccasinshell.*** The Gulf moccasinshell has an average length of just over 2 inches and has a smooth and yellowish to greenish brown shell with thin ridges and green rays (USFWS, 2003b). The Gulf Moccasinshell was federally listed as endangered in 1998 (63 FR 12664, March 16, 1998). This species occurs throughout Econfina Creek, the Flint and Chipola River main stems, and in several Apalachicola-Chattahoochee-Flint Basin tributaries (USFWS, 2003b). In Alabama, it occurs in Geneva and Houston Counties, in the southeast corner of the state (USFWS, 2015bz). Critical habitat in Alabama has been designated in the Chipola River in Houston County (USFWS, 2007b).

Adult mussels are typically found in contained patches in streams; these individuals are typically almost completely burrowed in the stream bed. The Gulf moccasinshell inhabits the channels of small to medium-sized creeks to large rivers having sand and gravel or silty sand in slow to moderate currents. Threats to the Gulf moccasinshell include habitat loss and alteration, range restriction, impoundments, water withdrawals, and nonnative (invasive) species (USFWS, 2003b).

***Heavy Pigtoe.*** The heavy pigtoe or Judge Tait's Mussel, is a bivalve freshwater mollusk that grows to approximately 2 inches long, 1.8 inches high, and 1.2 inches wide. The shell is a brown to brownish-black color, triangular in shape, and inflated with a shallow pink-tinted interior (USFWS, 2015ca). The heavy pigtoe was federally listed as endangered in 1987 (52 FR 11162 11169, April 7, 1987)

This species can only be found in streams and rivers on sand and gravel shoals in seven counties in western and central Alabama (USFWS, 2015ca) (USFWS, 1989c). Shells of the heavy pigtoe were last observed in a 1984 survey of the Tombigbee River and its tributaries, but have not been found since and may now be extinct. Threats to the heavy pigtoe include sedimentation, water diversion, and pollution from runoff (USFWS, 1989c).

***Interrupted Rocksnail.*** The interrupted rocksnail is a freshwater snail with an almost spherical shell growing to about 1 inch in length. The shell is thick, dark-brown to olive in color, and may have spots; typically has small ridges (USFWS, 2014m). The interrupted rocksnail was federally listed as endangered in 2010 (75 FR 67512, November 2, 2010).

This species historically occurred in the Coosa River drainage in Alabama and Georgia. Critical habitat was designated in 2010 for 63 miles of stream channels in the Coosa River drainage. It was reintroduced into the Lower Coosa River of Alabama and still exists in small wild populations in east and central Alabama; it is known or believed to occur in Cherokee, Elmore, or Etowah Counties (USFWS, 2016t). It is found in shoal, riffle, and reef habitats with a sand and boulder substrate with limited sediment and algae growth, and flowing water at depths less than 20 inches and slow-moving currents. Threats include habitat deterioration and water quality degradation (USFWS, 2014d).

***Lacy Elimia* (*snail*).** The lacy elimia is a gill-breathing snail that grows to about 0.4 in length. Its cone shaped shell is pointed, and usually folded in its upper whorls. The shell is dark brown to black in color, with no banding. The opening to the shell is a small oval shape of purple coloration. The lacy elimia was federally listed as threatened in 1998 (63 FR 57610 57620, October 28, 1998) (USFWS, 2015cb).

This species is found in the Coosa River drainage in Talladega County, located in central Alabama, although it is also believed to occur in Clay County (USFWS, 2016x). It inhabits highly oxygenated waters on rock shoals and gravel bars, and is usually found in tight clusters or colonies on larger rocks in a shoal. The greatest threat to the lacy elimia is water quality and habitat degradation (USFWS, 2005c).

***Littlewing Pearlymussel*.** The littlewing pearlymussel is a freshwater mussel that grows up to 1.5 inches. The shell of this species is light green or dark yellowish with dark rays, with a chalky appearance (USFWS, 2015i). The littlewing pearlymussel was federally listed as endangered 1988 (53 FR 45861 45865, November 14, 1988) (USFWS, 2015cc). Historically, the littlewing pearlymussel was known to occur in numerous rivers associated with the Tennessee and Cumberland River systems. It is known to occur in Alabama, Kentucky, North Carolina, and

Virginia. In Alabama, it occurs in Lauderdale and Limestone Counties in the northwestern corner of the state (USFWS, 1989d) (USFWS, 2015cd).

Suitable habitats for the littlewing pearlymussel consist of medium sized rivers and streams with cool clear water. Usually, these mussels are found behind large rocks. Specific factors for the decline of populations is not known but is believed that threats are similar to other mussels which include dams, dredging, and water quality degradation (USFWS, 1989d) (USFWS, 2015cc).

***Mitchell's Satyr Butterfly.*** The Mitchell's satyr butterfly has a wingspan of approximately 1.75 inches with brown wings having orange-ringed black spots and silver centers on the lower region (USFWS, 1999a). The Mitchell's satyr butterfly was federally listed as endangered in 1991 (56 FR 28825 28828, June 25, 1991). It was regionally known to occur in 30 locations within the states in the Great Lakes region. It has since been extirpated from many locations but isolated populations have been documented in regions of Alabama, Indiana, Michigan, Mississippi, Ohio, and Virginia. In Alabama, it can be found in Bibb, Greene, Hale, Perry, and Tuscaloosa Counties in the southwestern portion of the state (USFWS, 2015ce) (The Xerces Society, 2015).

Suitable habitats for the Mitchell's satyr butterfly are very restricted as it inhabits fens, a rare wetland type. Fens are low nutrient wetlands that receive carbonate rich groundwater and are suitable to feed the Mitchell's satyr caterpillars as their diet consist of sedges which are grass-like plants. Current threats to the survival of this species include habitat loss, pesticides and pollutants, and collecting. The habitats that this species depend on are being removed for development or are being degraded by pollution from agriculture and runoff (USFWS, 1999a).

***Narrow Pigtoe.*** The narrow pigtoe is a square-shaped 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 (USFWS, 2012g). The narrow pigtoe was federally listed as threatened in 2012 (77 FR 61663 61719, October 10, 2012) and is known or believed to occur in 11 counties in the state (USFWS, 2016y).

This species is found in medium creeks to rivers with slow to moderate current in stable substrates of sand, sand and gravel, or silty sand. 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 southeastern Florida and Alabama. The greatest threat to the narrow pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants (USFWS, 2012g).

***Orangefoot Pimpleback (pearlymussel).*** The orangefoot pimpleback, also known as the orange-footed pearlymussel, measures between 3.5 and 4 inches long, with a large and heavy shell marked by irregular growth rings and numerous bumps on its yellowish brown to chestnut brown surface (USFWS, 1984e). It was among the first invertebrate species to gain federal protection in 1976, under the Endangered Species Act (41 FR 24062 24067, June 14, 1976). A non-essential experimental population was established in 2007 (72 FR 52434 52461, September 13, 2007).

This species is known or believed to occur in Alabama, Illinois, and Kentucky, with a non-essential experimental population in Tennessee.  In Alabama, it can be found in Colbert and Lauderdale Counties in the northwestern corner of the state (USFWS, 2015cf).  The orangefoot pimpleback buries itself in the bottom of rivers in sand and gravel areas with only its feeding siphons and the edge of its shell remaining above the substrate.  As larvae, it is parasitic and attaches itself to the gills of a host fish until it has grown a shell (USFWS, 2015cg).  Threats to this species include dams and reservoirs, which separate upstream and downstream populations and eliminate sand and gravel substrate, siltation from industrial activity and development, and pollution from agricultural and industrial runoff (USFWS, 1984e) (USFWS, 2015cg).

***Orangenacre Mucket.***  The orangenacre mucket grows up to 3.6 inches in length with a thick outer shell and a rose colored, pink, or white inner shell.  The outer shell is a yellow to dark reddish brown color, sometimes with green rays (USFWS, 2000c).  The orangenacre mucket was federally listed as threatened in 1993 (58 FR 14330 14340, March 17, 1993).

This species occurs regionally in Alabama and Mississippi.  In Alabama, it can be found in the Alabama River and tributaries, streams of the Tombigbee and Black Warrior Rivers, and the Cahaba River and tributaries in 27 counties throughout the state (USFWS, 2015ch).  Critical habitat in Alabama was established in 2004 in Buttahatchee River, Sipsey River, Sucarnoochee River, North River, Cahaba River, and Alabama River and their creeks and tributaries (69 FR 40084 40171, July 1, 2014) (USFWS, 2004c).  It inhabits stable sand, gravel, and cobble substrate in moderate to swift currents in streams and small rivers.  Threats to the orangenacre mucket include habitat loss and degradation due to urban and agricultural runoff, impoundment projects, and mining projects (USFWS, 2000c) (USFWS, 2015ch).

***Oval Pigtoe.***  The oval pigtoe is a mussel that grows to approximately 2.5 inches in length.  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, March 16, 1998).  This species occurs in Econfina Creek, Flint and Chipola Rivers, and various tributary streams throughout its range in Alabama, Florida, and Georgia (USFWS, 2003b).  It occurs in Alabama in 11 counties in the eastern portion of the state (USFWS, 2015ci).  Critical habitat in Alabama has been designated in the Chipola River (72 FR 64286 64340, November 15, 2007) (USFWS, 2007b).

Adult mussels are typically found in contained patches in streams and almost completely burrowed in the sediment.  The oval pigtoe inhabits small to medium-sized creeks and rivers that are characterized by slow to moderate current and substrates that range from silty sand to sand and gravel.  Threats to the Oval pigtoe include significant habitat loss, range restriction, and population fragmentation and size reduction due to erosive land practices, construction of new impoundments, water withdrawals, and nonnative species (USFWS, 2003b).

***Ovate Clubshell.***  The ovate clubshell grows up to 2 inches in length.  The oval-shaped shell has an outer skin color of yellow to dark brown with occasional broad green rays, and a white interior (USFWS, 2000d).  The ovate clubshell was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993).

This species is found regionally in Alabama, Tennessee, and Mississippi. In Alabama, it can be found in 41 counties throughout the state (USFWS, 2015cj). Critical habitat was designated in 2004 in Buttahatchee River, Sipsey River, Sucarnoochee River, North River, Cahaba River, and the Coosa River and their streams and tributaries in Alabama (69 FR 40084 40171, July 1, 2014) (USFWS, 2004e). It inhabits sand and gravel shoals and runs of small rivers and large streams. Threats to the ovate clubshell include water quality degradation, channelization, household and agricultural runoff, and channel erosion (USFWS, 2000d).

***Oyster Mussel.*** The Oyster mussel is distinguishable by its dull to sub-shiny, yellowish-green shell with numerous narrow dark green streaks (62 FR 1647 1658, January 10, 1997)(USFWS, 2015ck). The inside of the shell is whitish to bluish-white in color. The oyster mussel was federally listed as endangered in 1997 (62 FR 1647 1658, January 10, 1997) and critical habitat was designated in 2004 (69 FR 53136 53180, August 31, 2004). Critical habitat in Alabama was designated in part of the Tennessee River in Colbert County. The species historically occurred throughout much of the "Cumberlandian" region of the Tennessee and Cumberland River drainages in Alabama, Kentucky, Tennessee, and Virginia. By 1991, the oyster mussel was considered to be extremely rare, with small populations in only three streams of the Tennessee River system in Tennessee and Virginia (USFWS, 2004f). Nonessential experimental populations were as created in 2001 in Alabama in the free-flowing reach of the Tennessee River, and in 2007 in Tennessee in portions of the French, Broad, and Holston rivers. In Alabama, it can be found in Colbert County in the northwestern corner of the state (USFWS, 2007c) (USFWS, 2015ck).

The oyster mussel inhabits small to medium-sized creeks and sometimes large rivers, in areas with coarse sand to boulder substrate and moderate to swift currents. Species threats include habitat loss from human-induced water quality degradation, including dams/impoundments, channelization, and mining activities, resulting in deforestation, industrial contamination, sedimentation in the upper Tennessee River system (USFWS, 2004f).

***Painted Rocksnail.*** The painted rocksnail grows up to about 0.8 inches in length. Its oval shaped shell is yellowish to olive-brown, and usually has four dark bands. Some have their bands broken up into squares or oval shapes (USFWS, 2005d). The painted rocksnail was federally listed as threatened in 1998 (63 FR 57610 57620, October 28, 1998).

This species can only be found in the lower reaches of three Coosa River tributaries in four counties in central Alabama. It attaches to cobble, gravel, or other hard substrates in the strong currents of riffles and shoals, breathing through its gills. Threats to the painted rocksnail include water and habitat degradation due to runoff pollution and sedimentation (USFWS, 2005d) (USFWS, 2015cl).

***Pale Lilliput* (*pearlymussel*).** The pale lilliput is a freshwater mussel growing up to 1.7 inches in length. It has a tawny to yellowish green color, and a moderately thin and slightly compressed shell without rays. The interior shell color ranges from purple to coppery, and the shell is egg-shaped and somewhat cylindrical (USFWS, 2015cm). The pale lilliput was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976).

This species can be found in the Paint Rock River drainage in Jackson County, in the northeastern corner of Alabama (USFWS, 1984f) (USFWS, 2015cm), and is also believed to occur in Madison and Marshall Counties (USFWS, 2016z). It is usually found in small rivers and streams in shallow, fast-flowing water with a stable, clean substrate. Threats to the pale lilliput include impoundment, siltation, and pollution, due to industrial and agricultural development of the Tennessee Valley (USFWS, 1984f).

**Pink Mucket (pearlymussel).** The pink mucket has a smooth yellowish-brown colored round shell that is approximately 4 inches long. This species was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). The pink mucket was historically known to occur from Oklahoma east to Virginia and Illinois south to Louisiana, however, due to different factors the populations of these species have decreased and are now only known to occur in small populations in Alabama, Arkansas, Illinois, Kentucky, Louisiana, Missouri, Ohio, and Virginia. In Alabama, it is found in nine counties in the northern portion of the state (USFWS, 1985b) (USFWS, 1997g) (USFWS, 2015cn).

Suitable habitat for the pink mucket consists of moderate to fast-flowing rivers and their tributaries with mud and sand in shallow riffle areas. Threats to the survival of this species include dams that disrupt the natural flow, impoundment, and water quality degradation (USFWS, 1997g).

***Plicate Rocksnail.*** The plicate rocksnail is a freshwater, gill-breathing snail that can grow up to 0.8 inches in length. The brown to green colored shell has four color bands and an ornamented body whorl with strong folds and ridges; the inner shell is typically bluish-white, but may also be pink or white. The plicate rocksnail was federally listed as endangered in 1998 (63 FR 57610 57620, October 28, 1998) (USFWS, 2015co).

This species can be found in the Locust Fork of the Black Warrior River, in Blount and Jefferson Counties, which are in central Alabama, it is also believed to occur in Walker County (USFWS, 2016n). The plicate rocksnail “inhabits shallow gravel and cobble shoals in flowing water.” The greatest threat to the plicate rocksnail consists of short- and long-term impacts of water and habitat degradation due to runoff pollution and sedimentation (USFWS, 2005e).

***Purple Bankclimber.*** The purple bankclimber is a freshwater mussel, with heavy, dark colored shells with ridges, reaching a maximum length of about 8 inches (USFWS, 2003b). The purple bankclimber was federally listed as threatened in 1998 (63 FR 12664 12687, March 16, 1998). This species occurs in the Apalachicola, Flint, and Ochlockonee Rivers, and from single sites in the Chattahoochee River and a Flint River tributary in Alabama, Florida, and Georgia (USFWS, 2003b). In Alabama, it occurs in Chambers, Lee, and Russell Counties, in the eastern portion of the state (USFWS, 2015cp).

The purple bankclimber burrows into sediment of small to large river channels, in areas of slow to moderate current. It is commonly associated with substrates that consist of sand or sand mixed with mud or gravel. Threats to the purple bankclimber include significant habitat loss, range restriction, and population fragmentation and size reduction due to erosive land practices, construction of new impoundments, water withdrawals, and nonnative species (USFWS, 2003b).

***Rabbitsfoot.*** The rabbitsfoot can grow up to 6 inches in length. The shell of the rabbitsfoot mussel is generally yellowish, greenish, or olive in color and turns yellowish brown with age (USFWS, 2015cs). The rabbitsfoot was federally listed as threatened in 2013 (78 FR 57076 57097, September 17, 2013). It has been estimated that these mussels have been eliminated from about 64 percent of its existing historical range and only about 10 of the populations that exists are considered to be large enough to be viable for long term. It occurs in 13 states; in Alabama, it is found in five counties in the northern portion of the state (USFWS, 2011c) (USFWS, 2015ct).

The rabbitsfoot is a sedentary filter feeder that obtains its oxygen and food from the water column. The rabbitsfoot prefers the shallow area of streams and rivers with sand and gravel along the banks. These mussels seldom burrow and instead use the gravel along the banks as refuge in fast moving rivers and streams. For reproduction this species prefers a stable and undisturbed habitat with a sufficient population of host fish including several genera of shiners (*Cyprinella, Luxilus,* and *Notropis*) (USFWS, 2011c).

Critical habitat was designated in 2015 for 31 stream segments where the mussels are known to occur (80 FR 24691 24774, April 30, 2015). In Alabama, the only designated habitat for the rabbitsfoot is a 50-mile segment of the Paint Rock River, the northern part of the state (USFWS, 2015cu). The current threats to the rabbitsfoot include the loss of habitat, isolation of populations, range restrictions, sedimentation, and presence of exotic non-native species (USFWS, 2011c).

***Ring Pink Mussel.*** The ring pink mussel is a freshwater mussel with a thick oval shell measuring about 3 to 4 inches in length and height, and living up to 50 years or more. The yellow-green to brown-black outer shell is darker colored in older specimens and does not have rays. The inner shell is a pink to deep purple color with a white border (USFWS, 2004g). The ring pink mussel was federally listed as endangered in 1989 (54 FR 40109 40112, September 29, 1989).

The endangered population of this species occurs in Alabama, Tennessee, and Kentucky. In Alabama, it can be found in Colbert and Lauderdale Counties in the northwestern corner of the state (USFWS, 2015cv). It inhabits shallow water over silt-free sand and gravel bottoms of large rivers. Threats to the ring pink mussel result from its restricted range and small population numbers, gravel dredging of rivers, and pollution (USFWS, 2015cw).

***Rough Hornsnail.*** The rough hornsnail is a freshwater snail with an elongated, pyramid shaped thick shell that can grow too approximately 1.3 inches. The shell has up to nine whorls that are yellowish-brown in color. The shell opening is white inside, and channeled at the base. It has prominent lumps on the lower whorls above the shell opening (USFWS, 2014e) (USFWS, 2015cx). The rough hornsnail was federally listed as endangered in 2010 (75 FR 67512 67550, November 2, 2010).

This species is only found in the Coosa River system in Chilton, Coosa, Elmore, Shelby, and Talladega Counties in central Alabama (USFWS, 2015cx). Critical habitat was designated at the time of listing in 17 miles of stream channels in the Coosa River drainage; Lower Coosa River in

Elmore County, Alabama, and Yellowleaf Creek in Shelby County, Alabama. It inhabits gravel, cobble, bedrock, and mud substrates in moderate current in depths of 3.3 feet to 9.8 feet, and tolerates silt deposition. Threats to the rough hornsnail include loss of habitat and range, small population size, degradation of water quality, and habitat deterioration (USFWS, 2014e).

***Rough Pigtoe.*** The rough pigtoe is a thick-shelled, triangular-shaped freshwater mussel. The mussel appears inflated, and has a dirty-yellow or rust-colored shell marked by uneven growth markings. The rough pigtoe was federally listed in 1976 (41 FR 24062 24067, June 14, 1976). It is only known to occur in five streams around the Mississippi watershed, including the Tennessee, Cumberland, Clinch, Green, and Barren Rivers (USFWS, 1984g). Regionally, the species' range extends from western Virginia to north Alabama and southern Indiana, with populations in Alabama, Indiana, Kentucky, and Virginia. In Alabama, it is found in nine counties in the northern portion of the state (USFWS, 2015cy).

The rough pigtoe is primarily observed in shoal areas of medium to large rivers, burying itself in the sand or gravel river bottom. Threats to the rough pigtoe include damming, the buildup of sediments, and pollution which result in habitat degradation for the species (USFWS, 1984g). A recent threat includes suffocation and competition from the zebra mussel (*Dreissena polymorpha*), which reproduces rapidly and at a high rate (USFWS, 2015cz).

**Round Rocksnail.** The round rocksnail is a freshwater, gill-breathing snail with an almost globelike shell and oval rounded shell opening that grows up to 0.8 inches in length. The shell color is yellow to dark brown or olive, and often has four solid or broken bands around it (USFWS, 2015da). The round rocksnail was federally listed as threatened in 1998 (63 FR 57610 57620, October 28, 1998).

This species is only found in Bibb, Chilton Jefferson, Shelby, and Tuscaloosa Counties, in central Alabama (USFWS, 2015da). It is found attached to cobble, gravel or other hard substrates in the strong currents of riffles and shoals in the Cahaba River drainage. The biggest threat to the round rocksnail is water quality degradation due to runoff pollution and sedimentation (USFWS, 2005f).

***Round Ebonyshell.*** The round ebonyshell is a round to oval 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, 2012g). 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 southern Alabama and Florida; it is currently known or believed to occur in 10 counties in Alabama (USFWS, 2016ab). 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 flooding and contaminant spills, and activities that cause streambed destabilization, such as gravel mining, dredging, and de-snagging for navigation (USFWS, 2012g).

**Sheepnose Mussel.** The sheepnose mussel grows about 5 inches with a light yellow to dull yellowish brown color shell having darker ridges (USFWS, 2012h). After multiple status reviews since 2004, the USFWS listed the sheepnose mussel as endangered in 2012 (77 FR 14914 14949, March 13, 2012). This species historically occurred mostly along the Mississippi River, and populations can now be found in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin. In Alabama, it can be found in seven counties in the northern portion of the state (USFWS, 2012h) (USFWS, 2015db).

The sheepnose mussel lives in large rivers and streams with rough substrates and moderate to swift currents where they feed on suspended algae, bacteria, detritus, and microscopic animals. This species prefers shallow shoal habitats above coarse sand and gravel. For reproduction the sheepnose prefers a stable undisturbed habitat with the presence of sauger (*Sander Canadensis*), its only confirmed host fish. Threats include sedimentation, dams that restrict natural flow, habitat reduction, water quality degradation, contaminations of nutrients, population fragmentation, and invasive species of zebra mussels (*Dreissena polymorpha*) (USFWS, 2012h).

***Shiny Pigtoe.*** The shiny pigtoe is a freshwater mussel which grows to lengths of approximately two inches long. The species' shell is yellow-brown with very dark green streaks and is irregularly oval-shaped (USFWS, 1984h). The shiny pigtoe was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). The species' range extends from the western region of Virginia across Tennessee to the northern regions of Alabama. The listing indicates experimental populations in various portions of the Tennessee River, reaching just south of the western border of Virginia, and a protected area is indicated within the Clinch River around Pendleton Island. Within Alabama, it can be found in Jackson, Madison, and Marshall Counties in the northern portion of the state (USFWS, 2015dc).

The shiny pigtoes are found in "relatively silt-free substrates of sand, gravel, and cobble in good flows of larger streams" (USFWS, 2015dc). Since the species is a filter feeder, a primary threat has consisted of water quality degradation due to pollution and mining development. Additional threats consist of water flow alterations and damming practices (USFWS, 1984h).

***Shinyrayed Pocketbook.*** The shinyrayed pocketbook is a freshwater 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 Ochlockonee River system in Alabama, Florida, and Georgia (USFWS, 2003b). In Alabama, it occurs in Barbour, Geneva, Houston, Lee, and Russell Counties in the eastern portion of the state (USFWS, 2015dd). Critical habitat in Alabama has been designated in the Chipola River (72 FR 34216 34224, June 21, 2007) (USFWS, 2007b).

Adult mussels are typically found in clusters in streams, almost completely burrowed in the sediment. 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, range restriction, and population fragmentation and size reduction due to erosive land practices, construction of new impoundments, water withdrawals, and nonnative species (USFWS, 2003b).

***Slabside Pearlymussel.*** The slabside pearlymussel has brownish colored shells with green rays, and grows to about 3.5 inches (USFWS, 2012i). After multiple status reviews, the USFWS listed the slabside pearlymussel as endangered in 2013 (78 FR 25041 25044, April 29, 2013). Regionally, this species is known to occur only in the Tennessee and Cumberland River systems within the states of Alabama, Kentucky, Mississippi, Tennessee, and Virginia. In Alabama, the slabside pearlymussel is found in Colbert, Franklin, Jackson, Lauderdale, Madison, and Marshall Counties, in the northern portion of the state. Critical habitat was designated in stream channels of the six Alabama counties in 2013. (78 FR 59555 59620, September 26, 2013) (USFWS, 2012i) (USFWS, 2015de).

The preferred habitat for the slabside pearlymussel consists of large creeks and moderate-sized rivers with sand and gravel bottoms and moderate current. The slabside pearlymussel, as most other mussel, are always at the bottom of relatively shallow creeks and rivers feeding on diatoms, algae and other microorganisms. The slabside pearlymussel is a summer brooder; once larvae are released from the females starting in mid-May to August, they must attach to a fish host to be fully developed by mid-summer (USFWS, 2012i).

The primary threat to the survival of the slabside pearlymussel is the loss and degradation of suitable habitats. River impoundments are the major cause of this decline. These activities change the temperature of water, alter the natural flow, and decrease the abundance of host fish. Water quality degradation from polluted discharges, runoff, and siltation us also threatening the survival of the species (USFWS, 2012i).

***Slender Campeloma.*** The slender campeloma is a freshwater snail that grows between 0.2 and 1.4 inches in length. Its shell is conically egg-shaped, with a tapered pointed spire at the top (USFWS, 2007e). The slender campeloma was federally listed as endangered in 2000 (65 FR 10033 10039, February 25, 2000).

This species only occurs in creeks and rivers in Lauderdale, Limestone, and Madison Counties in northern Alabama (USFWS, 2015df). It is found burrowing in soft sediments such as sand or mud, or dead organic material. The greatest threat to the slender campeloma is habitat destruction or modification due to increased development, logging, agriculture, water withdrawals, and runoff pollution (USFWS, 2007e).

***Snuffbox Mussel.*** The snuffbox mussel grows from 1.8 to 2.8 inches in length with a yellow, green, or brown triangular to oval shell with green rays (USFWS, 2012j). This species was federally listed as endangered in 2012 (77 FR 8632 8665, February 14, 2012). The snuffbox total population has reduced by 62 percent from its historical range. Currently this species only occurs in 79 streams and 14 rivers compared to 210 streams and lakes in its historical range (USFWS, 2012j). It still occurs in 14 states and in Canada. In Alabama, it can be found in eight counties in the northern portion of the state (USFWS, 2015dg).

The snuffbox mussels live in small to medium sized creeks, lakes, and rivers and feed on suspended algae, bacteria, and dissolved organic material. This species prefers shoal habitats with swift current over sand and gravel as they usually burrow deep in sand. For reproduction a stable and undisturbed habitat is require with a sufficient population of host fish such as logperch (*Percina caprodes*) and several other darters. Current threats to this species include sedimentation, pollution and water quality degradation, dams that restrict natural flow, and invasive non-native species of zebra mussels (USFWS, 2012j).

***Southern Acornshell.*** The southern acornshell is a freshwater mussel with an oval shell that grows up to 1.3 inches in length. The outer shell is glossy yellow, and rarely has rays. The interior shell color is usually white (GADNR, 2008). The southern acornshell was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993).

This species is only believed to occur in the upper Coosa River drainage and the Cahaba River in 16 counties in east-central Alabama, but it is considered extinct by many experts (USFWS, 2015dh). Although its habitat has not been well documented, it has been observed in gravel or sand substrates in medium to large rivers with moderate current (GADNR, 2008). Critical habitat was designated in 2004 (69 FR 40084 40171, July 1, 2004) in the Cahaba River and Coosa River and their creeks and tributaries. Threats to the southern acornshell include limited habitat, small population size, exotic species invasion, land use runoff pollution, and sedimentation (USFWS, 2004h).

***Southern Clubshell.*** The southern clubshell grows to 2.8 inches long, with a thick shell, and heavy hinge plate and teeth. The shell outline is roughly rectangular. The posterior ridge ends abruptly with little development of the posterior slope at the dorsum of the shell. The outer surface color ranges from yellow to yellow-brown with occasional green rays or spots on younger specimens (USFWS, 2000h). The species was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993). The species' range extends through Alabama, Mississippi, and Georgia. In Alabama, the species is known or believed to occur in 48 counties throughout the state. Critical habitat for the southern clubshell has been designated in Alabama, Mississippi, Georgia, and Tennessee. In Alabama, the critical habitat is designated in Buttahatchee River, Sucarnoochee River, Cahaba River, Alabama River, and Coosa River tributaries and drainages (69 FR 40084 40171, July 1, 2014) (USFWS, 2015di).

The southern clubshell inhabits sand/gravel/cobble substrate in shoals and runs of small rivers and large streams. Habitat modification, sedimentation, and water quality degradation are the primary causes of decline of the southern clubshell. This species cannot tolerate impoundment or channelization. Surviving populations are threatened by channelization projects, household and agricultural runoff, and channel degradation caused by sand and gravel mining and/or channel maintenance projects. (USFWS, 2000h)

***Southern Combshell.*** The southern combshell, also referred to as the penitent mussel. Adult mussels are about 2.2 inches long, with yellowish, greenish-yellow, or tawny colored shells, sometimes with darker dots (USFWS, 1989f). The species was federally listed as endangered in 1987 (52 FR 11162 11169, April 7, 1987). Historically, the species is known from Alabama and Mississippi in the Tombigbee River, East Fork Tombigbee River, Alabama River, Cahaba River, and the Coosa River. In Alabama, the species is known or believed to occur in Fayette, Lamar, Winston, and Marion Counties in the northwestern portion of the state (USFWS, 1989f) (USFWS, 2015dj).

The Southern combshell mussel inhabits large streams and rivers, primarily sand and gravel beds. The primary cause of population decline for the species is habitat modification for navigation. This includes physical destruction during dredging, increasing sedimentation, reducing water flow, and suffocating juveniles with sediment. Other threats include water diversion and non-point source pollution from fertilizers and pesticides (USFWS, 1989f) (USFWS, 2015dj).

***Southern Pigtoe.*** The southern pigtoe is a freshwater mussel with yellow to yellow-brown elliptical shells that grows to about 2.4 inches (USFWS, 2000h). The species was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993). Historically, the species is known from Alabama, Georgia, and Tennessee. In Alabama, the species is known or believed to occur in 16 counties from central to eastern Alabama. Critical habitat for the southern pigtoe has been designated in Alabama, Georgia, and Tennessee (69 FR 40084 40171, July 1, 2014). In Alabama, critical habitat is designated in the Coosa River, Hatchet Creek, Shoal Creek, Kelly Creek, Cheaha Creek, Yellowleaf Creek, Big Canoe Creek, and Lower Coosa River (USFWS, 2015dk).

The southern pigtoe inhabits sand/gravel/cobble substrates in small rivers and large streams. Threats to the species survival are sedimentation, eutrophication, and water quality degradation from domestic and agricultural runoff (USFWS, 2015dk).

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

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, 2012g). Its current range is only in the Choctawhatchee River drainage in southern Alabama and Florida, and it is known or believed to occur in 16 counties in Alabama (USFWS, 2016u). In 2012, critical habitat in Alabama is designated in the Upper Escambia River, Lower Escambia River, Patsaliga Creek, Choctawhatchee River, Upper Pea River, Lower Pea River (77 FR 61664 61719, October 10, 2012). The greatest threat to the Southern kidneyshell is habitat degradation and loss from excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants (USFWS, 2012g).

***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, 2012g). The southern sandshell was federally listed as threatened in 2012, with critical habitat designated in Alabama in the Upper Escambia River, Lower Escambia River, Patsaliga Creek, Choctawhatchee River, Upper Pea River, Lower Pea River, and Yellow River (77 FR 61663 61719, October 10, 2012).

Suitable habitat for the southern sandshell is characterized by small creeks and rivers with slow to moderate current in stable substrates that range from sand to mixtures of sand and fine gravel. Its range is the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee River drainages in southern Alabama and Florida. The greatest threat to the southern sandshell is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants (USFWS, 2012g).

***Spectaclecase Mussel.*** The spectaclecase mussel is a large (up to 9 inches long) freshwater mussel. Its brownish to black shell is large with a somewhat curved appearance and moderate inflation (USFWS, 2012k). This species was first listed as federally endangered in 2012 (77 FR 14914 14949, March 13, 2012). The spectaclecase mussel has suffered a 55 percent decrease in distribution and presently only occurs in 20 of the 44 streams it once inhabited. Most populations are now fragmented and limited to short reaches of streams in the 11 states it occurs: Alabama, Arkansas, Illinois, Iowa, Kansas, Kentucky, Minnesota, Missouri, Tennessee, Virginia, and Wisconsin. In Alabama, it can be found in six counties in the northern portion of the state (USFWS, 2015dl).

Suitable habitat for the spectaclecase mussel includes sheltered areas in large rivers. This species seeks out areas that are sheltered from the force of the river current beneath rock slabs, in firm mud banks, and in between tree roots. Spectaclecase mussels are long-lived and spend their entire adult lives partially or completely embedded in river bottom substrate; some specimens have been estimated to be up to 70 years old. This species of mussel has a parasitic life stage and is dependent on a host fish for successful rearing and relocation of larvae young. The current major threat to the survival of this species is dam construction. Dams alter the natural flow and temperature regime of rivers, blocking fish passage which is necessary to prevent fragmentation and connect populations. Sedimentation of rivers, pollution, channelization, and invasive zebra mussels also pose threats to this species (USFWS, 2012k).

***Stirrupshell.*** The stirrupshell is a freshwater mussel with shells that are a yellowish-green color, with green zigzag markings that become brown with age. Adult stirrupshells are about 2.2 inches long, 2 inches high, and 1.4 inches wide (USFWS, 1989f). The species was federally listed as endangered in 1987 (52 FR 11162 11169, April 7, 1987). Historically, the species is known to range from Alabama and Mississippi in the Tombigbee River, Black Warrior River, and Alabama River. In Alabama, the species is known to occur in the Tombigbee River, Black Warrior River, and Alabama River watersheds throughout the state (USFWS, 1989f) (USFWS, 2015dm).

The stirrupshell mussel inhabits large streams and rivers, primarily sand and gravel beds. The primary cause of population decline for the species is habitat modification for navigation. This can result in physical destruction during dredging, increased sedimentation, reduced water flow, and suffocation of juveniles with sediment. Other threats include water diversion and non-point source pollution from fertilizers and pesticides (USFWS, 1989f) (USFWS, 2015dm).

***Tapered Pigtoe.*** The tapered pigtoe is an elliptical mussel that grows to an average size 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, 2012g). 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] stable substrates of sand, small gravel, or sandy mud, with slow to moderate current (USFWS, 2012g)." Its current range is the Choctawhatchee River drainage in Alabama and Florida, and also includes several oxbow lakes in Florida, some with a flowing connection to the main river channel. It is known or believed to occur in 10 counties in Alabama (USFWS, 2016v). Critical habitat in Alabama for the tapered pigtoe has been designated in the Choctawhatchee River, Upper Pea River, and Lower Pea River. The greatest threat to the tapered pigtoe is habitat degradation and loss as a result of excessive sedimentation, bed destabilization, poor water quality, and environmental contaminants (USFWS, 2012g).

***Triangular Kidneyshell.*** The triangular kidneyshell is a freshwater mussel with shells that are straw-yellow color in juveniles and yellow-brown in adults. The maximum adult shell length is about 4 inches. Historically, the species is known or believed to occur from Alabama, Georgia, and Tennessee. In Alabama, the species is known or believed to occur in 22 counties in north-central Alabama. The species was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993). Critical habitat for the triangular kidneyshell has been designated in Alabama, Georgia, and Tennessee; in Alabama, the critical habitat is within North River, Cahaba River, Coosa River, and associated creeks and tributaries (69 FR 40084 40171, July 1, 2004) (USFWS, 2015dn).

The triangular kidneyshell inhabits "sand/gravel/cobble shoals and runs in small rivers and large streams." Primary threats to the species are "[h]abitat modification, sedimentation, eutrophication, and other forms of water quality degradation…[including]… urban and agricultural runoff, surface mine drainage, industrial and sewage treatment plant discharges, and localized household discharges (USFWS, 2000h).

***Tulotoma Snail.*** The tulotoma snail is a gill-breathing freshwater snail with a large spherical shell that is typically characterized by spiral lines of knob-like structures; adult tulotoma snails grow to a size somewhat larger than a golf ball (USFWS, 2000e). The tulotoma snail was federally listed as threatened in 1991 (56 FR 797 800, January 9, 1991).

This species is found only in the Coosa River drainage in 12 counties in central Alabama (USFWS, 2015do). It is found grouped in colonies under large rocks or boulders in shoals and runs with moderate to swift current. The biggest threat to the tulotoma snail is water quality degradation due to urban, household, and agricultural runoff; and discharges from industrial and sewage treatment plants (USFWS, 2000e).

***Upland Combshell.*** The upland combshell is a freshwater mussel with a square-shaped shell that grows up to 2.4 inches in length. The outside of the shell is yellowish-brown to tawny in color, and can have broken green rays or small green spots (USFWS, 2000f). The upland combshell was federally listed as endangered in 1993 (58 FR 14330 14340, March 17, 1993).

The historical range of this species was parts of the Mobile River Basin in Alabama, Georgia, and Tennessee. In Alabama, it was known or believed to occur in 21 counties in the Mobile

River Basin in the central portion of the state. However, recent surveys have failed to find any evidence of the species, and the upland combshell is now considered to be extinct by many experts (USFWS, 2015dq). Critical habitat was designated in 2004 (69 FR 40084 40171, July 1, 2004) in Alabama in the Cahaba and Coosa Rivers and their creeks and tributaries in the Mobile River Basin (USFWS, 2004i) (USFWS, 2000g). It inhabits stable sand, gravel, or cobble substrate in moderate to swift currents on shoals in rivers and large streams above the Fall Line. The biggest threat to the upland combshell is water quality degradation due to urban and agricultural runoff, and sedimentation (USFWS, 2000f).

***White Wartyback* (*pearlymussel*).** The white wartyback is a freshwater mussel with a thick, almost egg-shaped shell that has growth lines and a row of bumps on the middle part of the shell. The outer shell is a greenish-yellow or yellowish-brown color with no rays. The inside of the shell is white and iridescent (USFWS, 1984i). The white wartyback was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976), and a non-essential experimental population was established in 2007 (72 FR 52434 52461, September 13, 2007).

The endangered population of this species is known or believed to occur in Alabama and Kentucky, with the experimental population occurring in Tennessee. In Alabama, it is known or believed to occur in Colbert and Lauderdale Counties, in the northwestern corner of the state (USFWS, 2015dr). It inhabits gravel and sand substrate free of silt, in clean, fast-flowing water in large rivers. It buries itself in the sand or gravel between ledges of bedrock. Threats to the white wartyback include impoundments which flood its habitat; siltation due to mining, logging, and farming; and pollution due to agricultural and industrial runoff (USFWS, 2015ds).

***Yellow Blossom* (*pearlymussel*).** The yellow blossom is a freshwater mussel with an elliptical or egg-shaped shell growing up to 2.4 inches in length. The outside skin of the shell is somewhat shiny and is yellow, honey yellow, brownish yellow, or whitish in color with green rays across the surface. The inside color of the shell is bluish white and iridescent (USFWS, 1985c). The yellow blossom was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976) with a non-essential experimental population established in 2001 (66 FR 32250 32264, June 14, 2001).

The endangered population of this species is known or believed to occur in Alabama and Tennessee, and the experimental population is known or believed to occur in Alabama. Within Alabama, it is known or believed to occur in the Tennessee River and its tributaries throughout the state, with the experimental population in Colbert and Lauderdale Counties in the northwest corner of the state (USFWS, 2015dt). It inhabits shallow areas of rivers with a sand or gravel substrate and rapid current. Threats to the yellow blossom include impoundments, siltation, and pollution (USFWS, 1985c). Mussel experts believe that the yellow blossom is likely extinct, as the last known specimen of the yellow blossom was recorded in the Little Tennessee River and Citico Creek, Tennessee, in 1967, and has not been found alive or recently dead since then (USFWS, 2007d).

## Plants

There are 14 endangered and 8 threatened plant species that are federally listed for Alabama as summarized in Table 3.1.6-9. In addition, the white fringeless orchid (*Platanthera integrilabia*) has been identified a candidate species in Alabama. Information on the habitat, distribution, and threats to the survival and recovery of the listed species in Alabama is provided below.

**Table 3.1.6-9: Federally Listed Plant Species of Alabama**

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Alabama Canebrake Pitcher-plant | *Sarracenia rubra* ssp. *Alabamensis* | E | No | Acidic, very saturated, deep peaty sands or clays in sandhill seeps, swamps, and bogs. Found in Autauga, Chilton, and Elmore Counties in central Alabama. |
| Alabama Leather Flower | *Clematis socialis* | E | No | Mesic flats in neutral or slightly basic silt and clay soils about 50 to 100 feet from irregularly occurring creeks. It grows in full sun or partial shade in grass, sedge, and rush communities. Found in Cherokee, Etowah, and St. Clair Counties in northeastern Alabama. |
| Alabama Streak-sorus Fern | *Thelypteris pilosa* var. *alabamensis* | T | No | Crevices and rough rock surfaces of sandstone on river bluffs. Found in Lawrence and Winston Counties, northern Alabama. |
| American Chaffseed | *Schwalbea americana* | E | No | Successional habitats; found in 6 counties in southern and southeastern Alabama. |
| American Hart's-tongue Fern | *Asplenium scolopendrium* var. *Americanum* | T | No | Grows on or next to limestone in pit cave entrances. Found in Jackson, Marshall, and Morgan Counties in northeastern Alabama. |
| Fleshy-fruit Gladecress | *Leavenworthia crassa* | E | Yes; seven units in Lawrence and Morgan Counties, northern Alabama. | Inhabits well-lit deeper soils along the edges of shallow-soiled, open glade communities with exposed sheets of limestone outcrops having small areas of cedar hardwood vegetation. Found in Lawrence and Morgan Counties, northern Alabama. |
| Gentian Pinkroot | *Spigelia gentianoides* | E | No | Open space within well drained upland pinelands that are susceptible to periodic fires; found in 5 counties in central and southern Alabama. |
| Georgia Rockcress | *Arabis georgiana* | T | Yes; within Bibb, Dallas, Elmore, Monroe, Sumter, and Wilcox Counties across | High bluffs along major rivers, with dry-mesic to mesic soils of open rocky woodland and forested slopes; found in 18 counties across central Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| | | | central Alabama. | |
| Green Pitcher-plant | *Sarracenia oreophila* | E | No | Moist upland areas and along boggy, sandy streambanks; found in 8 counties in northeastern Alabama. |
| Harperella | *Ptilimnium nodosum* | E | No | Shallow ponds in hilly terrain and along gravelly streambanks of fast-moving water; found in 4 counties in the northeastern corner of Alabama. |
| Kral's Water-plantain | *Sagittaria secundifolia* | T | No | Frequently exposed shoals or rooted among loose boulders in calm pools in rocky streams; found in 6 counties in northern and central Alabama. |
| Leafy Prairie-clover | *Dalea foliosa* | E | No | Thin-soiled, moderately moist prairie, limestone cedar glades, and limestone barrens. Found in Colbert, Franklin, Lawrence, and Morgan Counties in northwest Alabama. |
| Little Amphianthus | *Amphianthus pusillus* | T | No | Eroded depressions formed on flat-to-doming granitic outcrops; found in 5 counties in eastern Alabama. |
| Louisiana Quillwort | *Isoetes louisianensis* | E | No | Sandy soils and gravel bars in or near shallow streams and overflow channels in riparian woodland/ bayhead forests; found in 2 counties in southern Alabama. |
| Lyrate Bladderpod | *Lesquerella lyrata* | T | No | Shallow soils near cedar glades, disturbed lawns, cultivated fields, grassy and rocky pastures, and roadsides. Found in Colbert, Franklin, and Lawrence Counties, northwestern Alabama. |
| Mohr's Barbara's Buttons | *Marshallia mohrii* | T | No | Moist prairie-like openings in woodlands and along shale-bedded streams; found in 14 counties in north-central Alabama. |
| Morefield's Leather Flower | *Clamatis morefieldii* | E | No | Rocky limestone woods near seeps or springs, usually on south and southwest facing slopes of mountains. Found in Jackson, Madison, and Marshall Counties in northeastern Alabama. |
| Pondberry | *Lindera melissifolia* | E | No | Seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions; found in Covington and Geneva Counties in southern Alabama. |
| Price's Potato-bean | *Apios priceana* | T | No | Open wooded areas, forest gaps and low areas near streams and rivers; found in 8 counties throughout Alabama. |
| Relict Trillium | *Trillium reliquum* | E | No | Moist hardwood forests with little or no disturbance in the recent past; found in 7 counties in southeastern Alabama. |

| Common Name | Scientific Name | Federal Status [a] | Critical Habitat in Alabama | Habitat Description |
|---|---|---|---|---|
| Tennessee Yellow-eyed Grass | *Xyris tennesseensis* | E | No | Wet spring meadows in sunny areas and calcareous bedrock; found in 10 counties in east-central Alabama. |
| Whorled Sunflower | *Helianthus verticillatus* | E | Yes; four units in Cherokee County, northeastern Alabama. | Moist, prairie-like remnants, woodlands openings, and adjacent to creeks; found in Cherokee County in northeastern Alabama. |

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015b) (USFWS, 2015c)

***Alabama Canebrake Pitcher-plant.*** The Alabama canebrake pitcher-plant is a carnivorous herb that grows two types of hollow leaves shaped like pitchers, as well as flattened leaves. The pitchers that grow in spring, when the plant blooms, are 7.9 to 19.7 inches in length and bent backward; the pitchers that grow in summer are larger, 7.9 to 27.6 inches in length, and erect. The maroon colored flowers grow alone on stalks up to 2 feet tall. The Alabama canebrake pitcher-plant was federally listed as endangered in 1989 (54 FR 10150 10154, March 10, 1989) (USFWS, 2015du).

This species is known or believed to occur only in the Coosa River drainage of Autauga, Bibb, Chilton, Dallas, Elmore, Lowndes, and Montgomery Counties in central Alabama. It inhabits "acidic, very saturated, deep peaty[109] sands or clays" (USFWS, 1992c) in sandhill seeps,[110] swamps, and bogs along the Fall Line of central Alabama. Threats to the Alabama canebrake pitcher-plant include habitat destruction, limited distribution from competing vegetation resulting from fire suppression, over collection, and poor land use practices (USFWS, 1992c).

***Alabama Leather Flower.*** The Alabama leather flower is a small herb that grows in clusters and can reach an average height of 12 inches. It is a rhizomatic[111] plant that reproduces by sending out roots and one- to few-flowered lower shoots. The lower leaves are triangular or oval-shaped with a scale-like appearance and under half-an-inch long. The middle leaves are oval-shaped and grow up to 4.7 inches long; upper leaves are oval-shaped in groups of 3 to 5. The urn or bell-shaped flowers grow alone at the tips of slender stems and are usually a little more than an inch long and blue-violet in color. The fruits are one-seeded and 1 to 1.2 inches in length. The Alabama leather flower was federally listed as endangered in 1986 (51 FR 34420 34422, September 26, 1986).

Regionally, this species is known or believed to occur in Alabama and Georgia. In Alabama, it is found in Blount, Calhoun, Cherokee, Etowah, Jefferson, and St. Clair Counties in the northeastern portion of the state (USFWS, 2015dv). It inhabits mesic flats in neutral or slightly

[109] A highly organic material found in marshy or damp regions, composed of partially decayed vegetable matter.

[110] A small spring, pool, or other place where liquid from the ground has oozed to the surface of the earth.

[111] A method of vegetative reproduction wherein a plant reproduces by sending out underground stems called rhizomes

basic silt and clay soils near irregularly occurring creeks. It prefers full sun or partial shade in grass, sedge, and rush communities. Threats to the Alabama leather flower include habitat destruction or modification and vulnerability due to the small number of populations that exist. (USFWS, 1989e).

***Alabama Streak-sorus fern.*** The Alabama streak-sorus fern is a small fern with short and slender creeping roots that are covered in reddish-brown scales. Leaf blades are usually 0.5 to 1.3 inches wide and 1.4 to 4 inches long on average, but can grow up to 8 inches in length. The stalks are slender and usually straw-colored, but can be darker and brownish toward the base. The upper surface of the leaf is yellow-green in color, and the lower surface is paler. The leaves are covered in scattered, needle-like hairs (USFWS, 1996a). The Alabama streak-sorus fern was federally listed as threatened in 1992 (57 FR 30164 30168, July 8, 1992).

This species is known or believed to occur in Cullman, Franklin, Lawrence, Walker, and Winston Counties, in northern Alabama (USFWS, 2015dw). It is typically found in crevices and rough rock surfaces of sandstone on river bluffs. It grows from the ceilings of sandstone overhangs, on sheltered sandstone ledges, and on the exposed cliff face. It prefers high humidity and moist, shaded locations. The greatest threat to the Alabama streak-sorus fern is its vulnerability to extinction due to its very small range and small population, which could easily be reduced by natural or human threats such as flooding, drought, or impoundments (USFWS, 1996a).

***American Chaffseed.*** The American chaffseed is a perennial that grows 12 to 24 inches high, with a cluster of large purple and yellow tubular flowers (USFWS, 2014f). 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, 2014f). In 2008, 53 known extant sites were recorded in this range. The species is known to occur in seven counties in Alabama, in the southern and southeastern portions of the state (USFWS, 2008b) (USFWS, 2014f).

Suitable habitat for this species includes “pine flatwoods, fire-maintained savannas, and ecotonal areas between peaty wetlands and xeric (dry) sandy soils, bog borders, and other open grass-sedge systems.” “The American chaffseed occurs in sandy (sandy peat, sandy loam), acidic, and seasonally moist to dry soils…[and]... in species-rich plant communities where grasses, sedges, and savanna dicots are numerous.” Threats to the American chaffseed are loss of habitat due to development and natural vegetation succession (USFWS, 2014f).

***American Hart’s-tongue fern.*** The American Hart’s-tongue fern is an evergreen fern with strap-shaped fronds that grow from 5 to 17 inches long, 0.75 to 1.75 inches wide, and are lobed at the base. Its green stem propagates rhizomatically and is 1 to 5 inches long with cinnamon-colored scales (USFWS, 1993c). The American Hart’s-tongue fern was federally listed as threatened in 1989 (54 FR 29726 29730, July 14, 1989).

Regionally, this species is known or believed to occur in Alabama, Michigan, New York, and Tennessee. In Alabama, it can be found in Jackson, Madison, Marshall, and Morgan Counties in the northeastern portion of the state (USFWS, 2015dx). It grows on or next to limestone in pit cave entrances with high humidity, substrate moisture, and shade. Threats to the American Hart's-tongue fern include trampling and habitat alteration and destruction due to timber removal, quarrying, and residential development (USFWS, 1993c).

***Fleshy-fruit Gladecress.*** The fleshy-fruit gladecress is a member of the mustard family that has a smooth and glossy surface and grows from 4 to 12 inches tall. The approximately 3-inch long leaves form a rosette at the base. It is an annual plant and flowers in the spring, with flower petals measuring 0.3 to 0.6 inches long (USFWS, 2014g). The fleshy-fruit gladecress was federally listed as endangered in 2014 (79 FR 44712 44718, August 1, 2014).

This species is known or believed to occur only in Cullman, Lawrence, and Morgan Counties, northern Alabama (USFWS, 2015dy). Critical habitat was designated in 2014 (79 FR 50989 51039, August 26, 2014) within seven units in Lawrence and Morgan Counties, northern Alabama. It inhabits deep soils along the edges of shallow-soiled, open glade communities having full sun exposed sheets of limestone outcrops with some cedar hardwood vegetation (USFWS, 2014h). Threats to the fleshy-fruit gladecress are habitat loss and degradation resulting from agricultural practices, off-road vehicles, dumping, residential and industrial development, and shading and competition from non-native plants (USFWS, 2014g).

***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 forms a five-pointed star when closed. It produces fruit capsules that forcefully eject their seeds upon maturity (USFWS, 2012l). 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. In Alabama, it is found in eight counties in the central and southern portions of the state (USFWS, 2015dz).

It grows as a solitary individual or in small clumps in dry rich organic soil, and in areas with visible limestone formations and chalky soils. The Gentian pinkroot usually inhabits open space within well drained fire-dependent upland pinelands. The primary threats to Gentian pinkroot are fire suppression, and habitat loss and alteration due to clearcutting, conversion of land to pine plantations, and land use development (USFWS, 2012l).

***Georgia Rockcress.*** The Georgia rockcress is a perennial herb that grows up to 35 inches tall. Its leaves form a rosette and usually persist through the fruiting season with green lower surfaces. Its stem leaves are alternate, lance- or narrow-oval shaped (0.4 to 2.0 inches long), and somewhat clasping around the stems. The upper surfaces of the stem leaves have stiff, branched hairs when young but lose the hairs when mature. It typically has four white petals (0.2 to 0.4 inches long) (USFWS, 2013e). Georgia rockcress was listed as threatened in 2014 (79 FR 54627 54635, September 12, 2014). The species is found in 22 counties across central Alabama and western Georgia (USFWS, 2013e) (USFWS, 2015ea). Critical habitat in Alabama is within Bibb, Dallas, Elmore, Monroe, Sumter, and Wilcox Counties (79 FR 26679 26684, May 9, 2014) (USFWS, 2014i).

Suitable habitat for this species is characterized by "high bluffs along major river courses, with dry-mesic to mesic soils of open rocky woodland and forested slopes…Georgia rockcress grows in a variety of dry situations, including shallow soil accumulations on rocky bluffs, ecotones of sloping rock outcrops, and sandy loam along eroding riverbanks (USFWS, 2013e)." Threats include habitat degradation, quarrying, timber harvesting, road building, and grazing in areas where the plant exists, development (bridges, roads, houses, commercial buildings, or utility lines) and hydropower dam construction (USFWS, 2013e).

***Green Pitcher-plant.*** The green pitcher-plant is a "carnivorous herb arising from moderately branched rhizomes. The species has two leaf types. The pitcher leaves (tubular leaves), which appear in spring, are 20-75 cm (8-30 in.) long, 6-10 cm (2.4-4.0 in.) in circumference at the orifice, and gradually narrow from the orifice to the base. Leaves are green to yellow-green with sunlit leaves sometimes maroon suffused, externally maroon veined, or, rarely, with a purple blotch at the orifice. A similarly colored hood arches over the orifice. The pitcher leaves wither by late summer, but are replaced by falcate phyllodia (flattened leaves), which persist until the next season. Flowers are borne singly on scapes 45-70 cm (18-28 in.) long. The petals are yellow. The fruit is a tuberculate capsule 1.5-1.8 cm (0.6-0.7 in.) wide" (USFWS, 2015eb). The green pitcher-plant was listed as endangered in 1979 (44 FR 54922 54923, September 21, 1979). The species is restricted to areas of the Cumberland Plateau and the Ridge and Valley Provinces in northeast Alabama and the Blue Ridge of Georgia and North Carolina. This species previously occurred in Coastal Plain and Piedmont areas in Alabama and Georgia and also in the Cumberland Plateau of eastern Tennessee (USFWS, 1994a). In Alabama, the species is known from eight counties in the northeast portion of the state (USFWS, 2015eb).

Suitable habitat for this species includes "moist upland areas and along boggy, sandy streambanks… [with soils that]… are generally acidic and derived from sandstones or shales." Threats include clearing and degradation of land for various types of development, impoundments, trampling and soil disturbance by cattle, over-collection by botanists or commercial dealers, and fire suppression (USFWS, 1994a).

***Harperella.*** Harperella, or pond harperella, is a perennial herb that grows between half a foot and three feet tall. Its thin stalks have quill-like leaves and end in small white flowers with typically five petals each (USFWS, 2015ec). The species was listed as endangered in 1988 within the Northeast Region (53 FR 37978 37982, September 28, 1988). Harperella's range reaches down the east coast from Maryland down to Georgia and extends across to Oklahoma. Within Alabama, Harperella can be found in Cherokee, DeKalb, Etowah, and Marshall Counties in the northeastern corner of the state (USFWS, 2015ed).

Habitat for pond harperella consists of shallow ponds in hilly terrain and along gravelly stream-banks of swift moving water. Threats to harperella consist of water changes in flow, depth, and quality, along with human factors such as damming, hydrologic alterations, and development. Habitat destruction, either through overwhelming water coverage or severe dehydration, can detrimentally impact the species' survival (USFWS, 2015ec).

***Kral's Water-plantain.*** The Kral's water-plantain "a submersed to emersed aquatic perennial arising from a stiff elongated rhizome up to 10 centimeters (cm) (4 inches) in length. The leaves are of two types, depending upon the velocity and depth of the water it inhabits. In swift shallows, the leaves are linear, rigid, and sickle-shaped; in quiet, deep waters, the leaves are longer and more quill-like. Separate male and female flowers are produced on a stalk, 10-50 cm

(4-20 inches) long. The petals are inconspicuous in the female flowers; however, in the male flowers, they are white and 1.0-1.5 cm (0.4-0.6 inches) long" (USFWS, 1991d). Kral's water-plantain was listed as threatened in 1990 (55 FR 13907 13911, April 13, 1990). The species is known to occur in northwestern Georgia and in northern Alabama; in Alabama, the species is known or believed to occur in nine counties in the northern and central portions of the state (USFWS, 2015ee).

Preferred habitat for Kral's water-plantain includes "frequently exposed shoals or rooted among loose boulders in quiet pools in rocky streams." Significant threats to the species include loss and impact to habitat, including "[c]learing of the adjacent watershed for silvicultural, residential-recreational development, surface mining, or agricultural purposes" (USFWS, 1991d).

***Leafy Prairie-clover.*** The leafy prairie-clover is a smooth and hairless perennial herb that is a member of the legume family. Its leaflets range from 9 to 31, but usually occur in numbers of 20 to 27. It has one to several stems that are 8 to 31 inches long growing up from a hardened crown of roots. The dense, cylindrical, lavender-purple flowering heads with five petals and orange pollen-covered anthers are 0.15 to 3.5 inches long and 0.24 to 0.4 inches wide (USFWS, 1996b). The leafy prairie-clover was federally listed as endangered in 1991 (56 FR 19953 19959, May 1, 1991).

Regionally, this species is known or believed to occur in Alabama, Illinois, and Tennessee. In Alabama, it is found in Colbert, Cullman, Franklin, Lawrence, and Morgan Counties in the northwest portion of the state (USFWS, 2015ef). It inhabits thin-soiled, moderately moist prairie, limestone cedar glades, and limestone barrens. It needs full sunlight and not a lot of competition from other plants to grow successfully. Threats to the leafy prairie-clover include habitat destruction and loss due to development and competition with other woody plants, over collecting, drought, and grazing by herbivores (USFWS, 1996b).

***Little Amphianthus.*** The little amphianthus is "a small, aquatic annual with very short a small, aquatic annual with very short (to ca. 6 mm) (0.25 inch), leafy, rooted, submerged stems which produce flowers and one or more threadlike scapes. The tip of each scape bears two small, ovate to lanceolate, oppositely arranged bracts. The scapes elongate as necessary (to Ca. 15 cm (6 inches)) to permit the bracts to float upon the surface of the water. A single small (to 4 mm (0.16 inch) long) white to pale purplish flower is borne between the two bracts. Other flowers borne on the usually submerged short stem are similar to the emersed flowers. The fruit is a small, shallowly bilobed capsule" (USFWS, 1993d). The little amphianthus was listed as threatened in 1988 (53 FR 3560 3565, February 5, 1988). The species range includes Alabama, Georgia, and South Carolina; in Alabama, the species is known or believed to occur in six counties in the eastern portion of the state (USFWS, 2015eg).

Suitable habitat for little amphianthus is "restricted to eroded depressions or (rarely) quarry pools formed on flat-to-doming granitic (either granite or granite-gneiss) outcrops." The species is usually found in depressions that have been eroded in the granite with "an intact rim restricting drainage, and with an accumulation of a few centimeters of mineral soil." (USFWS, 1993d) Threats to little amphianthus include destruction of habitat due to quarrying activities, disturbance by farm animals, dumping on rock outcrops, vehicular traffic, recreational impacts (foot traffic, littering, and firebuilding on rock outcrops), and extreme cold. (USFWS, 1993d)

***Louisiana Quillwort.*** The Louisiana quillwort "is a small, semi-aquatic, facultative evergreen plant with spirally arranged leaves arising from a globose, two-lobed corm. The pliant, hollow leaves are transversely septate and measure 2 to 3 millimeters (mm) (0.12 inch) wide, and up to 40 centimeters (cm) (16.0 inches) long. Spore-containing structures (sporangia) are embedded in the pale, broadened bases of the leaves." (USFWS, 1996c).

Louisiana quillwort was listed as endangered in 1992 (57 FR 48741 48747, October 28, 1992). The species is known or believed to occur in Alabama, Louisiana, and Mississippi; in Alabama, the species is known or believed to occur in Conecuh and Monroe Counties in the southern portion of the state (USFWS, 2015eh).

Habitat for the Louisiana quillwort "appears to be restricted to sandy soils and gravel bars in or near shallow blackwater streams and overflow channels in riparian woodland/bayhead forests of pine flatwoods and upland longleaf pine." The most serious threat to the species is "[h]abitat loss through land use practices that significantly transform riparian forest communities and alter stream quality and dynamics…Dredging, ditching, channelization, road construction, and off-road vehicles (ORV) can alter natural processes and result in habitat loss." In addition, timber removal, mining, feral hogs, beaver dams, and plant collection are potential threats (USFWS, 1996c).

***Lyrate Bladderpod.*** The lyrate bladderpod is a small, annual plant with one or more simple stems that grow to 4 to 12 inches in length. The flowers grow on stalks 0.4 to 0.6 inches long, with yellow rounded petals that are 0.2 to 0.3 inches long and 0.1 to 0.2 inches wide. The seeds are flat and oval-shaped, about 0.1 inches in length (USFWS, 1996d). The lyrate bladderpod was federally listed as threatened in 1990 (55 FR 39864 39868, September 28, 1990).

This species is known or believed to occur only in Colbert, Franklin, and Lawrence Counties, in northwestern Alabama (USFWS, 2015ei). It inhabits shallow soils near cedar glades, in disturbed lawns, cultivated fields, grassy and rocky pastures, and roadsides. The biggest threat to the lyrate bladderpod is habitat modification or destruction due to agricultural practices and poor land management (USFWS, 1996d).

***Mohr's Barbara's Button.*** The Mohr's Barbara's button "is an erect perennial herb, 3 to 7 decimeters (1 to 2.3 feet) tall. The leaves are alternate, 8 to 20 cm (3.2 to 7.8 in.) long, firm-textured, three-nerved, and lanceolate-ovate in shape. Leaves are often clustered near the base and gradually reduce in size upwards. Inflorescences typically consist of several flowering heads in a branched arrangement. The heads are approximately 2.5 cm (1 in.) wide and consist of disk flowers (tubular in shape) that are pale pink or white in color. The fruit is an achene." (USFWS, 2015ej). Mohr's Barbara button was listed as threatened in 1988 (53 FR 34698 34701, September 7, 1988). The species is known from Alabama and Georgia; in Alabama, the species is known or believed to occur in 16 counties in the north-central part of the state (USFWS, 2015ej).

Suitable habitat is characterized by prairie-like openings in woodlands with moist soils, and banks near shale-bedded streams. The soils are sandy clays, which are alkaline, high in organic matter, and seasonally wet. Plants occur in full sun or partial shade in a grass-sedge community. Threats include application of herbicides, road expansion, and the use of ROWs for installation of utility lines. Habitat loss also occurs from conversion to agricultural or silvicultural uses (USFWS, 1991e).

***Morefield's Leather Flower.*** The Morefield's leather flower is a perennial vine in the buttercup family that has urn-shaped, pinkish colored, 0.8 to 1 inch long flowers growing singly, or in few flowered groups, between the leaf and stem. The hairy, one-seeded fruits grow in clusters (USFWS, 1994b). The Morefield's leather flower was federally listed as endangered in 1992 (57 FR 21562 21564, May 20, 1992).

Regionally, this species is known or believed to occur in Alabama and Tennessee. In Alabama, it is found in Blount, Calhoun, Cherokee, Etowah, Jefferson, and St. Clair Counties, located in the northeastern part of the state (USFWS, 2015ek). It inhabits rocky limestone woods near seeps or springs, usually on the south and southwest facing slopes of mountains. Threats to the Morefield's leather flower include habitat loss due to residential development, and vulnerability due to its small range and population sizes (USFWS, 1994b).

***Pondberry.*** The pondberry "is a deciduous shrub, growing from less than 1 foot (30 cm) to, infrequently, more than 6 feet (2 m) in height. Leaves are aromatic, alternate, elliptical, somewhat thin and membranaceous, with entire margins. Shrubs usually are sparsely branched, with fewer branches on smaller plants. Plants are rhizomatous, frequently propagating by vegetative sprouts and forming colonies. Plants are dioecious, each plant is a male or a female, and produce clusters of small, yellow flowers in early spring prior to leaf development, from buds on branches produced from the growth during the preceding year. Immature fruits are drupes, green, and ripen to red by fall. (USFWS, 2015el)

Pondberry was listed as endangered in 1986 (51 FR 27495 27500, July 31, 1986). The species is known from Alabama, Arkansas, Georgia, Mississippi, Missouri, North Carolina, and South Carolina; in Alabama, the species is known or believed to occur in Coffee, Covington, and Geneva Counties in the southern portion of the state (USFWS, 2015el).

Suitable habitat for this species includes seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions. Threats to the species include alteration or destruction of its habitat through land-clearing, drainage modification, timber-harvesting, and disturbance from domestic animals (USFWS, 1993e).

***Price's Potato-bean.*** The Price's potato-bean is a perennial vine with leaves measuring 8 to 12 inches long, alternate, and composed of 5 to 9 leaflets 1.6 to 4 inches long The greenish-white or brownish pink flowers are tipped with magenta and measure 0.4 inches long, blooming from mid-July to mid-August (USFWS, 1993f). The Price's potato-bean was listed as threatened in 1990 (55 FR 429 433, January 5, 1990). Its habitat is comprised of open, wooded areas, in forest gaps and in open, low areas near streams and rivers, and prefers lightly disturbed area (USFWS, 1993f) (USFWS, 2015em). Regionally, this species can be found in Alabama, Illinois, Kentucky, Mississippi, and Tennessee. In Alabama, it can be found in ten counties throughout the state (USFWS, 2015en).

The narrow habitat requirements of this species mean that habitat succession and lack of regular, light disturbance threaten populations. Major threats to this species include cattle, which graze and trample the plant, timber harvesting, and herbicides, especially in ROWs where this species has been known to flourish (USFWS, 1993f) (USFWS, 2015em).

***Relict Trillium.*** The relict trillium "is distinguished from other sessile-flowered members of the genus by its decumbent or S-curved stems, distinctively shaped anthers, and the color and shape of its leaves. The flowers appear in early spring and are greenish to brownish purple or occasionally pure yellow in color. The fruit is an oval-shaped, berry-like capsule that matures in early summer" (USFWS, 1991f). The relict trillium was listed as endangered in 1988 (53 FR 10879 10884, April 4, 1988). The species occurs primarily in undisturbed moist hardwood forests in limited portions of Alabama, Georgia, and South Carolina; in Alabama, the species is known from seven counties in the southeastern portion of the state (USFWS, 1991f) (USFWS, 2015eo).

Suitable habitat for relict trillium includes "moist hardwood forests that have had little or no disturbance in the recent past. The soils on which it grows vary from rocky clays to alluvial sands, but all exhibit a high organic matter content in the upper soil layer. Most sites appear to be free from the influence of fire, both in the recent and distant past." The plant will also is known to inhabit disturbed sites, such as utility ROWs and former agricultural areas (USFWS, 1991f). The most significant threat is the loss or alteration of habitat resulting from residential development." Other threats include conversion of habitat to silviculture and agriculture uses. (USFWS, 1991f).

***Tennessee Yellow-eyed Grass.*** The Tennessee yellow-eyed grass is "a perennial which typically occurs in clumps of few to many bulbousbased individuals. The soft, bulbous bases are comprised of small, dark outer scales and fleshy, white to rose or purplish inner scales. The leaves are all basal; the outermost ones are short and scalelike, whereas the others are linear, 9 to 45 centimeters (cm), or 3.5 to 18 inches (in.) long, and 0.15 to 1.0 cm (0.06 to 0.4 in.) wide." The plant has "leafless, unbranched, flowering stalks each bearing a terminal, conelike inflorescence comprised of spirally arranged bracts enclosing small flowers with yellow or occasionally white petals" (USFWS, 1994c). The species was listed as endangered in 1991 (56 FR 34151 34154, July 26, 1991). The species is currently known or believed to occur in in Alabama, Georgia, and Tennessee; in Alabama, the species is known or believed to occur in 13 counties in the east-central portion of the state (USFWS, 2015ep).

"Suitable habitat for long-term survival of this species appears to be very limited. Populations are located in spring meadows or along small streams." Threats to the species include timber management, drainage of lowland wetlands and conversion to agricultural fields, the impoundment of wetlands, herbicide spraying for weed control, and off-road vehicles (USFWS, 1994c).

***Whorled Sunflower.*** The whorled sunflower "is a perennial arising from horizontal, tuberous-thickened roots with slender rhizomes. The stems are slender, erect, and up to 2 meters (m) (6 feet (ft.)) tall. The leaves are opposite on the lower stem, verticillate (whorled) in groups of 3 to 4 at the mid-stem, and alternate or opposite in the inflorescence at the end. Individual leaves are firm in texture and have a prominent mid-vein, but lack prominent lateral veins found in many members of the genus. The flowers are arranged in a branched inflorescence typically consisting of 3 to 7 heads" (USFWS, 2014j). The species was listed as endangered in 2014 (79 FR 44712 44718, August 1, 2014). This species is a member of the sunflower family known or believed to occur in Cherokee County, Alabama; Floyd County, Georgia; and McNairy and Madison Counties, Tennessee at the time of listing (USFWS, 2014j). In Alabama, the species is known from Cherokee County in the northeastern part of the state. Critical habitat for the whorled sunflower has been designated in Alabama, Georgia, and Tennessee; in Alabama, the critical habitat is within four units in Cherokee County (USFWS, 2015v).

Suitable habitat includes "moist, prairie-like remnants, which in a more natural condition exist as openings in woodlands and adjacent to creeks." Threats to the species include mechanical or chemical vegetation management for industrial forestry, ROW maintenance, or agriculture; shading and competition resulting from vegetation succession; limited distribution and small population sizes (USFWS, 2014j).

## 3.1.7 Land Use, Recreation, and Airspace

### *3.1.7.1 Definition of the Resource*

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

**Land Use and Recreation**

Land use is defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce, change, or maintain it" (Di Gregorio & Jansen, 1998). 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, 2012c).

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. Recreational resources are typically managed by federal, state, county, or local governments.

Descriptions of land uses are presented in three primary categories: forest and woodlands, agricultural, and developed. 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 areas of recreational significance within 12 identified 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, 2015). 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 Federal Aviation Administration (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 United States and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (FAA, 2014a). The ATO is comprised 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 [FSDO], 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, 2015b). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

### *3.1.7.2 Specific Regulatory Considerations*

Land use planning in Alabama is the primary responsibility of local governments (i.e., county). The main planning tools for local governments include the comprehensive plan, zoning ordinance, and subdivision ordinance. The land use code for each county sets forth the authority for each of these tools, as granted to the counties by state-enabling legislation. The comprehensive plan proposes land uses and locations of public facilities and utilities and projects long-term population growth. The zoning ordinance sets forth the rules used to govern the land by dividing localities into zoning districts and establishes allowable uses within the districts (e.g., agriculture, industry, commercial use). The subdivision ordinance manages the process for dividing large land parcels into smaller lots (Baldwin County, 2015).

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

#### *3.1.7.3 Land Use and Ownership*

For the purposes of this analysis, Alabama is classified into primary land use groups based on coverage type as forest and woodlands, agricultural, and developed land. Land ownership within Alabama is classified into four main categories: private, federal, state, and tribal land.

**Land Use**

Table 3.1.7-1 identifies the major land uses by coverage type in Alabama. Forest and woodlands comprise the largest portion of land use, with 62 percent of the land area in Alabama occupied by this category. Agriculture is the second largest area of land use, with 19 percent of the total land area. Developed areas account for approximately six percent of the total land area in Alabama (Table 3.1.7-1 and Figure 3.1.7-1). The remaining percentage of land includes public land, surface water, and other land covers that are not associated with specific land uses (USGS, 2011a).

**Table 3.1.7-1: Major Land Use in Alabama by Coverage Type**

| Land Use | Square Miles | Percent of Land |
|---|---|---|
| Forest and Woodland | 31,264 | 62% |
| Agricultural Land | 9,937 | 19% |
| Developed Land | 3,366 | 6% |
| Public Land, Surface Water, and Other Land Covers | 6,078 | 13% |

Source: (USGS, 2011a)

*Forest and Woodland*

Forest and woodland areas dominate Alabama's landscape, with many of them interspersed with and adjacent to agricultural areas. Woody wetland areas occur in the southern portion of the state in the coastal plain geographic region, transitioning to forested rolling hills in the northern portion of the state (Figure 3.1.7-1). The primary forest types that occur in Alabama are the loblolly pine/shortleaf pine (39 percent of total forestland), oak/hickory (31 percent of total forestland), and pine plantations (30 percent of total forestland) (Alabama Forestry Commission, 2015a). The large majority of Alabama's forestland is owned by private landowners (approximately 85 percent) and private companies (Alabama Forestry Commission, 2015a), with the remaining 15 percent owned and managed by the state and federal government.

<u>National Forests</u>

National forests in Alabama comprise approximately 1,121 square miles, or four percent of the state's total forestland, and includes four National Forests: Bankhead, Conecuh, Talladega, and Tuskegee National Forests. These forests are managed for multiple uses and values, including recreation activities (e.g., camping, hiking), timber production, and maintenance of fish and wildlife habitat.

State Forests

The Alabama Forestry Commission manages five state forests and the Alabama Department of Conservation and Natural Resources manages the Choccolocco State Forest, which is part of the Choccolocco Wildlife Management Area (WMA). These forests are managed for multiple-use purposes, including developed and undeveloped outdoor recreation (e.g., hiking, wildlife viewing), timber production, fish and wildlife habitat, hunting and fishing, aesthetic preservation, and forest research/educational purposes (Alabama Forestry Commission, 2015b). Table 3.1.7-2 presents the names and associated square miles for each of the six state forests.

**Table 3.1.7-2: State Forests in Alabama**

| State Forests | Square Miles |
|---|---|
| Choccolocco State Forest | 7.1 |
| Edward A. Hauss State Forest Nursery | 0.5 |
| Geneva State Forest | 11.1 |
| Little River State Forest | 3.3 |
| Macon State Forest | 0.3 |
| Weogufka State Forest | 0.4 |
| **Total** | **22.7** |

Source: (Alabama Forestry Commission, 2015b)

Private Forest and Woodland

Approximately 26,574 square miles, or 85 percent of Alabama's total forestland, is owned collectively by private landowners (Alabama Forestry Commission, 2015a). Private forestlands indirectly provide some public benefit, including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities. Scattered throughout the state, forests and woodlands on private lands often border agricultural fields, suburban neighborhoods, and state and national forests. For additional information regarding forest and woodland areas, see Section 3.1.6, Biological Resources, and Section 3.1.8, Visual Resources.

*Agricultural Land*

Agricultural land exists throughout the state on 9,937 square miles, or 19 percent of the total land area (Figure 3.1.7-1) (USGS, 2011a). Approximately 43,223 farms exist in Alabama, with an average size of 0.3 square miles (USDA, 2012a). Alabama's top agricultural products are poultry and eggs (65 percent of total agricultural receipts); grains, oilseeds, beans, and peas (8 percent of total agricultural receipts); cattle and calves (8 percent of total agricultural receipts); and other crops and hay (6 percent of total agricultural receipts) (USDA, 2012b).

### *Developed Land*

Developed land in Alabama is concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 3.1.7-1). Although only six percent of Alabama land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 3.1.7-3 lists the top five developed metropolitan areas within the state and their associated population estimates.

**Table 3.1.7-3: Top Five Developed Metropolitan Areas**

| Metropolitan Area | Population Estimate |
|---|---|
| Birmingham | 749,495 |
| Mobile | 326,183 |
| Huntsville | 286,692 |
| Montgomery | 263,907 |
| Tuscaloosa | 139,114 |
| **Total Population of Metropolitan Areas** | **1,765,391** |
| **Total State Population** | **4,849,377** |

Source: (U.S. Census Bureau, 2012a)

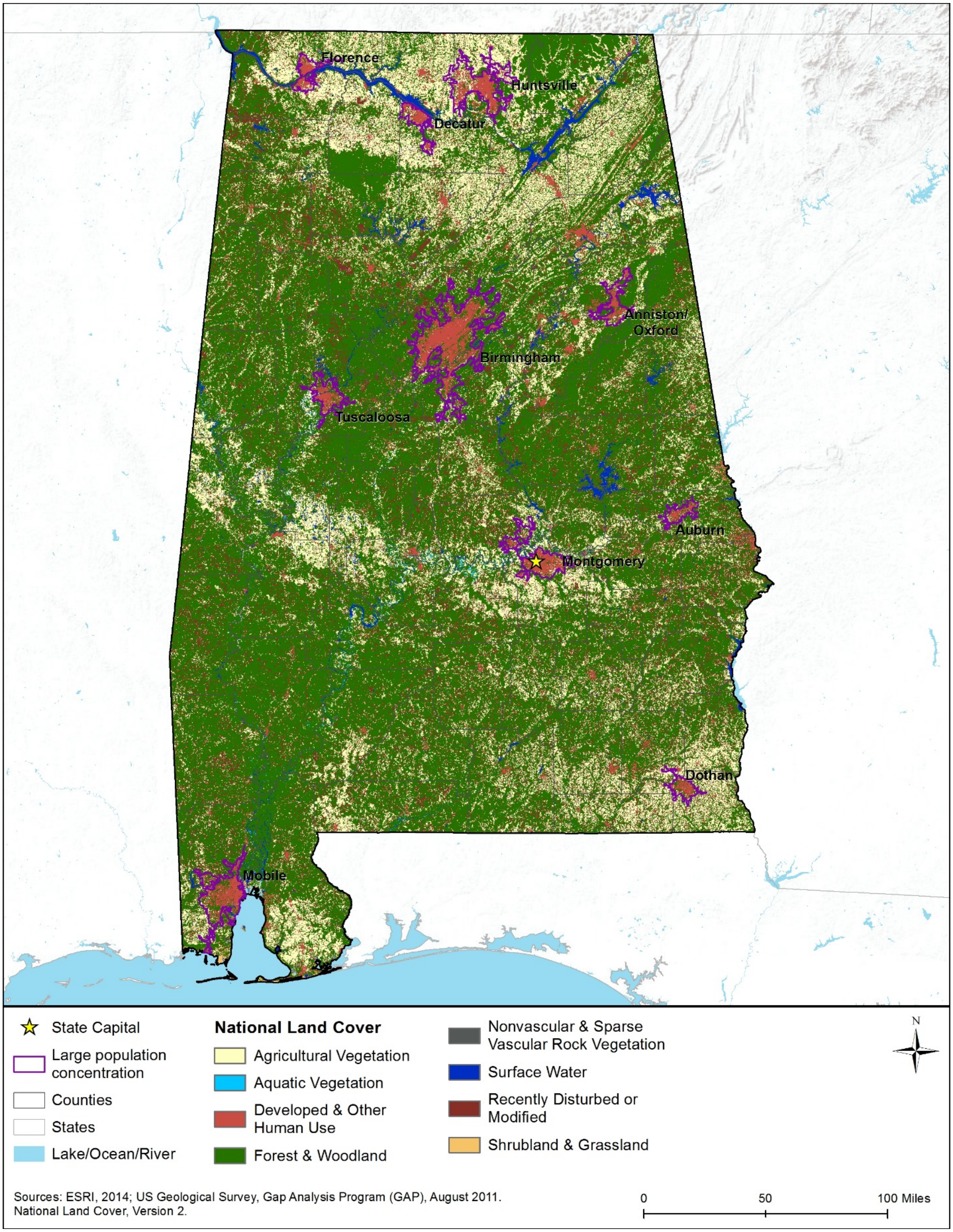



**Figure 3.1.7-1: Major Land Use Distribution in Alabama by Coverage Type**

## Land Ownership

Land ownership within Alabama has been classified into four main categories: private, federal, state, and tribal (Figure 3.1.7-2).[112]

### *Private Land*

The large majority of land in Alabama is privately owned (Figure 3.1.7-2), with most of this land falling under the land use categories of agricultural, forest and woodland, and developed (Figure 3.1.7-2). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[113]

### *Federal Land*

The federal government manages 1,771 square miles, or approximately three percent, of land in Alabama, including national forests, national wildlife refuges, and military facilities (Figure 3.1.7-2) (USGS, 2014f). Five federal agencies manage the majority of federal lands throughout the state (Table 3.1.7-4 and Figure 3.1.7-2). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state (Figure 3.1.7-2) (USGS, 2014g).

**Table 3.1.7-4: Federal Land in Alabama**

| Agency | Square Miles | Representative Type |
|---|---|---|
| U.S. Department of Agriculture (USDA) Forest Service | 1,121 | Forests and Wilderness |
| Department of Defense (DoD) | 376 | Military Installations |
| Tennessee Valley Authority (TVA) | 171 | Lakes, Rivers |
| U.S. Fish and Wildlife Service (USFWS) | 72 | Wildlife Refuges |
| National Park Service (NPS)[a] | 31 | Preserve, Military Park |
| **Total** | **1,771** | |

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

Source: (USGS, 2014g)

[112] 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.

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

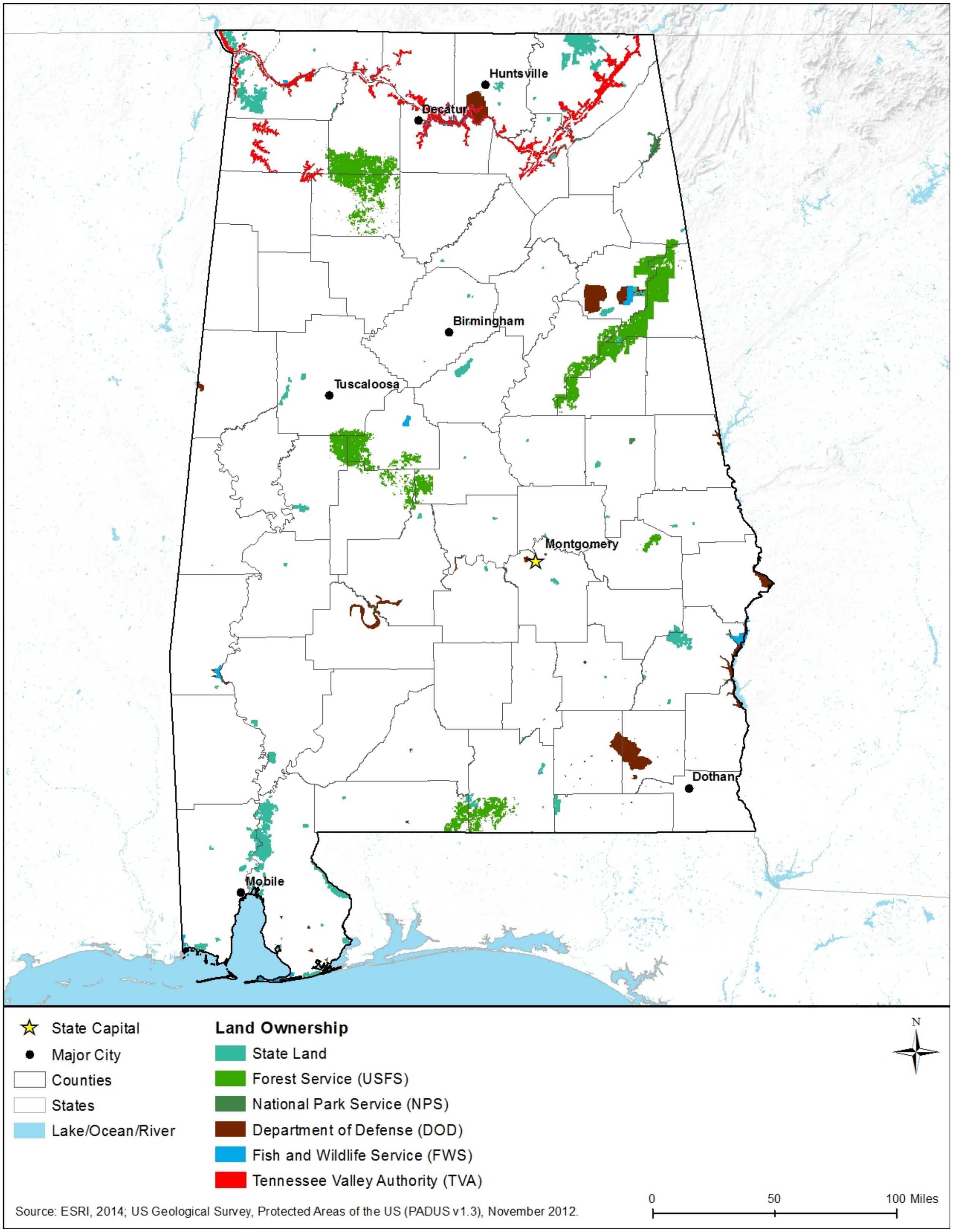



**Figure 3.1.7-2: Major Land Ownership Distribution**

The following is a brief description of federal land ownership in Alabama:

- The USDA Forest Service manages 1,121 square miles of land comprised of four National Forests: Bankhead, Conecuh, Talladega, and Tuskegee National Forests (USGS, 2014g).
- The Department of Defense (DoD) manages 376 square miles of land comprised of three military reservations (Fort McClellan, Fort Benning, and Fort Rucker), Maxwell Air Force Base, the Redstone Arsenal, the Anniston Army Depot, Barin Field, and five lakes and reservoirs managed by the Army Corps of Engineers (West Point, Aliceville, Walter F. George, Coffeeville, and William Dannelly Lakes) (USGS, 2014g).
- The Tennessee Valley Authority manages 171 square miles of surface water comprised of the Tennessee River, Cedar Creek Lake, Little Bear Creek Reservoir, Upper Bear Creek Reservoir, and Guntersville Lake (USGS, 2014g).
- The U.S. Fish and Wildlife Service (USFWS) manages 72 square miles of land comprised of five National Wildlife Refuges: Key Cave, Wheeler, Eufaula, Choctaw, Grand Bay, and Bon Secour National Wildlife Refuges (USGS, 2014g).
- The National Park Service (NPS) manages 31 square miles of land comprised of the Little River Canyon National Preserve and Horseshoe Bend National Military Park (USGS, 2014g).

*State Land* [114]

The State of Alabama manages approximately 445 square miles of land, or less than one percent of the total land in the state (Figure 3.1.7-2). These state-administered lands are managed by the Alabama Department of Conservation and Natural Resources, State Lands Division and include 375 square miles of land under the Forever Wild Land Trust and 70 square miles of School Trust Lands, Mental Health Trust Lands, and Muscle Shoal Grant Lands (ADCNR, 2015d).

*Tribal Land*

Approximately 0.4 square miles of land within the Poarch Creek Indian Reservation is managed by the Poarch Band of Creek Indians, which is the only federally recognized Indian Tribe currently located in the state (Figure 3.1.7-2) (USGS, 2014g).

#### *3.1.7.4 Recreation*

Alabama varies widely in its population density, affluence, and cultural interests. On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities including: community and recreation centers, theaters, museums, indoor/outdoor pools, athletic fields and courts, golf courses, multi-use trails, playgrounds, picnicking areas, theme/amusement parks, boat launches, and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. There are 24 state parks and many

[114] 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.

Forever Wild Land Trust tracts, Lands Division Recreation tracts, and wildlife management areas that provide public outdoor recreation opportunities (Alabama State Parks, 2015a). The Robert Trent Jones Golf Trail is a totally unique recreation system of 26 public golf courses that have been developed at 11 different sites across Alabama. The 631-mile Alabama Scenic River Trail is the longest water trail in any one U.S. state (Alabama State Parks, 2015b). Federally, the NPS, U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers (USACE) manage areas in Alabama with substantial recreational attributes.

This section discusses recreational opportunities and activities representative of various regions of Alabama. The state can be categorized by four distinct recreational regions, each of which are presented in the following subsections. For information on visual resources, such as National Scenic Byways and state-designated Byways, see Section 3.1.8, Visual Resources, and for detailed information on culturally/historically significant resources (e.g., National Historic Sites, National Historic Landmarks, sites on the National Register of Historic Places, and Natural Heritage Areas), see Section 3.1.11, Cultural Resources.

**Huntsville Region**

Huntsville is the major city in this northern region of the state, and the area's most prominent natural features are the Tennessee River, Cumberland Plateau, William Bankhead National Forest, Sipsey Fork National Wild and Scenic River, Louis Smith, Guntersville, and Weiss Lakes, and the Little River Canyon National Preserve (Figure 3.1.7-3).[115] As home of America's space program, Huntsville's U.S. Space and Rocket Center is the single focus of many visitors to this region. The Museum of Art, Botanical Garden, North Alabama Railroad Museum, Southern Railway System Depot, and the Constitution Hall Park Living History Village are popular cultural attractions. Monte Sano Mountain State Park, just east of the city, provides camping, picnicking, hiking, and biking trails, and a disc golf course (Alabama Historical Commission, 2015). Jackson County, in this region, has the highest concentration of caves of any U.S. county (The Nature Conservancy, 2016).

All of the areas of this region that surround centrally located Huntsville are rural and populated with small towns. The abundance of streams, rivers, lakes, forests, mountainous uplands, and caves provide residents and visitors with profuse opportunities to hunt and fish, engage in every type of water sport, hike, bike, off-highway vehicle (OHV) and horseback ride, rock climb, explore caves, camp, and view wildlife.

[115] 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.

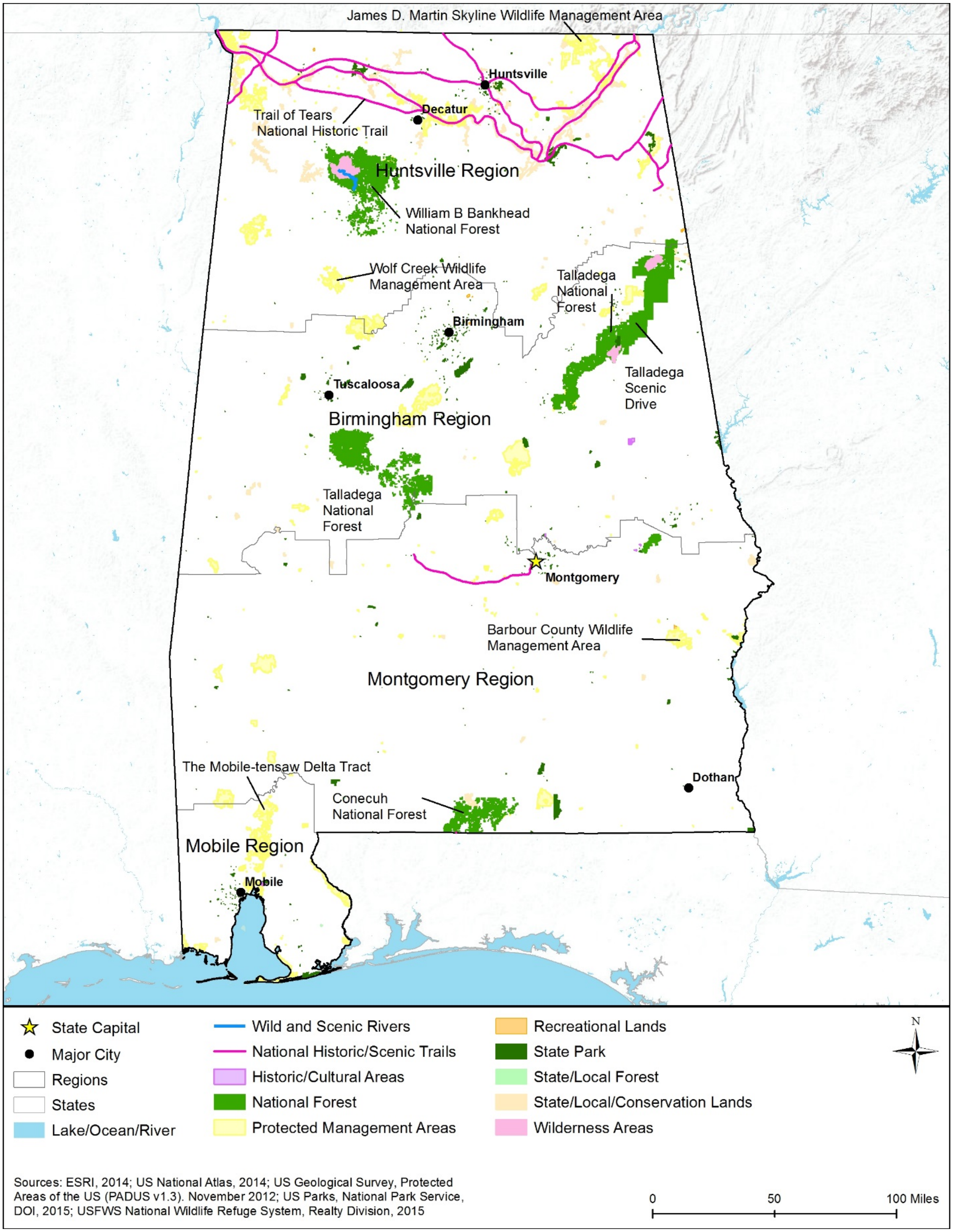



**Figure 3.1.7-3: Alabama Recreation Resources**

### Birmingham Region

Birmingham is the major city in this central region of the state, and the area's most prominent natural features are the Coosa River, Cumberland Plateau, Talladega National Forest, H. Neely Henry and Logan Martin Lake, and Lake Wedowee (Figure 3.1.7-3). Birmingham's beginnings as a steel-making town are celebrated by the Vulcan Park and Museum and the Sloss Furnaces Center for metal arts. Many legendary pioneers in the civil rights movement, country, blues, rock, and gospel music, and sports hail from Alabama. The Civil Rights Institute, Alabama Jazz Hall of Fame, and Sports Hall of Fame are popular tourist attractions in this city. Oak Mountain State Park's proximity to the Birmingham metro area makes it an oasis to residents and a recreational playground for visitors. Hiking, world-class mountain biking, cable skiing, boating, fishing, and camping are popular activities. (Alabama State Parks, 2015c)

All of the areas of this region that surround centrally located Birmingham are rural and populated with small towns. The abundance of streams, rivers, lakes, forests, mountainous uplands, and caves provide residents and visitors with profuse opportunities to hunt and fish, engage in every type of water sport, hike, bike, OHV and horseback ride, rock climb, explore caves, camp, and view wildlife.

### Montgomery Region

Montgomery is the major city in this southern region of the state, and the area's most prominent natural features are the Tombigbee River, Cumberland Plateau, Talladega, Tuskegee, and Conecuh National Forests, and Lake Martin (Figure 3.1.7-3). The Civil War and Civil Rights Movement frame the history of this capital city, so many museums, historical sites, and associated attractions are dedicated to those stories. The State Theater is highly regarded nationally, especially for its Shakespeare Festival productions. Racing fans flock to Talladega Superspeedway for nationally known races and motoring schools (Alabama State Parks, 2015d). The Talladega National Forest features 2,407-foot Cheaha Mountain, Alabama's tallest peak, the Cheaha Wilderness Area, and 145 miles of the Pinhoti National Recreation Trail (USFS, 2015b).

All of the areas of this region that surround centrally located Montgomery are rural and populated with small towns. The abundance of streams, rivers, lakes, forests, and uplands provide residents and visitors with profuse opportunities to hunt and fish, engage in every type of water sport, hike, bike, OHV and horseback ride, camp, and view wildlife.

### Mobile Region

Mobile is the major city in this coastal region of the state, and the area's most prominent natural features are the Mobile River and Bay, Gulf of Mexico, Dauphin Island, and coastal beaches (Figure 3.1.7-3). With such a dominant presence of waterways and shorelines in this region, water-related venues and recreational activities are everywhere. Gulf Shore's 32 miles of beautiful white sand beaches, and attractions such as Fort Morgan State Historic Site, Waterville Amusement Park, Adventure Island, Wharf Resort, Bon Secour National Wildlife Refuge, and sailing and fishing charters are popular recreational destinations. Dauphin Island is best known for its importance as a resting stop for migrating birds arriving from and returning to Central and

South America. The Audubon Bird Sanctuary has a unique variety of habitats including sand dunes, marshes, swamps, lakes, and maritime forests that provides superb opportunities for birding and wildlife viewing. Visitors come seeking opportunities to enjoy a minimally developed natural area for hiking, biking, picnicking, and beach activities.

Fairhope's French Quarter, antique shops, Gator Alley Boardwalk, Historic Fort Blakely State Park, and Five Rivers Delta Resources Outdoor Recreation Center draw many tourists to this small town on Mobile Bay. Also on the Bay, just adjacent to downtown, the USS Alabama Battleship Memorial Park features this famous battleship, as well as a variety of other military vehicles and equipment. (Alabama Herbarium Consortium & The University of West Alabama, 2015)

### *3.1.7.5 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 (MOA). 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 3.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[116] service is based on the airspace classification (FAA, 2008).

[116] ATC – Approved authority service to provide safe, orderly, and expeditious flow of air traffic operations. (FAA, 2015c)

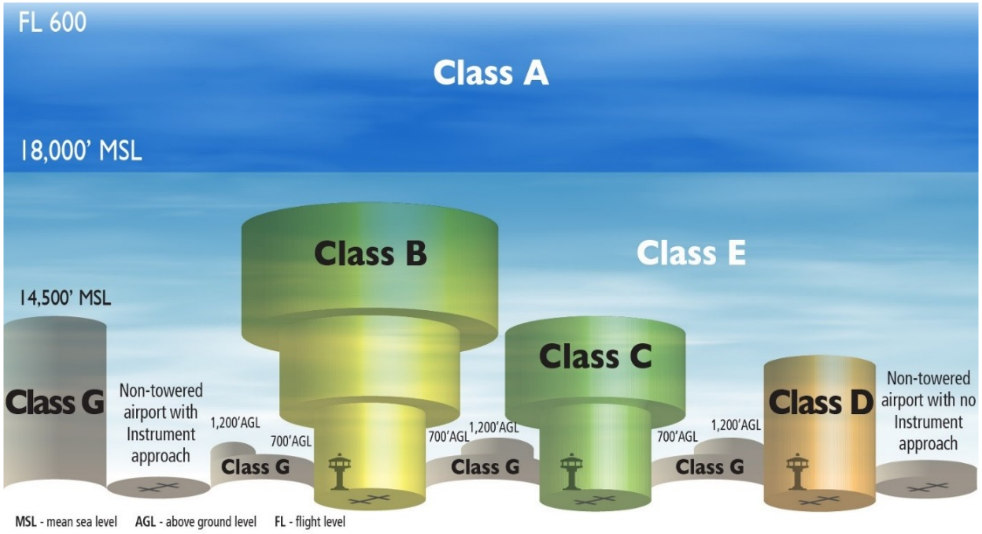



**Figure 3.1.7-4: National Air Space Classification Profile**

Source: Derived from (FAA, 2008)

## Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL).[117] Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[118]
- **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).

[117] 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." (FAA, 2015c).
[118] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015c).

### 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 (See Table 3.1.7-5).

**Table 3.1.7-5: 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 U.S. 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 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 (CFA) | "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." |

| SUA Type | Definition |
|---|---|
| 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, 2015c) (FAA, 2008)

## Other Airspace Areas

Other airspace areas, explained in Table 3.1.7-6, include Airport Advisory, Military Training Routes (MTR), Temporary Flight Restrictions (TFR), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

**Table 3.1.7-6: Other Airspace Designations**

| Type | Definition |
|---|---|
| Airport Advisory | There are three types:<br>• 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.<br>• Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower.<br>• 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:<br>• Protect people and property from a hazard;<br>• Provide safety for disaster relief aircraft during operations;<br>• Avoid unsafe aircraft congestion associated with an incident or public interest event;<br>• Protect the U.S. President, Vice President, and other public figures;<br>• Provide safety for space operations; and<br>• Protect in the State of Hawaii declared national disasters for humanitarian reasons.<br>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. |
| 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. |

| Type | Definition |
|---|---|
| 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, 2015c) (FAA, 2008)

### *3.1.7.6 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.

### *3.1.7.7 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 off airports 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. above ground 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
- Any construction or alteration located on a public use airport or heliport regardless of height or location" (FAA, 2015d).

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.

#### *3.1.7.8 Alabama Airspace*

The Aeronautics Bureau is one of several offices within the Alabama Department of Transportation. The Aeronautics Bureau's stated mission is "To serve the local airport operators and general public by assuring that aviation fuel taxes are spent on projects and research that will preserve and enhance Alabama's air transportation system. Ensuring the long-term safety and efficiency of Alabama's airports is essential to the state's transportation system" (ALDOT, 2015b). The Bureau's main purpose is airport safety via their inspection program and federal grant management. There is one FAA FSDO for Alabama located in Birmingham (FAA, 2015e).

Alabama 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 associated with their airports (National Association of State Aviation Officials (NASAO), 2015). Figure 3.1.7-5 presents the different aviation airports/facilities residing in Alabama, while Figure 3.1.7-6 and Figure 3.1.7-7 present the breakout by public and private airports/facilities. There are approximately 286 airports within Alabama as presented in Table 3.1.7-7 and Figure 3.1.7-6 and Figure 3.1.7-7 (USDOT, 2015a).

### Table 3.1.7-7: Type and Number of Alabama Airports/Facilities

| Type of Airport or Facility | Public | Private |
|---|---|---|
| Airport | 89 | 95 |
| Heliport | 0 | 95 |
| Seaplane | 2 | 5 |
| Ultralight | 0 | 0 |
| Balloonport | 0 | 0 |
| Gliderport | 0 | 0 |
| **Total** | **91** | **195** |

Source: (USDOT, 2015a)

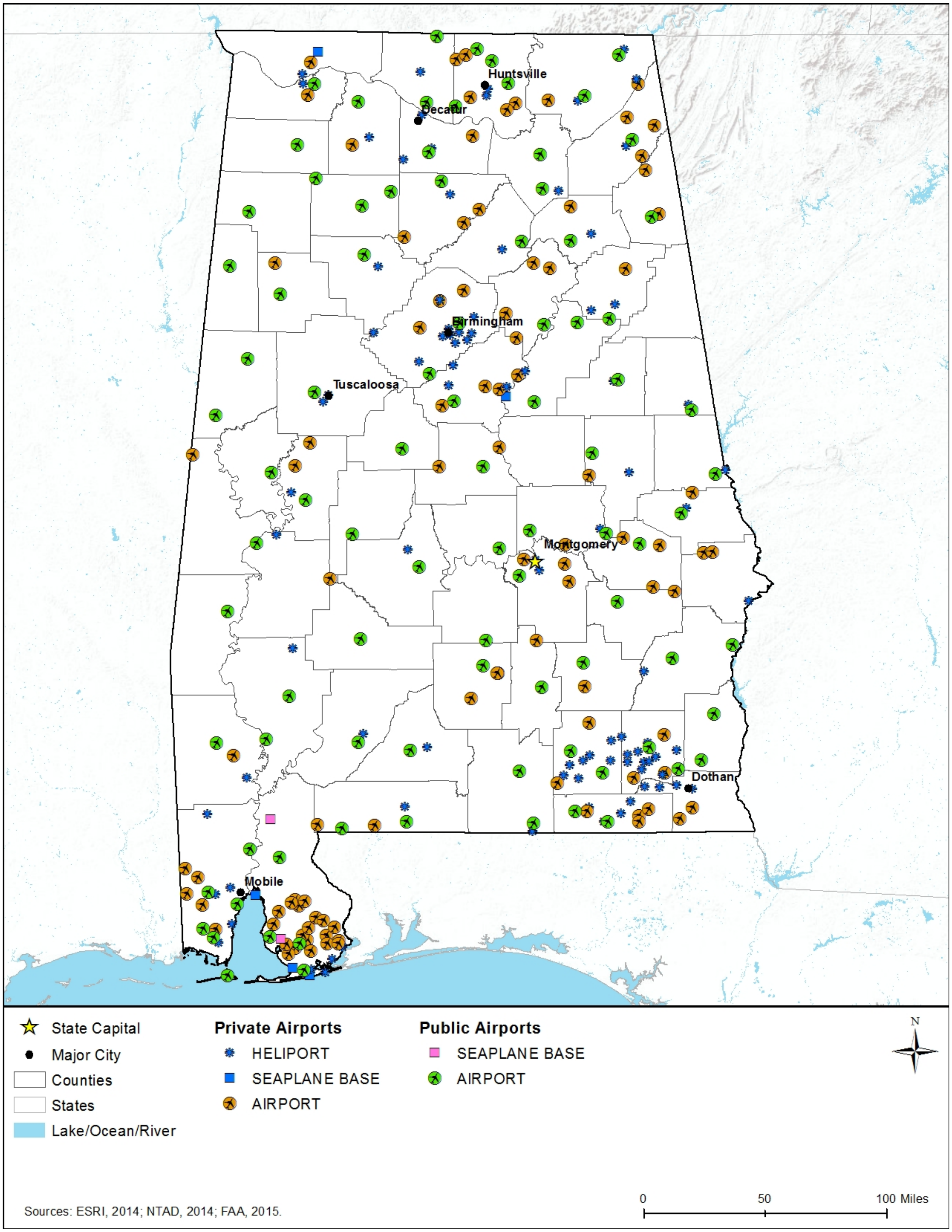



**Figure 3.1.7-5: Composite of Alabama Airports/Facilities**

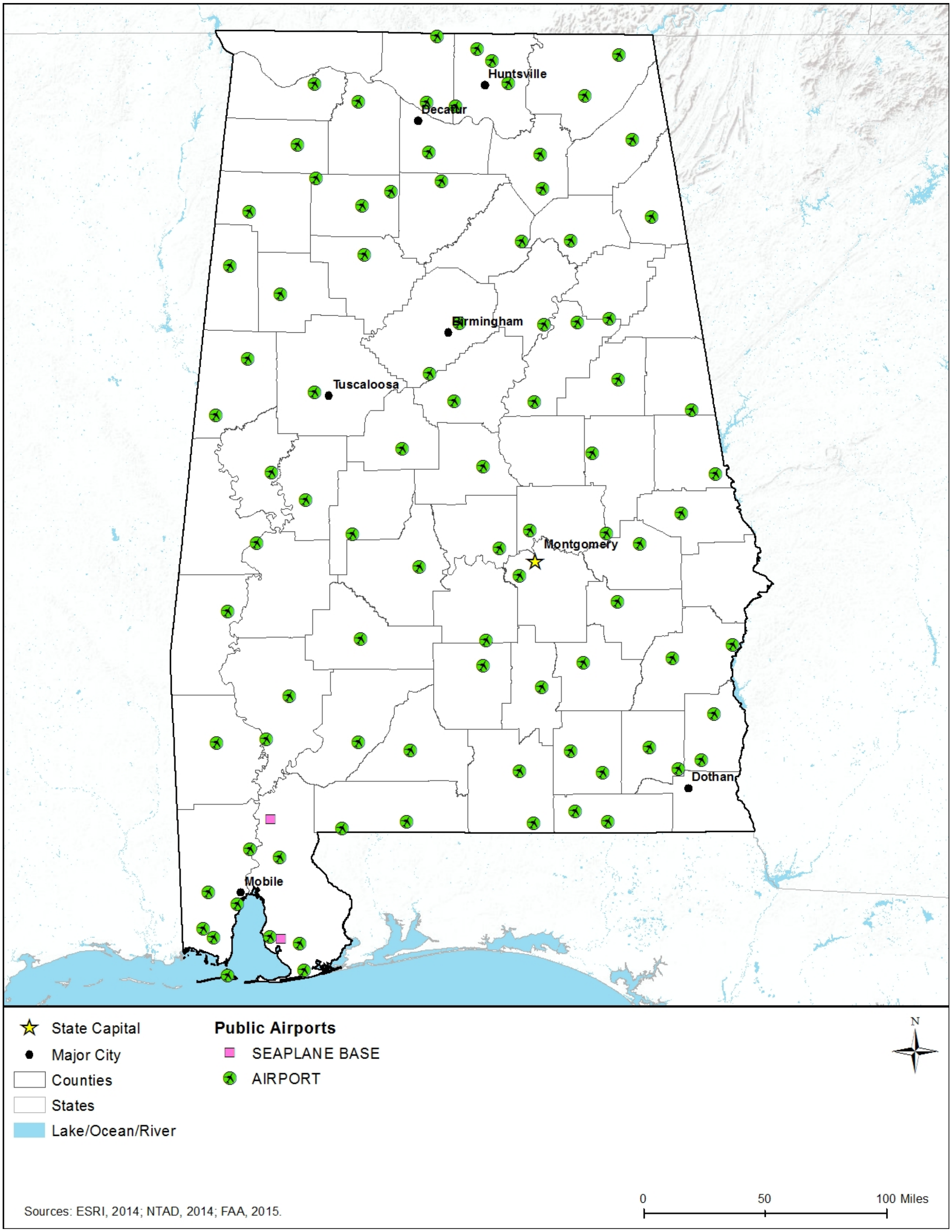



**Figure 3.1.7-6: Public Alabama Airports/Facilities**

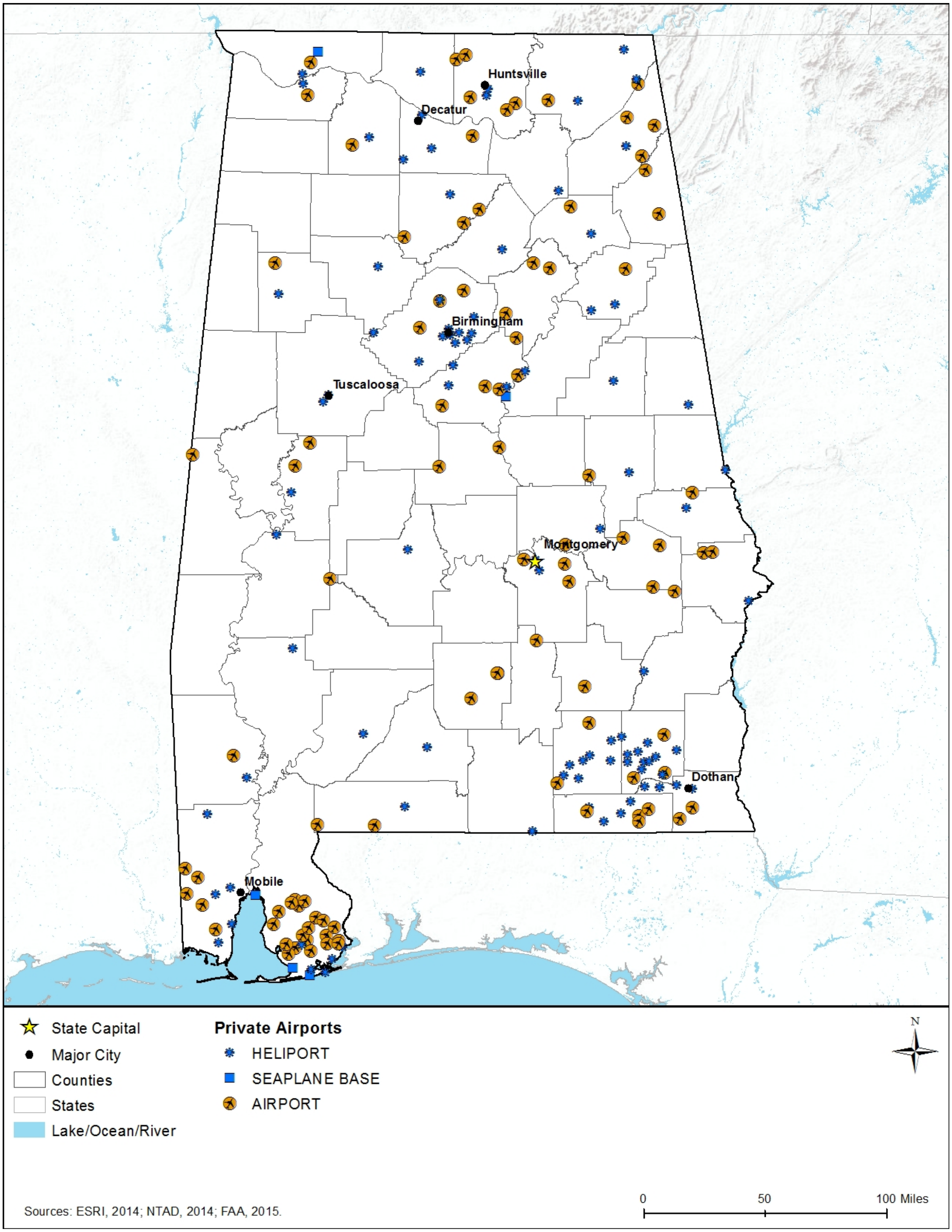



**Figure 3.1.7-7: Private Alabama Airports/Facilities**

There are Class C and D controlled airports for Alabama as follows:

- Three Class C –
  - Birmingham International
  - Huntsville International-Carl T. Jones Field
  - Mobile Regional
- Eight Class D –
  - Dothan
  - Cairns Army Air Field (AAF), Fort Rucker
  - Redstone AAF, Huntsville
  - Maxwell Air Force Base
  - Mobile Downtown
  - Montgomery Regional Airport-Dannelly Field
  - Troy Municipal
  - Tuscaloosa Municipal (FAA, 2014b)

SUAs (i.e., eleven restricted and four MOAs) located in Alabama are as follows:

- Anniston Army Depot (Restricted)
  - R-2101 Surface to 5,000 feet MSL
- Fort McClellan (Restricted)
  - R-2102A Surface to and including 8,000 feet MSL
  - R-2102B 8,000 feet MSL to and including 14,000 feet MSL
  - R-2102C 14,000 feet MSL to 24,000 feet MSL
- Fort Rucker (Restricted)
  - R-2103A Surface to, but not including, 10,000 MSL
  - R-2103B 10,000 feet MSL to 15,000 feet MSL
- Huntsville (Restricted)
  - R-2104A Surface to 12,000 feet MSL
  - R-2104B Surface to 2,400 feet MSL
  - R-2104C Surface to 12,000 feet MSL
  - R-2104D 12,000 feet MSL to flight level (FL) 300
  - R-2104E 12,000 feet MSL to FL300 (FAA, 2016)

Fort Benning, Georgia Restricted Area R-3000G extends into the eastern border of Alabama east of Montgomery. The four MOAs for Alabama are as follows:

- Birmingham – 10,000 feet MSL to, but not including, FL 180;
- Birmingham – 2,500 feet above ground level (AGL) to, but not including, 10,000 feet; Excluding three airspace with specific latitudes/longitudes: (1) From surface to, but not including 5,000 feet MSL, (2) From surface to, but not including, 4,000 feet MSL, and (3) From surface to, but not including, 4,000 feet MSL;
- Camden Ridge – 500 feet AGL to, but not including, 10,000 feet MSL; Excluding two airspace with specific latitudes/longitudes from surface to, but not including 4,000 feet MSL; and
- Rose Hill – 8,000 feet MSL to, but not including, FL180. (FAA, 2016)

MOAs of Mississippi (Columbus 1 and 4; Meridian East and West; Pine Hill East and West, and Bullseye 3), Florida (Pensacola North and South and Eglin D), and Georgia (Moody 3) extend into the western, southern, and eastern portions of the state (FAA, 2015f). MOA (Columbus 2) is in the airspace of Alabama, but is used by the 14th Flying Training Wing at Columbus Air Force Base, Mississippi. There is one Alert Area in the Dothan area – A-211 (Surface to and including 5,000 feet MSL). Two other Alert Areas extend into Alabama:

- Pensacola, Florida A-292 (Surface to 3,000 feet MSL within federal airways; Otherwise, surface to FL 175) extends into the lower northwest portion.
- Columbus Air Force Base A-400 (Surface to and including 6,500 feet MSL) extends into the western portion. (FAA, 2016)

The SUAs for Alabama are presented in Figure 3.1.7-8. There are no TFRs however, there is a National Security Area (NSA 0002)[119] located around Anniston (See Figure 3.1.7-8) with an altitude restriction of surface to 5,000 feet AGL within a three NM radius from the centered latitude and longitude points (FAA, 2015g). The restrictions associated with this NSA may impact the airspace in the area. MTRs in Alabama, presented in Figure 3.1.7-9 consist of twenty-eight Visual Routes, fourteen Instrument Routes, and twelve Slow Routes.

### UAS Considerations

The Governor established the Alabama Unmanned Aerial Systems Task Force in July 2014. Key goals set by the Governor included: (1) "Study the requirements for operating Unmanned Aerial Vehicles (UAV) and Unmanned Aerial Systems (UAS) by agencies of the State of Alabama, and the process for approval by the FAA. This will include all necessary steps to obtain a Certificate of Waiver Authorization (COA), which is required by FAA and must be approved in advance of UAV/UAS operations."; and (2) "Recommend a statewide plan for use of UAVs by the State of Alabama. This plan must be (1) science based, data driven, and in compliance with anticipated

[119] National Security Area (NSA) consists of defined vertical and lateral dimensions in the airspace where there is increased security of ground facilities. Pilots are expected to voluntarily avoid flying through the NSA. Additional security levels may result in further restrictions of the NSA, which FAA Headquarters would issue and disseminate with a NOTAM. (FHWA, 2014b)

FAA regulations to be promulgated in early 2015; and (2) in the best interest of the State of Alabama, taking into account the privacy interest of Alabama citizens. The task force is to include in its recommendation any proposed legislation necessary to implement such plan prior to the beginning of the 2015 Legislative Session" (ALDOT, 2015c). Executive Order (EO) Number 1, signed out in January 2015, assigns the authority over all unmanned aerial technology to the Aeronautics Bureau. The Unmanned Aerial Systems Council, established by this EO, is to serve as an advisory group to the Aeronautics Bureau (Office of the Governor State of Alabama, 2015).

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). Seven national parks within the State of Alabama have to comply with this agency directive (NPS, 2015d).

**Obstructions to Airspace Considerations**

The Aeronautics Bureau is responsible for determining if construction and operation of proposed tall structures will cause a temporary or permanent hazard to air navigation. The Alabama Department of Transportation has the authority to prohibit or restrict the construction of tall structures if they result in airspace and aircraft navigation hazards (ALDOT, 2015d).

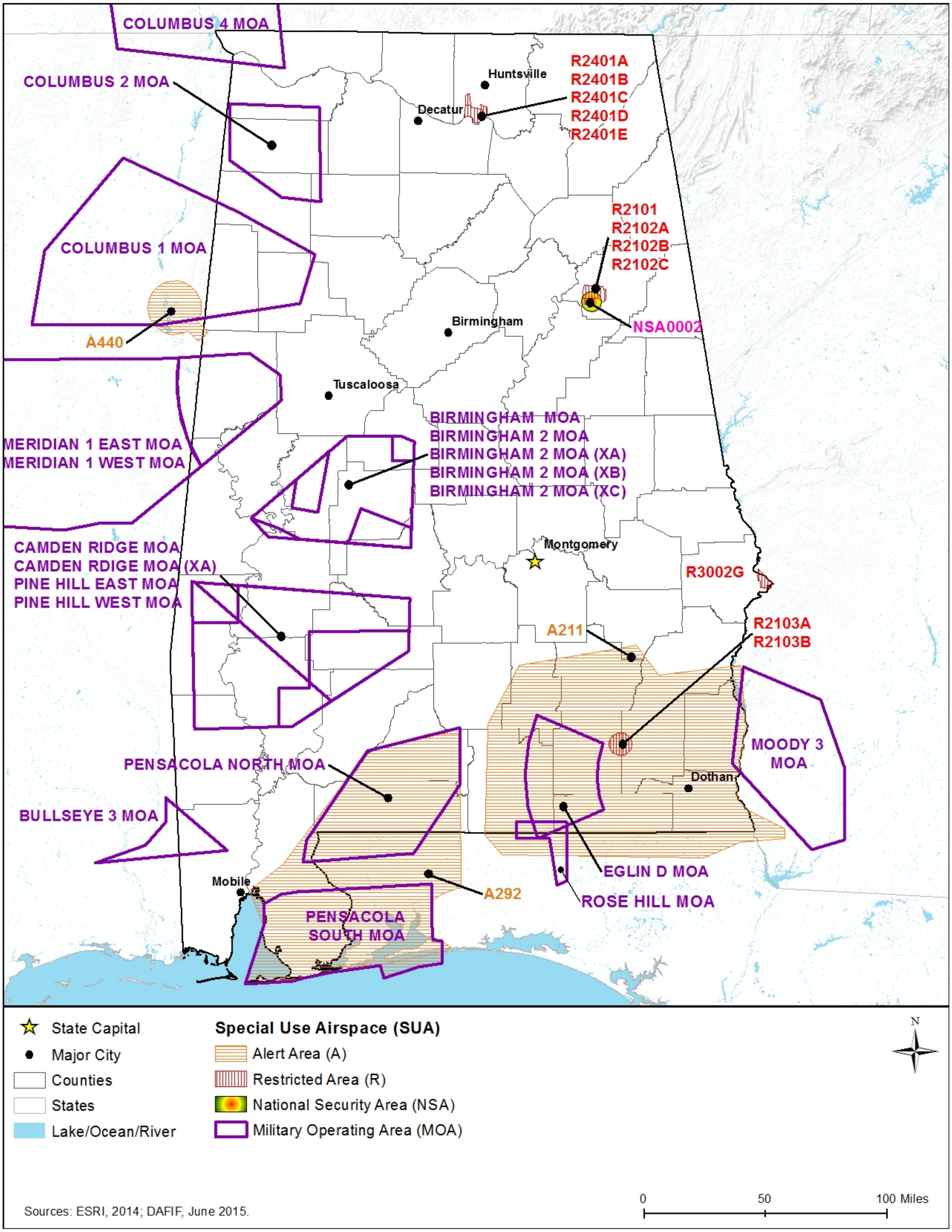



**Figure 3.1.7-8: SUAs in Alabama**

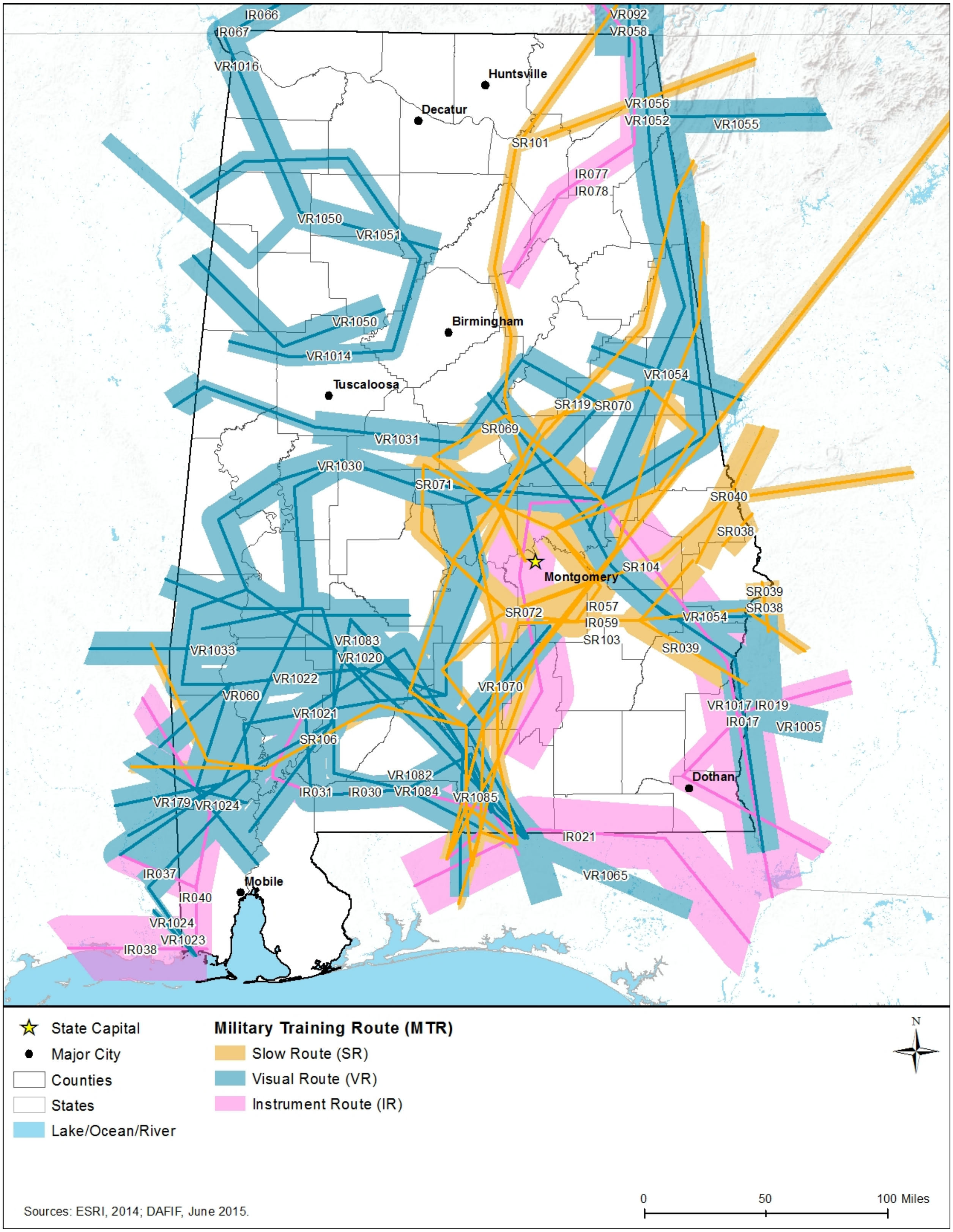



**Figure 3.1.7-9: MTRs in Alabama**

## 3.1.8 Visual Resources

### *3.1.8.1 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 such as mountain ranges, city skylines, ocean views, unique geological formations, rivers, and constructed landmarks such as bridges, memorials, cultural resources, or statues are considered visual resources. For some, cityscapes are valued visual resources; for others, views of natural areas are valued visual resources. 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).

### *3.1.8.2 Specific Regulatory Considerations*

Table 3.1.8-1 presents state and local laws and regulations that relate to visual resources.

**Table 3.1.8-1: Overview of Relevant Federal Laws and Executive Orders**

| State Law/Regulation | Regulatory Agency | Description |
|---|---|---|
| Alabama Code § 9-2-1: Department of Natural Resources | Alabama Department of Conservation and Natural Resources (ADCNR) | Establishes the ADCNR "to enable the Governor to exercise a direct and effective control over the natural resources, state parks and historical sites of the state and in order to bring together in one department for purposes of economy and efficiency all matters pertaining to the natural resources, state parks and monuments and historical sites of the state." |
| Alabama Code § 9-7-11: Preservation, Development, etc., of Coastal Areas | Coastal Area Board | Recognizes that the "coastal area is rich in a variety of natural, commercial, recreational, industrial and aesthetic resources of immediate and potential value to the present and future well-being of the state." |
| Alabama Code § 41-9, Article 10, Division 1: Alabama Historical Commission | Alabama Historical Commission | Establishes the Alabama Historical Commission "to further foster the understanding and preservation of [state] heritage" and confers responsibility for objects and sites of historical significance in the state to the Commission. |

In addition to the state laws and regulations, in Alabama local jurisdictions have the authority to designate and prevent destruction of historic and cultural resources, which contain important visual resources. Additionally, in Alabama local jurisdictions determine zoning laws and regulations for development, which may or may not restrict impacts to the state's visual resources.

### *3.1.8.3 Character and Visual Quality of the Existing Landscape*

Alabama has a wide range of visual resources. The state is home to such landscape as rolling grassland plains, flat-topped mountains, hills, and pine forests. The Appalachian Mountains rise from the north central part of the state and extend northward to Canada. The highest point in the state is found a little further south in the Talladega National Forest, Cheaha Mountain. Alabama's landscape consists of 65 percent forest but underground caves, marshland, and swamps are also found in the state. Alabama has more than 1,350 miles of navigable rivers, more than any other state in the U.S., including all or portions of the Alabama, Chattahoochee, Conecuh, Mobile, Tennessee, and Tombigbee Rivers. (World Atlas, 2015b) Additionally, the state is ranked fifth in the state for biodiversity (Alabama Herbarium Consortium & The University of West Alabama, 2015)

Two thirds of Alabama are characterized by forested and the remaining third is mostly pasture/range lands (Figure 3.1.7-1 in Section 3.1.7, Land Use, Recreation, and Airspace). Forested lands are the state's most dominant visual resource. Visual resources within forested areas are generally comprised of continuous, natural looking cover with gradual transitions of line and color. They are typically characterized by the lack of disturbance or disruption of the landscape. Pasture/range lands are the second most dominant landscape in the state. (USDA, 2015). Their primary vegetation is herbaceous plant and shrubs for foraging livestock. Pasture is different from range in that its vegetation is introduced and propagated to provide preferred forage for grazing livestock. (NRCS, 2015g)

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.

### *3.1.8.4 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 3.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Alabama, there are 1,282 NRHP listed sites, which include 2 National Historic Sites, 1 National Military Park, and 1 National Monument. Some State Historic Sites and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time (NPS, 2015e).

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).

**National Heritage Areas**

National Heritage Areas (NHAs) 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, the Muscle Shoals NHA in Alabama may contain scenic or aesthetic areas considered visual resources or visually sensitive (Figure 3.1.8-1) (NPS, 2015f).

**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, 2015g). NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016a). 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 Alabama, there are 37 NHLs, including sites such as Apalachicola Fort Site, Mobile City Hall, Foster Auditorium, Montgomery Union Station and Train Shed, and Tuskegee Institute (Figure 3.1.8-1) (NPS, 2015h). By comparison, there are over 2,500 NHLs in the United States, less than 1.5 percent of these located in Alabama (NPS, 2015b). Figure 3.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

**National Historic Sites and Military Parks**

Alabama has two National Historic Sites and one National Military Park, which are preserved by the NPS to "commemorate persons, events, and activities important in the nation's history." (NPS, 2003). Parks are generally larger in size and complexity than sites (NPS, 2003). The two national historic sites in Alabama are Tuskegee Airmen and the Tuskegee Institute. The National Military Park is Horseshoe Bend. These sites and parks may contain aesthetic and scenic values associated with history. Locations of the above are identified on the map in Figure 3.1.8-1. (NPS, 2015f)

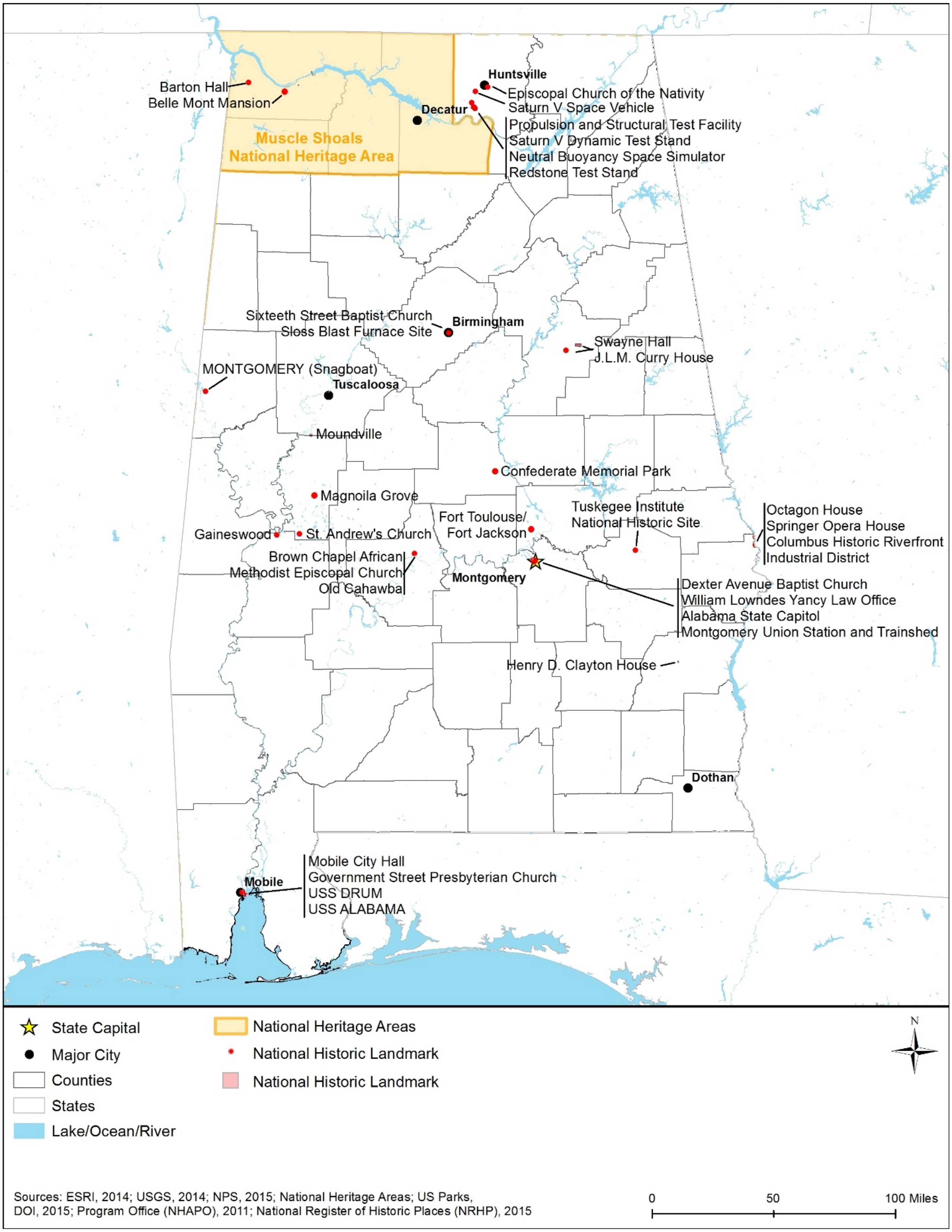



**Figure 3.1.8-1: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive**

## State Historic Sites and Museums

The Alabama Historical Commission, History Alabama, maintains twelve state historic sites and museums under its purview. These sites include Belle Mont Mansion, Confederate Memorial Park, Fort Toulouse-Fort Jackson, Magnolia Grove, and Old Cahawba (see Table 3.1.8-2 and Figure 3.1.8-1) (Alabama Historical Commission, 2015).

**Table 3.1.8-2: Alabama State Historic Sites**

| State Historic Site Name | |
|---|---|
| Alabama Capitol | Gaineswood |
| Belle Mont Mansion | Freedom Rides Museum/Greyhound Bus Station |
| Confederate Memorial Park | Magnolia Grove |
| Fendall Hall | Middle Bay Lighthouse |
| Fort Mims | Old Cahawba |
| Fort Morgan | Pond Spring – The General Joe Wheeler Home |

Source: (Alabama Historical Commission, 2015)

### *3.1.8.5 Parks and Recreation Areas*

Parks and recreation areas include state parks, National Recreation Areas, National Seashores, National Forests, and National and State Trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. Figure 3.1.7-3 in Section 3.1.7, Land Use, Recreation, and Airspace, identifies parks and recreational resources that may be visually sensitive in Alabama. For additional information about recreation areas, including national and state parks, see Section 3.1.7, 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 Alabama, there are seven[120] officially designated National Parks in addition to other NPS affiliated areas. There are two National Historic Sites, two National Historic Trails, one National Military Park, one National Heritage Area, one National Parkway (Figure 3.1.8-2), one National Monument, and one National Preserve. Table 3.1.8-3 identifies the National Parks and affiliated areas located in Alabama. For additional information regarding parks and recreation areas, see Section 3.1.7, Land Use, Recreation, and Airspace.

[120] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015f). Actual lists of parks and NPS affiliated areas may vary here depending on when areas are designated by Congress.

**Figure 3.1.8-2: The Old Trace at MP 375.8 on the Natchez Trace Parkway**

Source: (NPS, 2015i)

**Table 3.1.8-3: Alabama National Parks and Affiliated Areas**

| Area Name | |
|---|---|
| Horseshoe Bend National Military Park | Selma to Montgomery National Historic Trail |
| Little River Canyon National Preserve | Trail of Tears National Historic Trail |
| Muscle Shoals National Heritage Area | Tuskegee Airmen National Historic Site |
| Natchez Trace Parkway | Tuskegee Institute National Historic Site |
| Russell Cave National Monument | |

Source: (NPS, 2015f)

## National Forests

Several agencies manage forested areas in Alabama, including the U.S. Forest Service (USFS). There are four National Forests managed by the USFS in Alabama (see Table 3.1.8-4) (USFS, 2015c). The USFS conducts inventories of the forest lands and assigns scenic resource categories from which they manage for scenic and visual resources (USFS, 1995). The scenic inventories are used to manage the forest landscape and to protect areas of high scenic integrity (USFS, 1995). Table 3.1.8-4 identifies the USFS units located in Alabama (see Figure 3.1.8-3). For additional information regarding parks and recreation areas, see Section 3.1.7, Land Use, Recreation, and Airspace.[121]

**Table 3.1.8-4: National Forests in Alabama**

| National Forest Name | Acres | Visual Resources |
|---|---|---|
| Conecuh National Forest | 84,000 | Upland longleaf pine forest, shallow ponds, bogs, wildlife, sinkhole ponds, streams, bottomlands, Blue Springs |

[121] 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 Forest Name | Acres | Visual Resources |
| --- | --- | --- |
| Talladega National Forest | 392,567 | Waterfalls, Cheaha Mountain, Chestnut oak, Virginia pine, longleaf pine, loblolly pine, rock bluffs, outcrops, cliffs, flora, wildlife |
| Tuskegee National Forest | 11,252 | Loblolly pine plantations, hardwood groves, broad ridges, floodplains, stream terraces, creeks, wildlife |
| William B. Bankhead National Forest | 180,581 | Waterfalls, sandstone cliffs, deep gorges, majestic hardwood trees, wildflowers, wildlife, natural bridge |

Source: (USFWS, 2013f) (Tour East Alabama, 2015) (USFS, 2015d) (Alabama Birding Trails, 2015) (U.S. National Forest Campground Guide, 2015) (USFS, 2015e)

## National Monuments

NPS defines a national monument as a "nationally significant resource…smaller than a national park and [lacking]…diversity of attractions." Alabama is home to one national monument managed by NPS, Russell Cave (see Table 3.1.8-3 and Figure 3.1.8-3) (NPS, 2015f). Russell Cave is an archeological site containing "one of the most complete records of prehistoric cultures in the southeast…dating from 10,000 B.C. to 1,650 A.D" (NPS, 2015f).

## Army Corps of Engineers Recreation Areas

There are seven USACE recreation areas within the state, Alabama River Lakes, Black Warrior and Tombigbee Lakes, George W. Andrews Lake, Lake Seminole, Tennessee-Tombigbee Waterway, Walter F. George Lake, and West Point Lake (see Figure 3.1.8-3) (USACE, 2015). 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).

## Tennessee Valley Authority Recreation Areas

The Tennessee Valley Authority "manages public lands for multiple benefits" and "protects natural resources while providing recreational opportunities across the Valley" (TVA, 2008). TVA is the land and water steward for eight reservoirs in Alabama including Guntersville, Wheeler, Wilson, Pickwick, Bear Creek, Upper Bear Creek, Little Bear Creek, and Cedar Creek reservoirs, and considers the impacts of activities on the environment "to ensure the unique and beautiful Valley resources [are] preserved" (see Figure 3.1.8-3) (TVA, 2015b). TVA manages recreational, natural, and cultural resources in these areas to improve water quality, shoreline conditions, recreation, and biodiversity (TVA, 2015b). For additional information regarding parks and recreation areas, see Section 3.1.7, Land Use, Recreation, and Airspace.

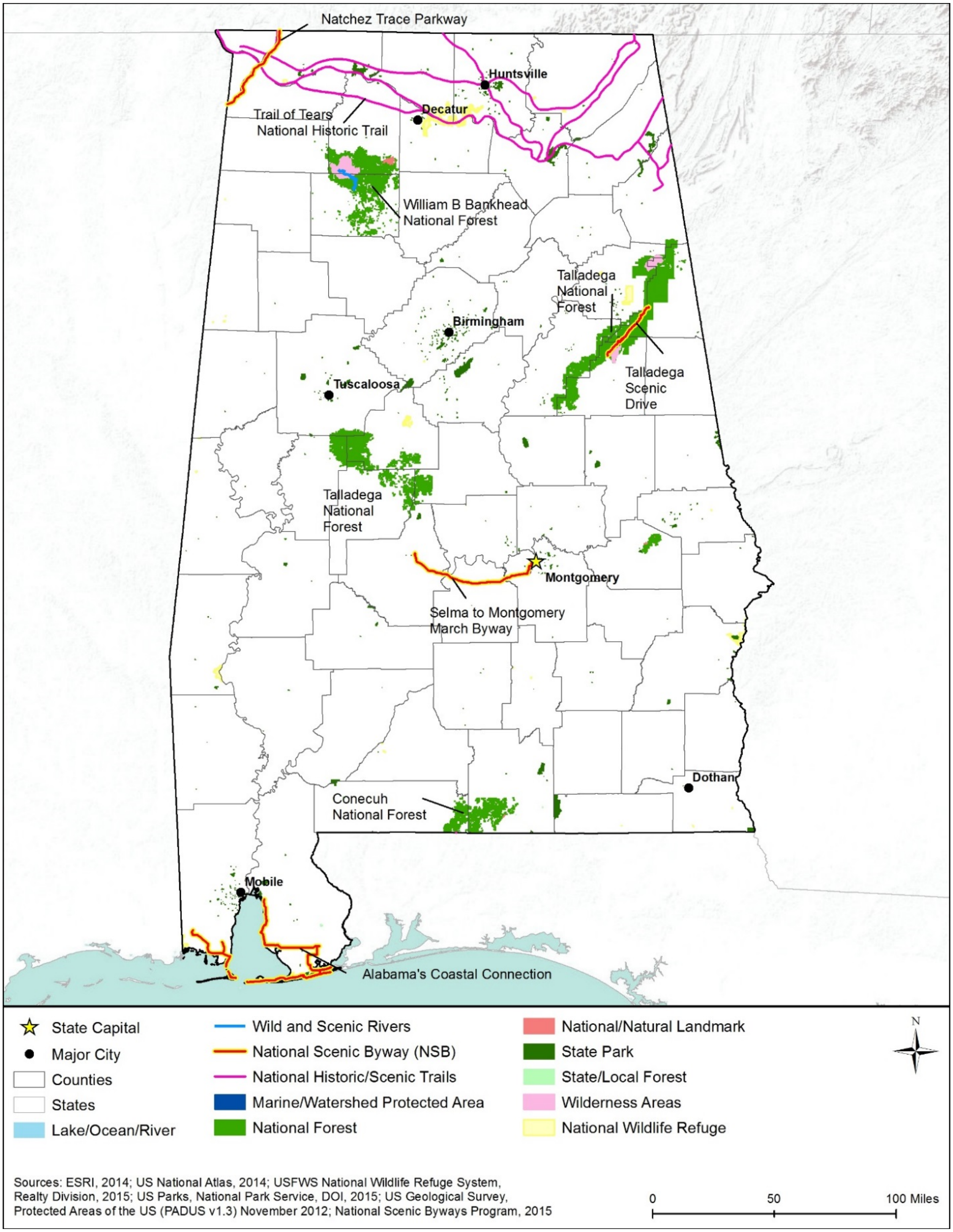



**Figure 3.1.8-3: Natural Areas that May be Visually Sensitive**

### State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Alabama residents and visitors. There are 24 state parks in Alabama[122] (Figure 3.1.8-3), most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (Figure 3.1.8-4 as an example). Table 3.1.8-5 contains a sampling of state parks and their associated visual attributes. For a complete list of state parks, visit the Alabama State Parks website. (Alabama State Parks, 2015b)

**Table 3.1.8-5: Examples of Alabama State Parks and Associated Visual Attributes**

| State Park | Visual Attributes |
|---|---|
| Buck's Pocket State Park | Appalachian Mountain vistas, Lake Guntersville, rock overhangs, creeks, Buck's Pocket canyon, Point Rock sandstone formation, 200-250 million year old geologic formations, native flora |
| Chewacla State Park | Chewacla Lake, Moore's Mill Creek, Chewacla Falls, waterfowl, sandy beach, rock dams, native flora, gneiss boulders |
| DeSoto State Park | Lookout Mountain, waterfalls, wildflowers |
| Monte Sano State Park | Mountains, wooded forests, native flora |
| Rickwood Caverns State Park | Cave, 260 million year old cave formations, rock fossils |

Source: (Alabama State Parks, 2015b)

**Figure 3.1.8-4: DeSoto State Park**

Source: (Alabama State Parks, 2015c)

### State Forests

There are two state forests in Alabama, which are managed for timber production as well as for wildlife and recreation: Geneva State Forest and Little River State Forest (see Figure 3.1.8-3). These forests contain scenic landscapes of water features (lakes and rivers), evergreen forests, and wildlife.

[122] Alabama owns 24 state parks; however, Chattahoochee State Park is managed by the county in which it resides and Claude D. Kelley Recreation/ Little River State Park is managed by a private organization.

### State and Federal Trails

Alabama maintains a network of 275 miles of trails in the state parks for recreational purposes, including hiking, biking, walking, and horseback riding (Alabama State Parks, 2015d). Due to their locations in the state parks, these trails contain visual resources similar to those in the state park in which they reside (see Table 3.1.8-5). For additional information about Alabama's trails, visit the Trails portion of the Alabama State Parks website (Alabama State Parks, 2015d).

The National Trails System Act defines National Historic Trails as "extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historic significance" (NPS, 2012b). Two National Historic Trails pass through Alabama and/or surrounding states: Selma to Montgomery National Historic Trail and the Trail of Tears National Historic Trail (see Figure 3.1.8-3). The Selma to Montgomery National Historic Trail is a 54-mile pathway that recounts the historical march of Dr. Martin Luther King, Jr. and supporters for African American voting rights. The Trail of Tears National Historic Trail commemorates the survival of the Cherokee people removed from Georgia, Alabama, and Tennessee to Indian Territory in Oklahoma. (NPS, 2015f)

In addition to National Scenic and Historic Trails, 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, 2015). In Alabama, there are 55 National Recreation Trails administered by the USDA Forest Service, Alabama Department of Conservation State Lands Division, local and state governments and non-profit organizations (National Recreation Trails, 2015).

## *3.1.8.6 Natural Areas*

### National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. 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." 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 National Park System. These designated wilderness areas are managed by the U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service (USFWS), and National Park Service (NPS, 2015j). Alabama is home to three federally managed Wilderness Areas: Cheaha Wilderness, Dugger Mountain Wilderness, and Sipsey Wilderness (see Figure 3.1.8-3) (Wilderness.net, 2015).

### National Preserves

The National Park Service designates national preserves as "areas having characteristics associated with national parks, but in which Congress has permitted continued public hunting, trapping, oil/gas exploration and extraction" (NPS, 2015k). Alabama is home to one National Preserve, the Little River Canyon National Preserve (see Figure 3.1.8-3). This river Preserve flows mostly on top of Lookout Mountain and includes visual resources such as waterfalls, upload forests, canyon rims and bluffs, pools, sandstone cliffs, and boulders. (NPS, 2015l)

### State Preserves

Alabama does not separately designate state land as preserve land but rather works to conserve wildlife and priority habitats on existing state properties (like parks and Wildlife Management Areas) (ADCNR, 2015e). However, private organizations maintain some private lands for the purposes of conserving wildlife and habitat. The Nature Conservancy maintains 22 private lands for protection for both people and nature in Alabama (The Nature Conservancy, 2015).

### Rivers Designated as National or State 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. 61.4 Miles – the Sipsey Fork – of the West Fork River has been designated a National Wild and Scenic River in Alabama (see Figure 3.1.8-3). Alabama does not designate separate state wild, scenic, or recreational rivers.

### National Wildlife Refuges

National Wildlife Refuges (NWR) 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, 2015bj). There are 11 NWRs in Alabama (USFWS, 2015cq) (see Figure 3.1.8-3) (see Table 3.1.8-6) including the Grand Bay NWR. This refuge houses the largest area of pine savanna in the Gulf Coastal Plain. Its 32,000 acres spans both Alabama and Mississippi and is incorporated along with the Mississippi Sandhill Crane and Bon Secour NWRs as the Gulf Coast NWR Complex (USFWS, 2015cr). Visual resources within this NWR include wet pine savannas, marshes, bayous, freshwater streams, brackish water, maritime forest, wetlands, salt pans, and wildlife (fish, fowl and flora) (USFWS, 2015dp).

**Table 3.1.8-6: Alabama National Wildlife Refuges**

| NWR Name | |
|---|---|
| Key Cave NWR | Grand Bay NWR |
| Bon Secour NWR | Mountain Longleaf NWR |
| Cahaba River NWR | Sauta Cave NWR |
| Choctawa NWR | Watercress Darter NWR |
| Eufaula NWR | Wheeler NWR |
| Fern Cave NWR | |

Source: (USFWS, 2015cq)

### State Wildlife Management Areas

The Alabama Department of Conservation & Natural Resources Division of Wildlife and Freshwater Fisheries manages 29 State Wildlife Management areas on over 775,000 acres for recreational hunting (see Table 3.1.8-7) (ADCNR, 2014c). For additional information on wildlife refuges and management areas, see Section 11.7, Wildlife. For additional information on wildlife refuges and management areas, see Section 3.1.6.4, Terrestrial Wildlife.

**Table 3.1.8-7: Alabama Wildlife Management Areas**

| WMA Name | |
|---|---|
| Autauga WMA | Little River WMA |
| Barbour WMA | Lowndes WMA |
| Black Warrior WMA | Mobile-Tensaw Delta and W.L. Holland WMA |
| Blue Springs WMA | Mulberry Fork WMA |
| Choccolocco WMA | Sam R. Murphy WMA |
| Coosa WMA | Oakmulgee WMA |
| David K. Nelson WMA | Perdido River WMA |
| Fred T. Simpson WMA | Riverton WMA |
| Freedom Hills WMA | Scotch WMA |
| Geneva State Forest WMA | Seven Mile Island WMA |
| Grand Bay Savanna WMA | Swan Creek-Mallard Fox Creek WMA |
| Hollins WMA | Upper Delta WMA |
| Jackson County WMA | William R. Ireland Sr.-Cahaba River WMA |
| James D. Martin-Skyline WMA | Forever Wild Gothard-AWF Yates Lake WMA |
| Lauderdale WMA | |

Source: (ADCNR, 2014c)

### National Natural Landmarks

National Natural Landmarks (NNL) 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 Alabama, there are seven NNLs (see Table 3.1.8-8 and Figure 3.1.8-3). Some of the natural features located within these areas include cave ecosystems, tupelo gum swamp, karst topography, and "one of the most important [wetlands]" in the U.S. (NPS, 2012c). One of these NNLs is Cathedral Caverns in Cathedral Caverns State Park (Figure 3.1.8-5). The 126 feet wide by 25 feet high cave houses one of the largest stalagmites in the world along with a stalagmite forest. (Alabama State Parks, 2015a)

**Figure 3.1.8-5: Cathedral Caverns**

Source: (Alabama State Parks, 2015a)

**Table 3.1.8-8: Alabama National Natural Landmarks**

| NNL Name | |
|---|---|
| Beaverdam Creek Swamp | Newsome Sinks Karst Area |
| Cathedral Caverns | Red Mountain Expressway Cut |
| Dismals | Shelta Cave |
| Mobile-Tensaw River Bottomlands | |

Source: (NPS, 2012c)

### *3.1.8.7 Additional Areas*

#### National Parkways

National Parkways are roadways with parkland running parallel "intended for scenic motoring along a protected corridor [and] often [connecting] cultural sites" (NPS, 2015m). The one National Parkway in Alabama is Natchez Trace Parkway. This parkway is 444 miles of scenic drive through 10,000 years of history, having been used by American Indians, settlers and future presidents (NPS, 2015n).

#### 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 USDOT FHWA manages the National Scenic Byways Program. Alabama has four designated National Scenic Byways: Alabama's Coastal Connection (130 miles), Natchez Trace Parkway – also a National Parkway, Selma to Montgomery March Byway (54 miles) and Talladega Scenic Drive (26.4 miles) (Figure 3.1.8-3) (FHWA, 2015h).

Similar to National Scenic Byways, the ALDOT administers the Alabama Scenic Byway program. There are seven State Byways in Alabama (Figure 3.1.8-3) (see Table 3.1.8-9). The

Appalachian Highlands Scenic Byway traverses "diverse beauty from the deepest canyon east of the Mississippi to the highest peak in Alabama" (see Figure 3.1.8-3) (Alabama Scenic Byways, 2015).

**Table 3.1.8-9: Alabama State Byways**

| State Byway Name | Mileage | Visual Resources |
|---|---|---|
| The Appalachian Highlands Scenic Byway | 80 | Appalachian Mountains, lush vegetation, geologic formations, quaint historic rural communities |
| Barbour County Governors' Trail | 55 | Historic homes, historic sites |
| The Black Belt Nature and Heritage Trail | 217 | Historic sites, wildlife, cityscapes, pristine river bottomland, quaint shops |
| Black Warrior River Scenic Byway | 12 | Black Warrior River, historic ruins, river landscapes, downtown cityscapes, historic sites, forests |
| Leeds Stagecoach Route | 18 | Historic sites, horse farms, historic homes, lake vistas |
| Lookout Mountain Parkway | 50 | Gorges, rivers, lakes, wildlife, waterfalls, farms, woodlands, caves, caverns |
| Tensaw Parkway | Unknown | River delta, farmland, waterways, wildlife, bottomland, swamps, marshes, bird sanctuaries, historic sites, Red Hill spring |

Source: (America's Scenic Byways, 2015)

## 3.1.9 Socioeconomics

### *3.1.9.1 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. 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. This PEIS addresses environmental justice in a separate section (Appendix D). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Infrastructure (Section 3.1.1), Land Use, Recreation, and Airspace (Section 3.1.7), and Visual Resources (Section 3.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (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, 2016b).[123]

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.

[123] 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.

### *3.1.9.2 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.

### *3.1.9.3 Communities and Populations*

This section discusses the population and major communities of Alabama. It 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.

**Statewide Population and Population Growth**

Table 3.1.9-1 presents the 2014 population and population density of Alabama in comparison to the South region[124] and the nation. The estimated population of Alabama in 2014 was 4,849,377. The population density was 96 persons per square mile (sq. mi.), which was lower than the population density of the region (114 persons/sq. mi.), and higher than the population density of the nation (90 persons/sq. mi.). In 2014, Alabama was the 24th largest state by population among the 50 states and the District of Columbia, 28th largest by land area, and had the 28th greatest population density (U.S. Census Bureau, 2015a) (U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2015ab).

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**Table 3.1.9-1: Land Area, Population, and Population Density of Alabama**

| Geography | Land Area (sq. mi.) | Estimated Population 2014 | Population Density 2014 (persons/sq. mi.) |
|---|---|---|---|
| Alabama | 50,645 | 4,849,377 | 96 |
| South Region | 914,471 | 104,109,977 | 114 |
| United States | 3,531,905 | 318,857,056 | 90 |

Sources: (U.S. Census Bureau, 2015a) (U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2015ab).

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 3.1.9-2 presents the population growth trends of Alabama from 2000 to 2014 in comparison to the South region and the nation. The state's annual growth rate decreased by half in the 2010 to 2014 period compared to 2000 to 2010, from 0.72 percent to 0.36 percent. The growth rate of Alabama in the latter period was considerably lower than the growth rates of both the region, at 1.14 percent, and the nation, at 0.81 percent.

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[124] The South region comprised 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 3.1.9-2: Recent Population Growth of Alabama**

| 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 |
| Alabama | 4,447,100 | 4,779,736 | 4,849,377 | 332,636 | 69,641 | 0.72% | 0.36% |
| 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, 2015d; U.S. Census Bureau, 2015e)

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 Census Bureau does not prepare population projections for the states. Therefore, Table 3.1.9-3 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 Alabama's population will increase by 566,767 people, or 11.7 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.69 percent, which is higher than the historical growth rate from 2010 to 2014 of 0.36 percent and very close to the growth rate from 2000 to 2014 of 0.72 percent. The projected growth rate of the state is lower than that of the region (0.97 percent) and the nation (0.80 percent).

**Table 3.1.9-3: Projected Population Growth of Alabama**

| 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 |
| Alabama | 4,849,377 | 5,332,383 | 5,499,905 | 5,416,144 | 566,767 | 11.7% | 0.69% |
| 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; UVA Weldon Cooper Center, 2015) (ProximityOne, 2015)

### Population Distribution and Communities

Figure 3.1.9-1 presents the distribution and relative density of the population of Alabama. 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, 2015f).

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, 2012b; U.S. Census Bureau, 2015g). 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. Dispersed dots indicate dispersed population across the less densely settled areas of the state. In general, for areas outside of the ten population concentrations depicted on Figure 3.1.9-1, the northern part of the state is more densely populated than the southern part of the state.

Table 3.1.9-4 provides the populations of the 10 largest population concentrations in Alabama, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[125] In 2010, the largest population concentration was the Birmingham area, which had 749,495 people. The state had no other population concentrations over 500,000. It had four areas with populations between 100,000 and 400,000. The smallest of these 10 population concentrations was the Dothan area, with a 2010 population of 68,781. The fastest growing areas, by average annual rate of change from 2000 to 2010, were the Decatur, Huntsville, and Montgomery areas, all with annual growth rates of approximately 3 percent. Only three areas had a growth rate under 1.00 percent; these areas were the Anniston/Oxford area (0.51 percent), the Florence area (0.78 percent), and the Mobile area (0.27 percent).

Table 3.1.9-4 also shows that the top 10 population concentrations in Alabama accounted for 44.7 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 92.5 percent of the entire state's growth. These figures indicate that the population of the remainder of the state, as a whole, grew at a slower rate during 2000 to 2010 than did the populations within the 10 population concentrations.

[125] 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.

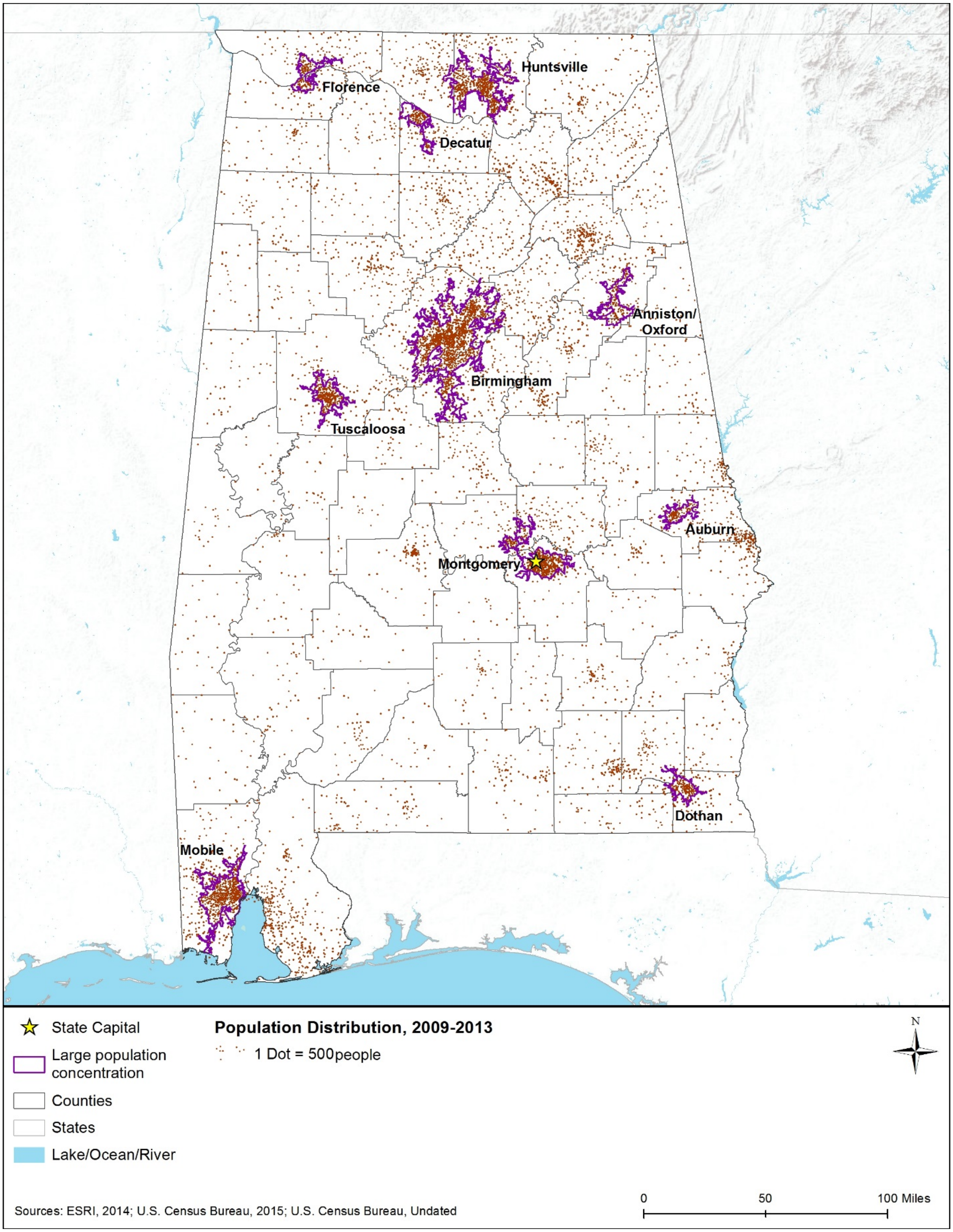


**Figure 3.1.9-1: Population Distribution in Alabama, 2009–2013**

**Table 3.1.9-4: Population of the 10 Largest Population Concentrations in Alabama**

| Area | Population | | | | Population Change 2000 to 2010 | |
|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2009–2013 | Rank in 2010 | Numerical Change | Rate (AARC)[a] |
| Anniston/Oxford | 75,840 | 79,796 | 79,910 | 6 | 3,956 | 0.51% |
| Auburn | 60,137 | 74,741 | 76,605 | 8 | 14,604 | 2.20% |
| Birmingham | 663,615 | 749,495 | 755,033 | 1 | 85,880 | 1.22% |
| Decatur | 52,315 | 70,436 | 69,649 | 9 | 18,121 | 3.02% |
| Dothan | 60,792 | 68,781 | 69,657 | 10 | 7,989 | 1.24% |
| Florence | 71,299 | 77,074 | 78,064 | 7 | 5,775 | 0.78% |
| Huntsville | 213,253 | 286,692 | 290,918 | 3 | 73,439 | 3.00% |
| Mobile | 317,605 | 326,183 | 329,671 | 2 | 8,578 | 0.27% |
| Montgomery | 196,892 | 263,907 | 261,228 | 4 | 67,015 | 2.97% |
| Tuscaloosa | 116,888 | 139,114 | 142,198 | 5 | 22,226 | 1.76% |
| **Total for Top 10 Population Concentrations** | **1,828,636** | **2,136,219** | **2,152,933** | **NA** | **307,583** | **1.57%** |
| **Alabama (statewide)** | **4,447,100** | **4,779,736** | **4,799,277** | **NA** | **332,636** | **0.72%** |
| **Top 10 Total as Percentage of State** | **41.1%** | **44.7%** | **44.9%** | **NA** | **92.5%** | **NA** |

[a] AARC = Average Annual Rate of Change (compound growth rate)

Sources: (U.S. Census Bureau, 2012b; U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015i)

### *3.1.9.4 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 3.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

### Economic Activity

Table 3.1.9-5 compares several economic indicators for Alabama to the South region and the nation. The table presents two indicators of income[126] – 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 3.1.9-5, the per capita income in Alabama in 2013 ($23,384) was $1,627 lower than that of the region ($25,011), and $4,800 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 3.1.9-5 shows that in 2013, the MHI in Alabama ($42,882) was $3,680 lower than that of the region ($46,562), and $9,368 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 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 3.1.9-5 compares the unemployment rate in Alabama to the South region and the nation. In 2014, Alabama's statewide unemployment rate of 6.8 percent was higher than the rate for the region (6.1 percent) and the nation (6.2 percent).

[126] 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, 2015o)

**Table 3.1.9-5: Selected Economic Indicators for Alabama**

| Geography | Per Capita Income 2013 | Median Household Income 2013 | Average Annual Unemployment Rate 2014 |
|---|---|---|---|
| Alabama | $23,384 | $42,882 | 6.8% |
| South Region | $25,011 | $46,562 | 6.1% |
| United States | $28,184 | $52,250 | 6.2% |

Sources: (BLS, 2015b; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l)

Figure 3.1.9-2 and Figure 3.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015j) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 3.1.9-1 (U.S. Census Bureau, 2012b; U.S. Census Bureau, 2015g). Following these two maps, Table 3.1.9-6 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 Alabama.

Figure 3.1.9-2 shows that all, but three counties in Alabama had a MHI below the national median, and about half the counties in Alabama had very low MHI levels (less than $37,092). The three counties with MHI levels above the national median were in the Huntsville area and around the southern and eastern periphery of the Birmingham area. Table 3.1.9-6 is generally consistent with those observations. It shows that MHI in the Birmingham, Huntsville, and Montgomery areas was above the state average. MHI in all other population concentrations was below the state average. MHI was lowest in the Anniston/Oxford, Auburn, and Florence areas. These are three of the five smallest population concentration areas (those with populations under 100,000).

Figure 3.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that employment rates are highly variable across the state. Only 12 counties had unemployment rates below the national average (that is, better employment performance); most of these counties were located near at least one of the 10 largest population concentrations in Alabama. Counties with the highest unemployment rates were mostly in the southern half of the state, where population density is generally lower than the rest of the state. When comparing unemployment in the population concentrations to the state average (Table 3.1.9-6), only the Anniston/Oxford, Decatur, and Mobile areas had 2009–2013 unemployment rates that were higher than the state average of 10.8 percent. The unemployment rates in the 10 areas were quite variable, ranging from 8.1 percent in the Florence area to 15.3 percent in the Anniston/Oxford area.

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 3.1.9-7 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 lower in Alabama than in the South region and the nation. The percentage of government workers was higher in the state than in the region and nation. Self-employed workers were a lower percentage in the state than in the region and nation.

By industry, Alabama has a mixed economic base and some notable figures in the table are as follows. Alabama 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 higher percentage of persons working in “manufacturing” than did the region or the nation. It also had a notably lower percentage of workers in the “professional, scientific, management, administrative, and waste management services” industry compared to the nation.

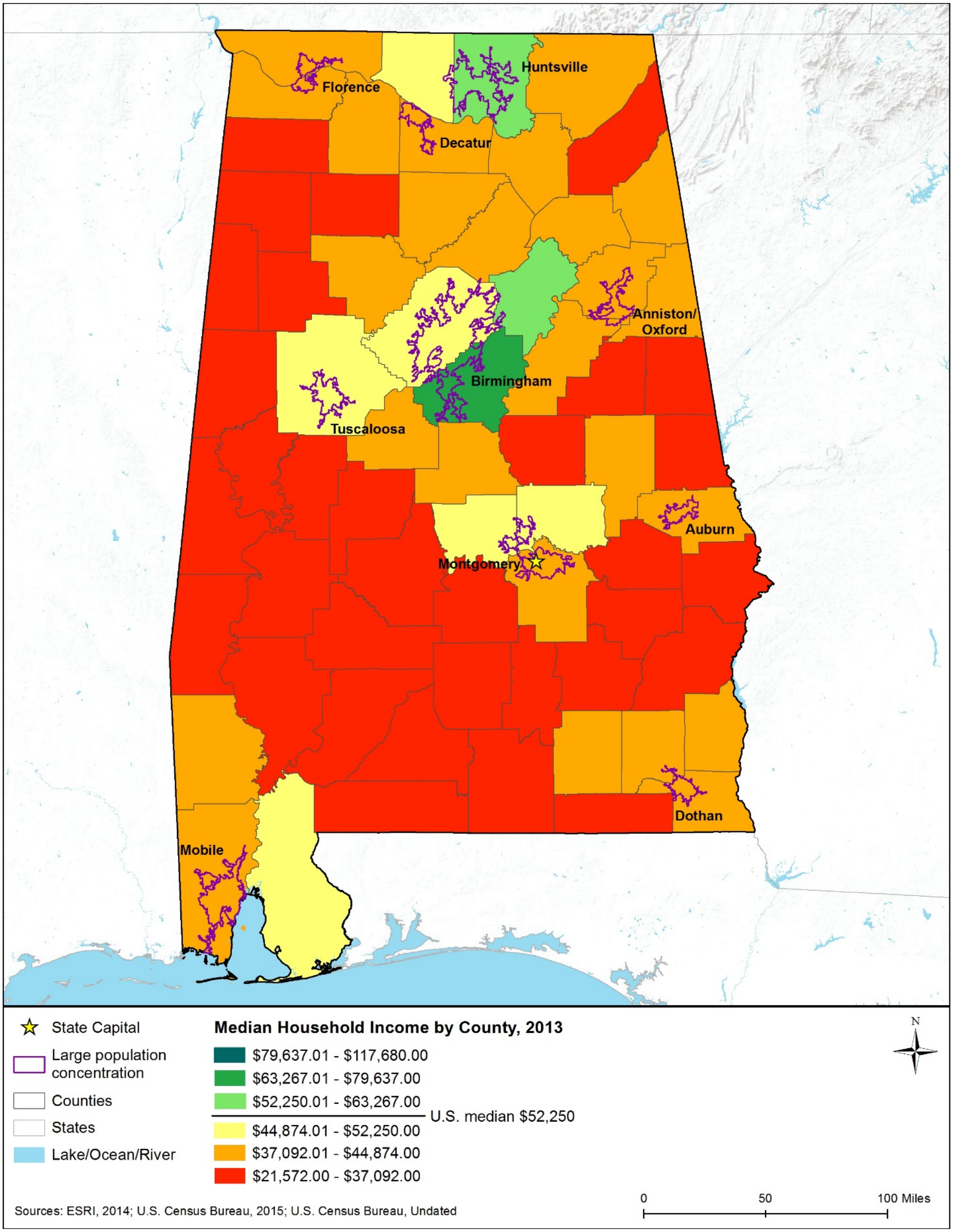


**Figure 3.1.9-2: Median Household Income in Alabama, by County, 2013**

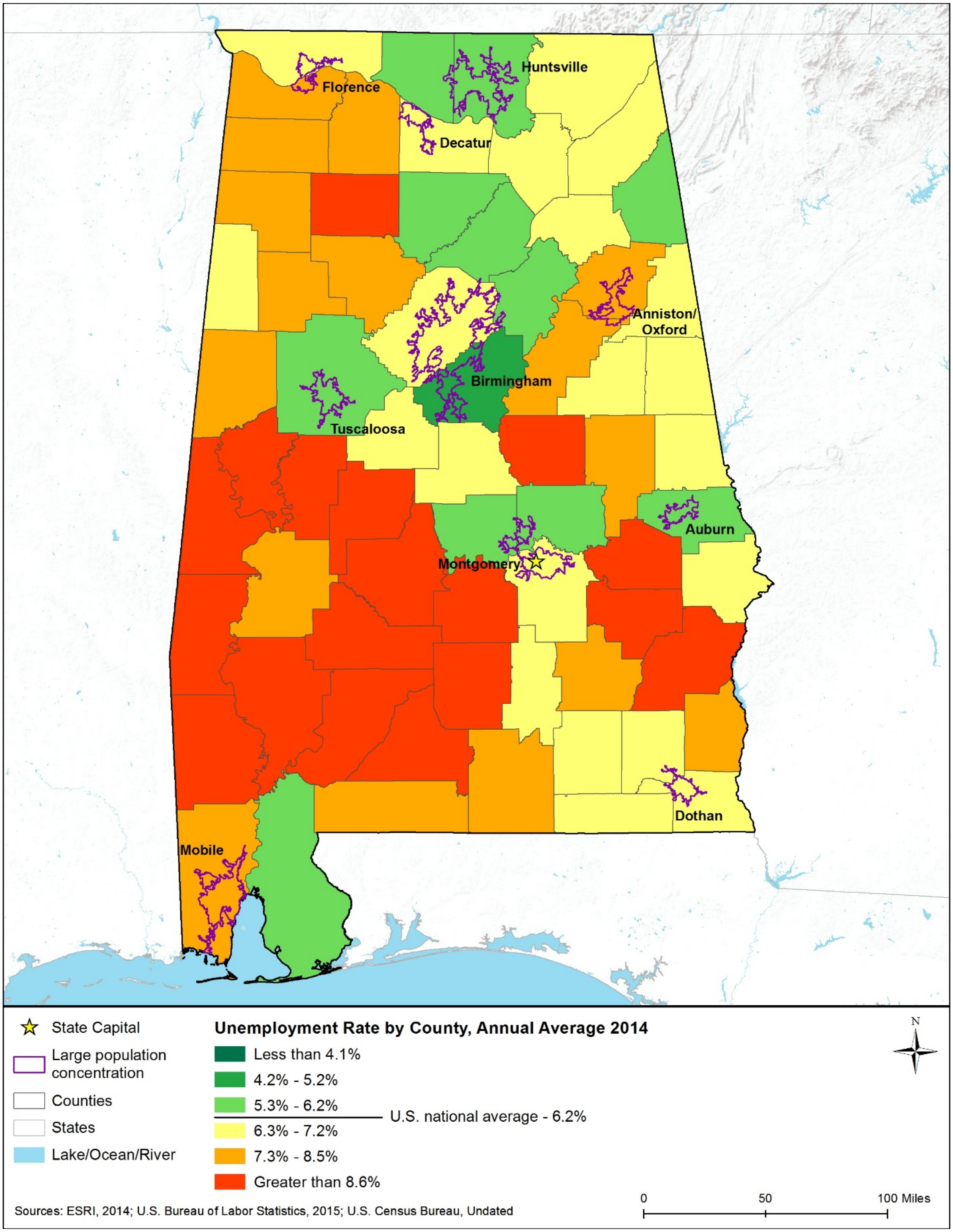


**Figure 3.1.9-3: Unemployment Rates in Alabama, by County, 2014**

### Table 3.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Alabama, 2009–2013

| Area | Median Household Income | Average Annual Unemployment Rate |
|---|---|---|
| Anniston/Oxford | $38,432 | 15.3% |
| Auburn | $34,659 | 8.5% |
| Birmingham | $49,749 | 9.5% |
| Decatur | $40,544 | 13.2% |
| Dothan | $40,076 | 8.8% |
| Florence | $38,993 | 8.1% |
| Huntsville | $60,089 | 10.1% |
| Mobile | $41,778 | 12.1% |
| Montgomery | $45,506 | 9.1% |
| Tuscaloosa | $42,639 | 8.3% |
| Alabama (statewide) | $43,253 | 10.8% |

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

### Table 3.1.9-7: Employment by Class of Worker and by Industry, 2013

| Class of Worker and Industry | Alabama | South Region | United States |
|---|---|---|---|
| Civilian Employed Population 16 Years and Over | 2,010,934 | 45,145,155 | 145,128,676 |
| Percentage by Class of Worker | | | |
| Private wage and salary workers | 78.3% | 79.4% | 79.7% |
| Government workers | 16.2% | 14.5% | 14.1% |
| Self-employed in own not incorporated business workers | 5.3% | 5.9% | 6.0% |
| Unpaid family workers | 0.2% | 0.2% | 0.2% |
| Percentage by Industry | | | |
| Agriculture, forestry, fishing and hunting, and mining | 1.7% | 2.4% | 2.0% |
| Construction | 6.4% | 6.9% | 6.2% |
| Manufacturing | 14.4% | 9.9% | 10.5% |
| Wholesale trade | 2.3% | 2.8% | 2.7% |
| Retail trade | 12.2% | 12.1% | 11.6% |
| Transportation and warehousing, and utilities | 4.9% | 5.2% | 4.9% |
| Information | 1.7% | 1.9% | 2.1% |
| Finance and insurance, and real estate and rental and leasing | 5.5% | 6.3% | 6.6% |

| Class of Worker and Industry | Alabama | South Region | United States |
|---|---|---|---|
| Professional, scientific, management, administrative, and waste management services | 9.0% | 10.5% | 11.1% |
| Educational services, and health care and social assistance | 22.9% | 22.0% | 23.0% |
| Arts, entertainment, and recreation, and accommodation and food services | 8.4% | 9.9% | 9.7% |
| Other services, except public administration | 5.1% | 5.2% | 5.0% |
| Public administration | 5.5% | 4.8% | 4.7% |

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

Table 3.1.9-8 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 3.1.9-7 for 2013.

**Table 3.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Alabama, 2009–2013**

| Area | Construction | Transportation and Warehousing, and Utilities | Information | Professional, Scientific, Management, Administrative, and Waste Management Services |
|---|---|---|---|---|
| Anniston/Oxford | 3.8% | 3.2% | 1.6% | 7.5% |
| Auburn | 3.9% | 2.0% | 1.6% | 8.2% |
| Birmingham | 5.7% | 5.1% | 2.7% | 11.3% |
| Decatur | 8.5% | 4.5% | 1.5% | 8.3% |
| Dothan | 5.2% | 7.6% | 1.5% | 8.3% |
| Florence | 5.7% | 5.6% | 1.4% | 8.3% |
| Huntsville | 4.8% | 2.6% | 2.7% | 18.4% |
| Mobile | 6.2% | 5.3% | 1.7% | 10.2% |
| Montgomery | 4.4% | 3.9% | 1.3% | 9.6% |
| Tuscaloosa | 6.5% | 3.0% | 1.8% | 7.2% |
| Alabama (statewide) | 6.9% | 5.2% | 1.7% | 9.1% |

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

## 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 3.1.9-9 compares Alabama to the South region and nation on several common housing indicators.

As shown in Table 3.1.9-9, in 2013 Alabama had a lower percentage of housing units that were occupied (83.2 percent) than the region (85.2 percent) or nation (87.6 percent). Of the occupied units, Alabama had a higher percentage of owner-occupied units (68.0 percent) than the region (64.6 percent) or nation (63.5 percent). Alabama also had a higher percentage of detached single-unit housing (also known as single-family homes) (68.2 percent) compared to the region (63.8 percent) and nation (61.5 percent). The homeowner vacancy rate in Alabama (2.8 percent) was higher than the rates for the region (2.2 percent) and the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015o). The vacancy rate among rental units was higher in Alabama (9.2 percent) than in the region (8.5 percent) or nation (6.5 percent).

**Table 3.1.9-9: Selected Housing Indicators for Alabama, 2013**

| Geography | Total Housing Units | Housing Occupancy & Tenure | | | | Units in Structure |
|---|---|---|---|---|---|---|
| | | Occupied Housing | Owner-Occupied | Homeowner Vacancy Rate | Rental Vacancy Rate | 1-Unit, Detached |
| Alabama | 2,190,027 | 83.2% | 68.0% | 2.8% | 9.2% | 68.2% |
| South Region | 44,126,724 | 85.2% | 64.6% | 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, 2015p)

Table 3.1.9-10 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 3.1.9-10 shows that during this period the percentage of occupied housing units ranged from 77.6 to 90.7 percent across these population concentrations, which bracketed the state percentage of 84.4 percent.

**Table 3.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Alabama, 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 |
| Anniston/Oxford | 36,247 | 84.4% | 62.7% | 3.2% | 6.1% | 70.9% |
| Auburn | 35,090 | 86.7% | 48.8% | 4.4% | 6.5% | 45.5% |
| Birmingham | 340,691 | 87.2% | 65.8% | 3.1% | 9.6% | 69.8% |
| Decatur | 30,319 | 90.7% | 61.8% | 1.8% | 2.7% | 67.2% |
| Dothan | 30,815 | 86.7% | 57.4% | 3.1% | 7.5% | 70.1% |
| Florence | 37,945 | 88.5% | 62.5% | 3.7% | 7.3% | 73.8% |

| Area | Total Housing Units | Housing Occupancy & Tenure | | | | Units in Structure |
|---|---|---|---|---|---|---|
| | | Occupied Housing | Owner-Occupied | Homeowner Vacancy Rate | Rental Vacancy Rate | 1-Unit, Detached |
| Huntsville | 126,855 | 89.7% | 67.3% | 2.9% | 10.7% | 70.2% |
| Mobile | 144,291 | 87.0% | 63.2% | 2.8% | 10.8% | 72.7% |
| Montgomery | 113,173 | 87.8% | 61.1% | 2.7% | 7.5% | 70.6% |
| Tuscaloosa | 63,118 | 77.6% | 56.9% | 1.4% | 13.1% | 56.2% |
| Alabama (statewide) | 2,178,116 | 84.4% | 69.7% | 2.5% | 8.9% | 68.4% |

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

### Property Values

Property values have important relationships to both the wealth and affordability of communities.

Table 3.1.9-11 provides indicators of residential property values for Alabama 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, 2015o).

The table shows that the median value of owner-occupied units in Alabama in 2013 ($122,700) was lower than the corresponding values for the South region ($137,752) and the nation ($173,900).

**Table 3.1.9-11: Residential Property Values in Alabama, 2013**

| Geography | Median Value of Owner-Occupied Units |
|---|---|
| Alabama | $122,700 |
| South Region | $137,752 |
| United States | $173,900 |

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

Table 3.1.9-12 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. Most of the 10 areas had median values higher than the state median value ($122,500). The highest median property values were in the Auburn ($167,400) and Huntsville areas ($172,700). The lowest value was in the Anniston/Oxford area, at $101,800. The three areas (Anniston/Oxford, Decatur, and Florence areas) that had median property values below the state average also had median household incomes that were below the state average (Table 3.1.9-6).

**Table 3.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Alabama, 2009–2013**

| Area | Median Value of Owner-Occupied Units |
|---|---|
| Anniston/Oxford | $101,800 |
| Auburn | $167,400 |
| Birmingham | $154,600 |
| Decatur | $116,100 |
| Dothan | $130,900 |
| Florence | $111,400 |
| Huntsville | $172,700 |
| Mobile | $125,900 |
| Montgomery | $125,000 |
| Tuscaloosa | $157,900 |
| Alabama (statewide) | $122,500 |

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

## 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, 2006a). 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 3.1.9-13 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 are 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 3.1.9-13 shows that the Alabama state government received more total revenue in 2012 on a per capita basis than their counterpart governments in the region, but slightly less than counterparts in the nation. Alabama local governments received less total revenue per capita than counterpart governments in both the region and nation. Alabama state and local governments had slightly higher per capita levels of intergovernmental revenues[127] from the federal government than counterparts in the region and nation. In comparison to counterparts in the region and nation, the Alabama state government obtained somewhat higher per capita revenue from property taxes, while Alabama local governments received substantially lower per capita revenue from property taxes. General sales taxes were lower on a per capita basis for the Alabama state government, and higher for Alabama local governments, compared to counterparts in the region and nation. Conversely, selective sales taxes, and public utility taxes specifically, were higher on a per capita basis for the Alabama state government, and lower for Alabama local governments, compared to their counterparts in the region and nation. Individual and corporate income tax revenues for Alabama state and local governments, on a per capita basis, generally were higher than or similar to revenues for those governments in the region, and lower than revenues for those governments in the nation.

**Table 3.1.9-13: State and Local Government Revenues, Selected Sources, 2012**

| Type of Revenue | | Alabama | | Region | | United States | |
|---|---|---|---|---|---|---|---|
| | | **State Govt. Amount** | **Local Govt. Amount** | **State Govt. Amount** | **Local Govt. Amount** | **State Govt. Amount** | **Local Govt. Amount** |
| **Total Revenue** | **($M)** | $28,970 | $20,508 | $524,374 | $449,683 | $1,907,027 | $1,615,194 |
| | **Per capita** | $6,008 | $4,253 | $5,148 | $4,414 | $6,075 | $5,145 |
| Intergovernmental from Federal | ($M) | $8,113 | $1,080 | $160,706 | $18,171 | $514,139 | $70,360 |
| | Per capita | $1,682 | $224 | $1,578 | $178 | $1,638 | $224 |
| Intergovernmental from State | ($M) | $0 | $5,729 | $0 | $115,088 | $0 | $469,147 |
| | Per capita | $0 | $1,188 | $0 | $1,130 | $0 | $1,495 |
| Intergovernmental from Local | ($M) | $115 | $0 | $2,815 | $0 | $19,518 | $0 |
| | Per capita | $24 | $0 | $28 | $0 | $62 | $0 |
| Property Taxes | ($M) | $322 | $2,232 | $2,073 | $109,687 | $13,111 | $432,989 |
| | Per capita | $67 | $463 | $20 | $1,077 | $42 | $1,379 |
| General Sales Taxes | ($M) | $2,275 | $1,876 | $82,651 | $25,836 | $245,446 | $69,350 |
| | Per capita | $472 | $389 | $811 | $254 | $782 | $221 |
| Selective Sales Taxes | ($M) | $2,352 | $298 | $41,447 | $9,394 | $133,098 | $28,553 |
| | Per capita | $488 | $62 | $407 | $92 | $424 | $91 |
| Public Utilities Taxes | ($M) | $737 | $57 | $5,101 | $4,745 | $14,564 | $14,105 |

[127] 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, 2006b).

| Type of Revenue | | Alabama | | Region | | United States | |
|---|---|---|---|---|---|---|---|
| | | State Govt. Amount | Local Govt. Amount | State Govt. Amount | Local Govt. Amount | State Govt. Amount | Local Govt. Amount |
| | Per capita | $153 | $12 | $50 | $47 | $46 | $45 |
| Individual Income Taxes | ($M) | $3,017 | $101 | $38,637 | $1,226 | $280,693 | $26,642 |
| | Per capita | $626 | $21 | $379 | $12 | $894 | $85 |
| Corporate Income Taxes | ($M) | $413 | $0 | $8,099 | $114 | $41,821 | $7,210 |
| | Per capita | $86 | $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)

## 3.1.10 Environmental Justice

### *3.1.10.1 Definition of the Resource*

EO 12898, *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).[128] 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” (Executive Office of the President, 1994). Under the EO, each federal agency must “make achieving environmental justice part of its mission by identifying and 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” (USEPA, 2016e). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (DOC, 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, 2015d) offers guidance on Environmental Justice issues and provides an “environmental justice screening and mapping tool,” EJSCREEN (USEPA, 2015e).

The CEQ guidance provides several important definitions and clarifications that this PEIS utilizes:

[128] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

- 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 U.S. 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).

### *3.1.10.2 Specific Regulatory Considerations*

The Alabama Department of Environmental Management (ADEM) began receiving funding for an Environmental Justice program, and appointed an Environmental Justice Ombudsman and Coordinator, in 2006 (ADEM, 2006). In the two years that followed, ADEM began conducting environmental justice trainings for its employees, developed a strategy called "Eleven Environmental Justice Steps to a Better Alabama," adopted the USEPA Region 4 Environmental Justice Action Plan, and promoted asthma awareness (ADEM, 2007; ADEM, 2008). Research did not identify any ADEM information regarding environmental justice subsequent to 2008. Federal laws relevant to environmental justice are described in Section 1.8, Overview of Relevant Federal Laws and Executive Orders.

### *3.1.10.3 Environmental Setting: Minority and Low-Income Populations*

Table 3.1.10-1 presents 2013 data on the composition of Alabama's population by race and by Hispanic origin. The state's population has somewhat lower percentages of individuals who identify as American Indian/Alaska Native (0.5 percent), Asian (1.2 percent), Some Other Race (1.1 percent), or Two or More Races (1.7 percent) than the populations of the South region and the nation. (Those percentages are, for American Indian/Alaska Native, 0.9 percent for the South region and 0.8 percent for the nation; for Asian, 2.6 percent and 5.1 percent respectively; for Some Other Race, 3.3 percent and 4.7 percent respectively; and for Two or More Races, 2.4 percent and 3.0 percent respectively.) The state's percentage of individuals who identify as Black/African American (26.6 percent) is considerably higher than the percentages for the region (18.4 percent) and nation (12.6 percent). The state's population of persons identifying as White (68.9 percent) is lower than that of the South region (72.3 percent) and the nation (73.7 percent).

The percentage of the population in Alabama that identifies as Hispanic (3.9 percent) is substantially smaller 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. Alabama's All Minorities population percentage (33.7 percent) is considerably lower than that of the South region (42.3 percent) and somewhat lower than that of the nation (37.6 percent).

Table 3.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Alabama (18.7 percent) is somewhat higher than that for the South region (18.2 percent) and considerably higher than the figure for the nation (15.8 percent).

**Table 3.1.10-1: 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 | Other Race | Two or More Races | | |
| Alabama | 4,833,722 | 68.9% | 26.6% | 0.5% | 1.2% | 0.0% | 1.1% | 1.7% | 3.9% | 33.7% |
| 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% |

Source: (U.S. Census Bureau, 2015t)
"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.

**Table 3.1.10-2: Percentage of Population (Individuals) in Poverty, 2013**

| Geography | Percent Below Poverty Level |
|---|---|
| Alabama | 18.7% |
| South Region | 18.2% |
| United States | 15.8% |

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

### *3.1.10.4 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 3.1.10-1 visually portrays the results of the environmental justice population screening analysis for Alabama. 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, 2015y) and Census Bureau urban classification data (U.S. Census Bureau, 2012b) (U.S. Census Bureau, 2015z).

Figure 3.1.10-1 shows that a high proportion of Alabama has high potential for environmental justice populations. The distribution of these high potential areas is somewhat uneven across the state, with much of the southern, less densely populated portion of the state showing high potential. High potential areas also occur frequently within the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is fairly even in the northern part of the state, but moderate potential areas occur somewhat less frequently in the southern part of the state.

It is important to understand how the data behind Figure 3.1.10-1 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 3.1.10-1 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). Environmental Consequences (Section 3.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

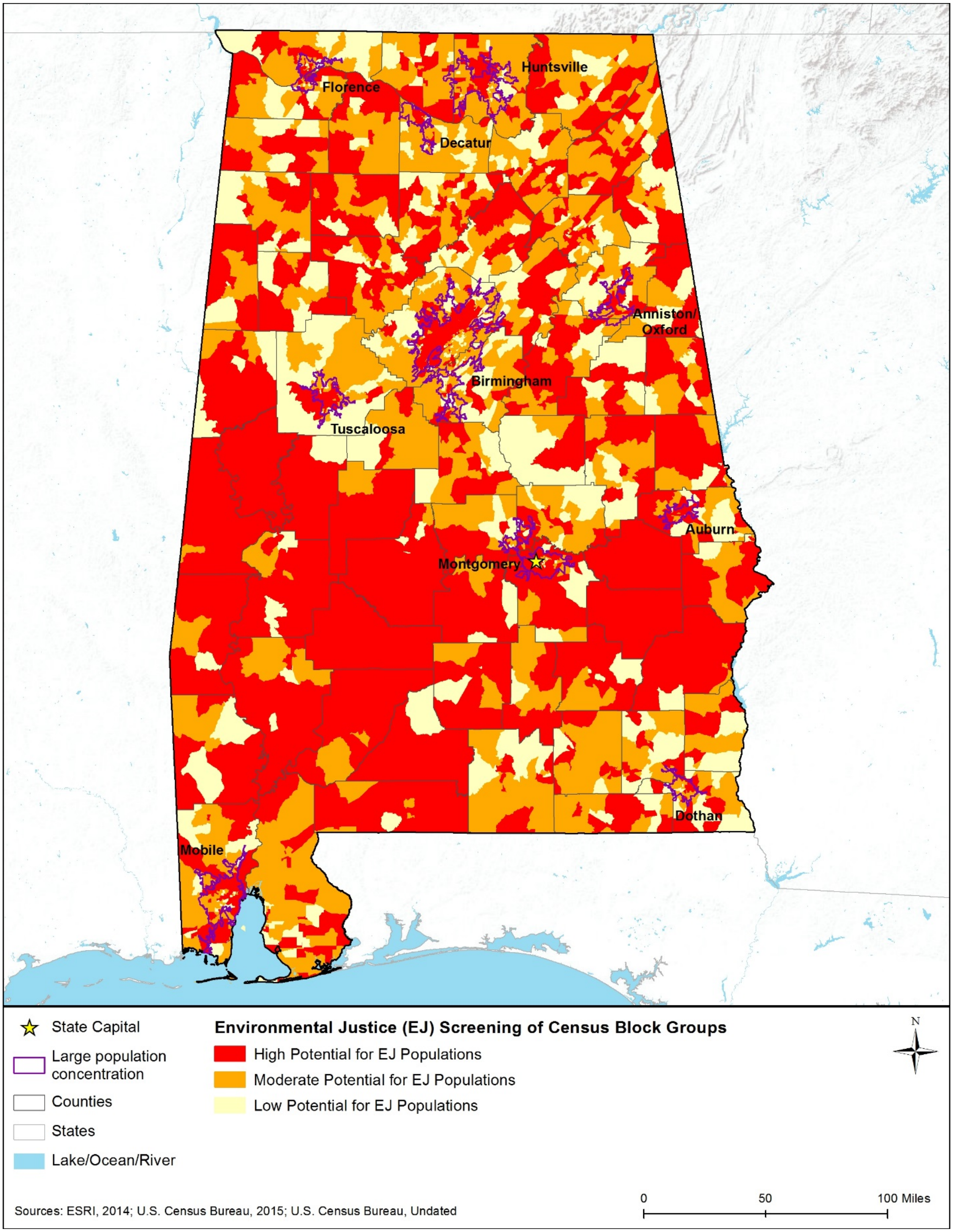


**Figure 3.1.10-1: Potential for Environmental Justice Populations in Alabama, 2009–2013**

## 3.1.11 Cultural Resources

### *3.1.11.1 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 National Register of Historic Places (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. 470cc(c) 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 (NRCS, 2015e); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

### *3.1.11.2 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.

Alabama does not have a state law and regulation that is similar to that of NHPA. 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.

### *3.1.11.3 Cultural Setting*

Evidence of American Indian occupation in Alabama dates back to 11500 B.C. After the last ice age, the climate warmed and the environment became more conducive to human habitation (Sherwood, N, Randall, & Meeks, 2004). The many waterways throughout the state provided both food and transportation that supported the development of prehistoric cultures. The rivers and streams became trade routes, provided sources of food, and were fertile drainage basins that eventually permitted agricultural practices that are prevalent today (NPS, 2015o). The geology of the region provided an abundance of raw materials that American Indians used to make tools. Since the beginning of human settlement in Alabama, the advancement of tool technology was crucial in the development of prehistoric societies (NPS, 2015o).

There are hundreds of documented archaeological sites in Alabama, 28 of which are listed on the NRHP. Thirteen NRHP sites are historic, historic military, or aboriginal in origin, and 15 sites are prehistoric in origin (NPS, 2015q).

Archaeologists typically divide large areas into regions to concentrate their studies. There are three physiographic region in Alabama: the Appalachian Highlands, Atlantic Plain, and Interior Plains.

The following sections provide additional detail about Alabama's prehistoric periods (approximately 11500 B.C. to A.D. 1500) and the historic period since European contact and exploration in the 1500s. Section 3.1.11.4 presents an overview of the initial human habitation in Florida and the cultural development that occurred before European contact. Section 3.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 3.1.11.6 provides a current list of significant archaeological sites in Florida and tools that the state has developed to ensure their preservation. Section 3.1.11.7 document the historic context of the state since European contact, and Section 3.1.11.8 summarizes the architectural context of the state during the historic period.

#### *3.1.11.4 Prehistoric Setting*

There are four distinct periods associated with the prehistoric human populations that inhabited present day Alabama: The Paleoindian Period (11500 to 8500 B.C.), Archaic (8500 to 1000 B.C.), Woodland (1000 B.C. to A.D. 500), and Mississippian (A.D. 1000 to 1540). Figure 3.1.11-1 shows a timeline representing these periods of early human habitation in Alabama. 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 Alabama (Anderson D. G., 1995).

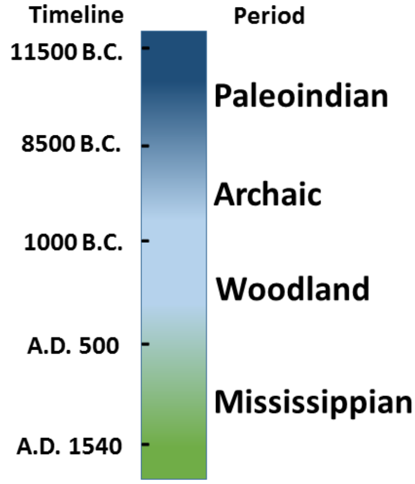


**Figure 3.1.11-1: Timeline of Prehistoric Human Occupation in Alabama**

Source: Adapted from (Institute of Maritime History, 2015)

### Paleoindian Period (11500 – 8500 B.C.)

The Paleoindian Period represents the earliest human habitation of the southeast United States. Evidence of early human beings in Alabama is based on the discovery of stone projectile points, commonly known as "arrowheads," which are found on the surface, in shallow deposits, deep alluvial deposits, along the coast, and submerged under water. It is likely that the earliest people to occupy the state were 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 believe that humans of the Paleoindian Period lived in small groups, which ranged across the state as they followed migratory large mammals, including mammoth and bison. (Anderson, et al., 2010; Walker, Detwiler, Meeks, & Driskell, 2001)

Paleoindians lived in small nomadic, extended family units of 30-40 people that survived by hunting mammals and gathering edible wild plants. It is believed that they were descended from people who spread into North America via a land bridge at the Bering Strait during the latter part of the last ice age (known as the Late Pleistocene epoch) (Pichardo, 2005)Archeologists have documented that 1,871 points discovered in Alabama are from the Paleoindian Period, 1,147 of which are fluted (398 from the Clovis culture) and 724 of other varieties. (Anderson, et al., 2010; Walker, Detwiler, Meeks, & Driskell, 2001).

### Archaic Period (8500 – 1000 B.C.)

Throughout the region that includes present day Alabama, temperatures became warmer during the Archaic Period and there was greater seasonal variations in the climate. The North American continent was experiencing the final glacial retreat from the last ice age. Flora and fauna similar to that presently found in Alabama began to be established, and the American Indian peoples began living in cohesive family based units. The Archaic Period in Alabama is divided into the Early, Middle, and Late periods (Haag, 1961; Homesy, 2009; McNutt, 2008).

Much like the Paleoindians that preceded them, Early Archaic people were hunter-gatherers, whose diet consisted of wild plants and animals. Technology was based on chipped stone, from which arrow points and other tools, such as drills, choppers, flake knives, scrapers, gouges, and hammerstones were manufactured. The people began to establish settlements around streams and rivers where potable water could be found. Based on the calculations from the number of Early Archaic archaeological sites found in Alabama, archeologists conclude there was a steady increase of populations during this phase. (Haag, 1961; NPS, 2015o).

In the Middle Archaic, populations steadily increased and societies became more regionalized. Tools became more sophisticated. The first signs of stone grinding implements for food preparation in Alabama date to this period, which is evidence of horticulture (Alvey, 2005).

Shellfishing was conducted along rivers and the seacoast. Archaeological sites discovered from the Middle Archaic including storage pits, remains of house floors, and the burying of deceased members of society, all of which are indications that people were becoming less nomadic and more sedentary (NPS, 2015p; Alvey, 2005).

Throughout the southeastern United States, Late Archaic cultures increasingly developed regional distinctions. This phase includes what archaeologist refer to as the Gulf Formational Period, which is documented to have occurred 4,500 to 3,200 years ago primarily within the area of Alabama, middle Tennessee, and eastern Mississippi. The archaeological record of this phase shows the first signs of fiber-tempered fired and decorated ceramic technology, which becomes more sophisticated in the Woodland and Mississippian cultures that follow (Rothschild, Turner, & DeLuca, 1988). Fiber-tempered ceramic technology was invented as a result of "trade between the Stallings Island and Orange cultures of the South Atlantic coast and the Poverty Point culture of the lower Mississippi River Valley." Prior to fiber-tempered pottery, the ceramic varieties were undercoated. (NPS, 2015o)

**Woodland Period (1000 B.C. – A.D. 1000)**

Similar to the Archaic Period, the Woodland Period is divided into three sequential periods: Early, Middle, and Late. During the course of the Woodland Period, there is a continuing shift from semi-nomadic to more sedentary communities, along with the continued expansion of horticulture or crop-growing practices (Jenkins & Krause, 2009).

Hunting and fishing remained important forms of subsistence during the Early Woodland phase in Alabama. Although more deliberate attempts at farming began to be established, the collection of shellfish and plant foraging was also taking place. Most Early Woodland sites show evidence of fiber-tempered pottery and archaeologists analyze various types of pottery to help differentiate between early, middle, and late Woodland Period sites (Lolley, 2003; NPS, 2015o).

Sophisticated art began to be developed in the Early Woodland phase. One example is the abstract cave art found in the Mud Glyph Cave in northern Alabama. Similar cave art of this phase has be found throughout the southeastern United States (Cressler, Simek, Ahlman, Bennett, & Franklin, 1999). Mound building also began to spread during the Early Woodland period.

The practice of mound-building continued throughout the Middle Woodland Period, and the use of mounds continued to become more elaborate. The ceremonial earthen mounds contained graves of elite individuals. Graves containing exotic gifts presumably to accompany the dead into the afterlife are prevalent throughout the state. Towards the end of the Early Woodland and into the Middle Woodland there is evidence of evolving trade practices and new routes. One example of this is meteoritic iron that was used for making various type of jewelry, beads, earspools, buttons, and headdresses, which have also been found in northern Florida.

The Late Woodland is characterized by advancements in cultural productivity, as mound areas expanded to host civic and ceremonial functions other than burials in adjacent plazas. The bow and arrow also replaced the atlatl, which allowed for greater efficiency in hunting (NPS, 2015o).

Maize, beans, and squash cultivation increased during the Late Woodland period, although hunting, fishing, and foraging activities continued. Archaeological sites become smaller during this period; however, there is a significant increase in the numbers of sites (NPS, 2015p).

**Mississippian Period (A.D. 1000 – 1500)**

The Mississippian culture was a mound-building American Indian civilization that flourished between the Woodland period and European contact in parts of what is now the Midwestern, Eastern, and Southeastern areas of the United States. Evidence of Mississippian culture in Alabama is evident throughout the state The American Indians of this period were organized by Chiefdoms, which were complex hierarchal societies sharing similar traditions under the leadership of a tribal Chief. Since 2009, there has been increasing research on the Mississippian culture due to new theories and tools for archaeologists. Most of the research on the Mississippian culture conducted prior to 2009 was focused on the Chiefdom cultures that dominated most of the region; some of the more recent research has focused on the cultures that existed outside of the chiefdoms (Blitz, 2010; Jenkins & Krause, 2009).

Chiefdoms became more elaborate, and “an ideological belief system called the Southeastern Ceremonial Complex” was being practiced. They built “large platform mounds which were often concentrated in civic-ceremonial centers at the political capital of the chiefdoms” (Bense, 1996).

The development of agriculture and exploitation of the coastal environment were the two main types of subsistence of this period. The intensification of maize cultivation allowed for the increased of abundance of food that could support the growing chiefdoms. Storage of food for future use was becoming more commonplace. Fish and nuts were being procured, and the intensification of deer and other hunting was escalated. Hunting, fishing, gathering of wild plants along bays and estuaries were predominant in the coastal regions of Alabama (Bense, 1996).

### *3.1.11.5 Federally Recognized Tribes of Alabama*

According to the National Conference of State Legislators, the Poarch Band of Creek Indians is the only federally recognized Tribe in Alabama (National Conference of State Legislators, 2015; GPO, 2015). Figure 3.1.11-2 shows the general historic location of other tribes that were known to exist in this region of the United States, but are not officially federally recognized.

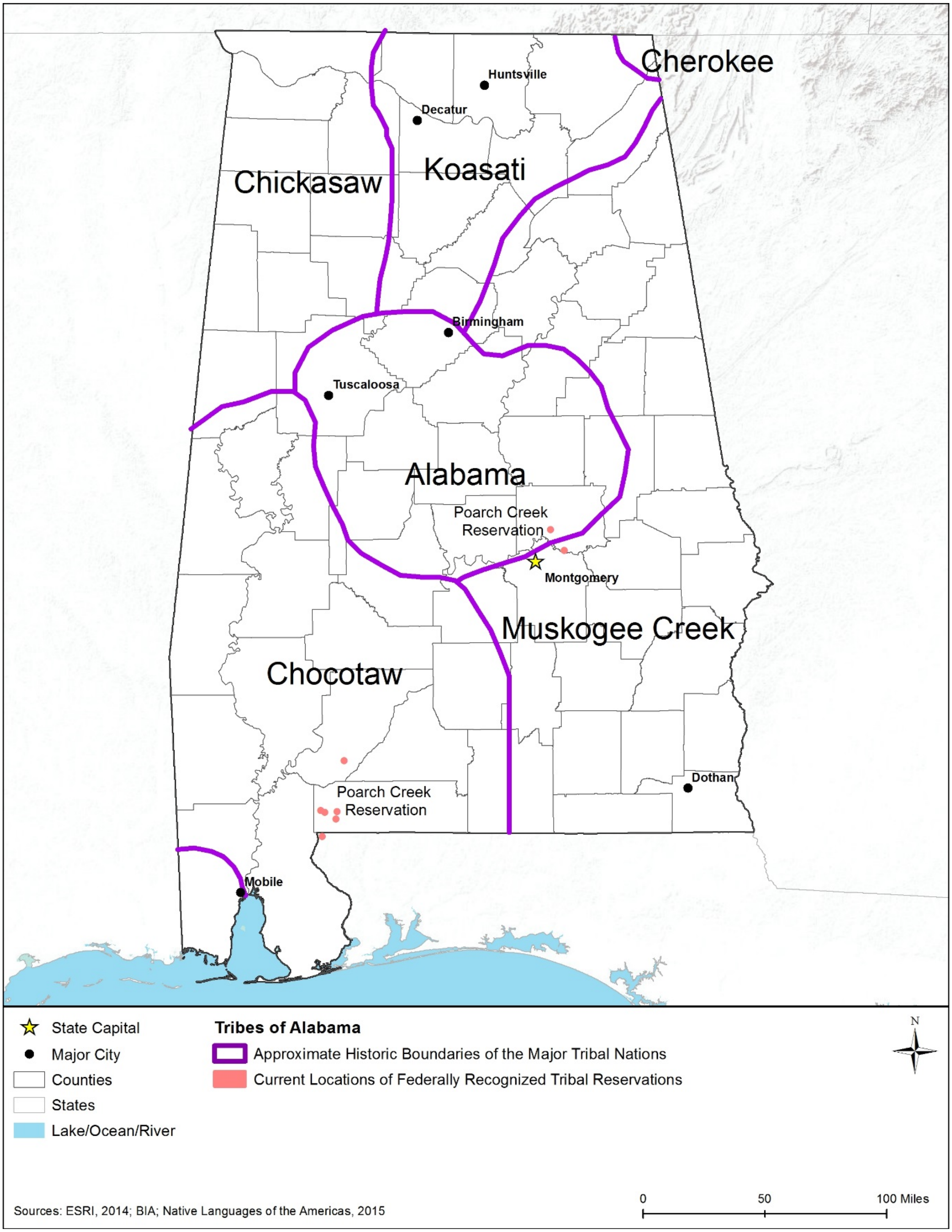


**Figure 3.1.11-2: Federally Recognized Tribes and Historic Boundaries of Major Tribal Nations in Alabama**

#### *3.1.11.6 Significant Archaeological Sites of Alabama*

There are 28 archaeological sites in Alabama listed on the NRHP (NPS, 2015q). Table 3.1.11-1 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 increase as new sites are discovered. A current list of NRHP sites can be found on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2015q)

**Alabama State Cultural Resources Database and Tools**

***Alabama Historical Commission (AHC)***

The Alabama Historical Commission serves as the State Historic Preservation Office (SHPO) for Alabama. The AHC website hosts multiple resources including news, historic site information, a staff directory, and access to the state landmark register. The Alabama Register of Landmarks is the state's official listing of sites and buildings that have been identified for preservation. The register is publicly accessible (http://preserveala.org/alabamaregister.aspx?sm=f_b), and can be downloaded as a PDF that contains links to additional information for specific sites (ADAH, 2015a).

***Alabama Archaeological Society (AAS)***

The Alabama Archaeological Society is an organization open to the public for those interested in historic and prehistoric preservation. There are eight chapters of the AAS, whose goals are to promote and preserve regional archaeology through volunteer work and public outreach. The AAS website (https://www.alabamaarchaeology.org/) provides users with preservation news, volunteer opportunities, and access to its newsletter. Information on purchasing the society publication, *The Journal of Alabama Archaeology* is also available (Alabama State Parks, 2015a).

***Office of Archaeological Research (OAR)***

The Office of Archaeological Research is a department within the University of Alabama, which provides various service offerings to clients, including cultural resource management, archaeological research, architectural services, and cemetery research. The OAR website (http://museums.ua.edu/oar/) contains numerous resources such as lesson plans, a staff directory, and information on purchasing publications. The OAR also sponsors three online archaeological databases for collections that the organization has contributed to: the 50 Years of Alabama Archaeology, the Moundville Stolen Pots Website, and the 1930s WPA/TVA Archaeological Photograph Database.

**Table 3.1.11-1: Archaeological Sites on the NRHP in Alabama**

| Closest City | Site Name | Type of Site |
|---|---|---|
| Bay Minette | Old Mobile Site; Fort Louis De La Louisiane | Historic, Military |
| Birmingham | Sloss Blast Furnace Site | Historic |
| Bridgehead | Blakeley | Historic, Military |
| Brierfield | Brierfield Furnace | Historic |
| Camden | Liddell Archeological Site | Historic – Aboriginal, Prehistoric |
| Dauphin Island | Indian Mound Park | Prehistoric |
| Epes | Fort Tombecbee | Historic, Military |
| Florence | Seven Mile Island Archeological District | Historic – Aboriginal, Prehistoric |
| Fort Benning | Yuchi Town | Historic – Aboriginal, Prehistoric |
| Fort Mitchell | Fort Mitchell Site | Historic, Military |
| Haleyville | Archeological Site No. 1LA102 | Prehistoric |
| Haleyville | Archeological Site No. 1WI50 | Prehistoric |
| Holy Trinity | Apalachicola Fort | Historic |
| Leighton | La Grange Rock Shelter | Prehistoric |
| Maud | Rock Creek Archeological District (Act44,Act45) | Prehistoric |
| Montgomery | Harrington Archaeological Site | Prehistoric |
| Montgomery | Muklassa | Historic – Aboriginal, Prehistoric |
| Montgomery | Shine, Jere, Site | Historic – Aboriginal, Prehistoric |
| Ohatchee | Fort Strother Site | Historic, Military |
| Selma | Cahaba | Historic |
| Sheffield | Tuscumbia Landing Site | Historic |
| Shorter | Atasi Site | Historic – Aboriginal, Prehistoric |
| St. Stephens | Old St. Stephens Site | Historic |
| Stockton | Bottle Creek Indian Mounds | Historic – Aboriginal, Prehistoric |
| Stockton | Nanna Hubba Bluff | Historic – Aboriginal, Prehistoric |
| Tensaw | Fort Mims Site | Historic, Historic – Aboriginal, Military |
| Tuskegee | Archeological Site No. 1MC110 | Historic – Aboriginal, Prehistoric |
| Wetumpka | Hickory Ground | Historic, Historic – Aboriginal |

Source: (NPS, 2015q)

### *3.1.11.7 Historic Context*

In 1519, Alonso Alvarez de Piñeda explored Mobile Bay. In 1540, the first known European explorer to travel through Alabama was Hernando de Soto on his expedition's travels through the southeast. Later, a member of Hernando de Soto's expedition, navigator Bernaldo Peloso, and Guido de Lavazares explored the upper Gulf of Mexico, including Mobile Bay, in 1558. Spain made others attempts to establish a colony in the Alabama region during the 16th century, all of which were unsuccessful (ADAH, 2015b). In 1702, Fort Louis de la Louisiane was established by the French upriver from Mobile Bay, but was soon moved downriver to the current location of Mobile. Following the French and Indian War, France relinquished its claim to the territory, with control of Mobile shifting to Great Britain as part of West Florida. Spain gained control of Mobile during the American Revolution. In 1817, Alabama became a U.S. territory (ADAH, 2015c) (ADAH, 2015d). On December 14, 1819, Alabama became the 22nd state to join the Union (ADAH, 2015d).

Agriculture was important to the economy of Alabama and cotton was grown widely on large plantations during the Antebellum Era. Steamboat travel opened trade and transportation within the state during the early-to-mid 19th century, with Montgomery becoming an important city. In 1826, the capital was moved to Tuscaloosa, and in 1846, it was moved again to its current location in Montgomery (ADAH, 2015d). On January 11, 1861, Alabama seceded from the Union, being the fourth state to do so. Numerous military engagements occurred in Alabama during the Civil War, including a naval engagement at the Battle of Mobile Bay in 1863. Following the war, Alabama was governed under the Reconstruction policy that applied to all states that had chosen to secede. Birmingham was established in 1871, eventually becoming a major iron and steel producer (ADAH, 2015e).

In 1896, "George Washington Carver arrive[d] in Macon County to direct Tuskegee Institute's agricultural school" (ADAH, 2015e). Tuskegee University (formerly the Tuskegee Institute) is a prominent historically African American educational institution (ADAH, 2015e). During World War I (WWI), soldiers from Alabama served prominently, including "Alabama's 167th Regiment… (which served) at the front longer than any U.S. regiment" (ADAH, 2015f). During World War II (WWII), numerous military bases were established in Alabama, including the training facility that trained the "Tuskegee Airmen," a prominent African American military pilot squad that flew or served as ground support for both U.S. Army Air Force fighter and bomber groups (ADAH, 2015f).

Following WWII, Alabama became a hotbed of activity during the civil rights movement. Rosa Parks' famous bus incident, the Monterey Bus Boycott, the forced integration at the University of Alabama, and Dr. Martin Luther King Jr.'s march from Selma to Montgomery were all crucially important moments in the civil rights movement. Sites associated with these events attribute a high degree of historic significance to the state today and draw visitors wishing to experience this history (ADAH, 2015g). The historic Greyhound Bus Station in Montgomery is a now a museum.

Alabama has 1,282 National Register of Historic Places (NRHP) listed sites, as well as 37 National Historic Landmarks (NHL) (NPS, 2014d) (NPS, 2015e). Alabama contains one National Heritage Area (NHA), the Muscle Shoals National Heritage Area, which is in the

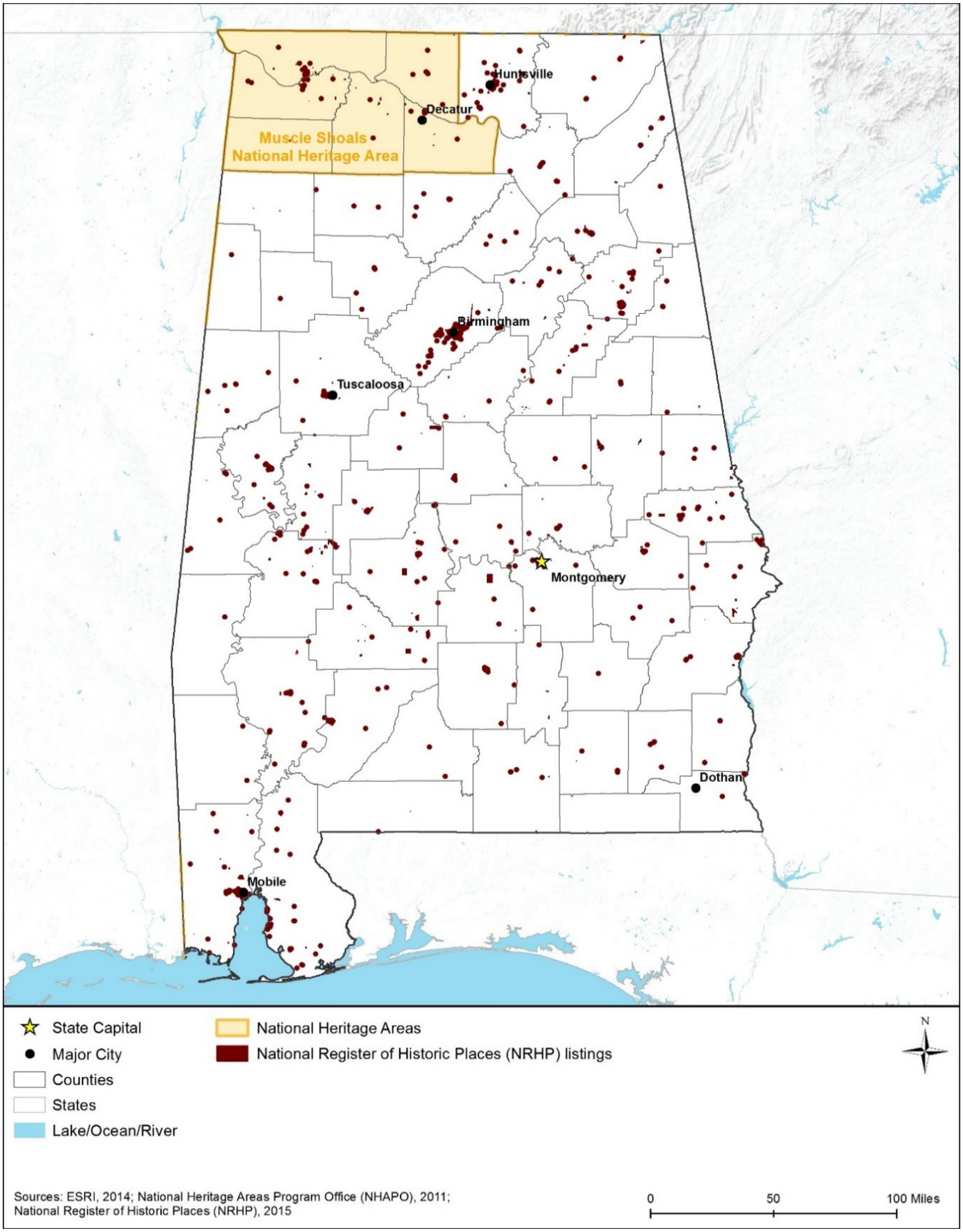


**Figure 3.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Alabama**[129]

northwestern corner of the state (NPS, 2015r). Figure 3.1.11-3 shows the location of the NHA and NRHP sites within the state of Alabama.[130]

### *3.1.11.8 Architectural Context*

While European architecture has been present in Alabama since the 16th century, no structures remain from before the early 19th century (Alabama Historical Commission, 2001). The French Fort Conde (1723) has been partially reconstructed at a reduced size and is interpreted for visitors (History Museum of Mobile, 2015). Early English-speaking settlers built log houses that exhibited trends seen throughout the southeast. “Dog trot” houses were common, and were well-suited for the southern climate. Dog trots were central passage houses with an open-air central passageway. Around Mobile, where settlement first occurred, Coastal Cottages, also known as Creole Cottages, were common. These featured raised living spaces, full-width porches, and double-pitched roofs common to French Colonial architecture (Alabama Historical Commission, 2001).

As the 19th century progressed and settlement widened, additional housing types began to appear (Figure 3.1.11-4). The Extended I-house was common, which was a traditional I-house but with single story shed-roofed extensions on both the front and rear elevations.[131] These houses often feature Federal or Greek Revival stylings and were built up through the Civil War, with some late examples being built after the Civil War. I-houses with ell additions were also built, and often included higher style detailing than the more vernacular I-houses and Extended I-houses. Spraddle-roof houses and Tidewater cottages similar to those in Virginia were also common during the 19th century (Alabama Historical Commission, 2001). The Dudley Snow House, which features the characteristic change in roof pitch over the front porch, and rear porch/addition, is an example of an Alabama Spraddle-roof houses (Gamble, 1990).

High-style houses were also built, with Federal houses being built in places like Mobile through the second quarter of the 19th century, and Greek Revival being common from about 1835 through the onset of the Civil War. Additional revival styles became popular prior to the Civil War, such as Gothic Revival and Italianate. Romanesque Revival and Second Empire lasted through the 1880s, and Queen Anne architecture was built through the first decade of the 20th century (Alabama Historical Commission, 2001). These housing types were found in rural areas and were common on working plantations and farms. This is particularly true of the styles that predated the Civil War, as a population shift began occurring after the Civil War as the state began to industrialize.

During the 20th century, Beaux Arts architecture became popular and can be seen in public buildings such as courthouses and libraries. Carnegie libraries were built in Alabama, some of which employed the Beaux Arts style, as did high style homes. Colonial Revival became popular during the early 20th century and “can…be spotted by such features as a gambrel roof or

[129] The oddly shaped polygons in this figure are artifacts of available data of NRHP district listings. The accuracy of the location data for these resources varies, resulting in variations in the appearance of each resource.
[130] See Section 3.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.
[131] I-houses were usually one room deep and two stories in height, with either a hall-parlor or central passage floor plan. Matching end chimneys were common.

neoclassical columns…mixed…with Victorian stained glass and other incongruous features" (Alabama Historical Commission, 2001). Bungalows and Prairie houses were built until WWII, with bungalows being popular in urban areas. Just prior to and following WWII, minimal traditional houses were built, as were ranch houses during the Midcentury years. Modern styles were also popular, including Art Deco, Art Moderne, and International style buildings, and would have been common in commercial and institutional architecture (Alabama Historical Commission, 2001).

Significant building types in Alabama include a variety of historic schools ranging from Rosenwald Schools built for underprivileged African American communities to institutions of higher education, such as the University of Alabama and Tuskegee University (National Register of Historic Places, 1997) (ADAH, 2015e). Historic schools can be important for a variety a reasons ranging from their architecture to their involvement in the Civil Rights movement and larger world conflicts. Birmingham was established in the late 19th century with the purpose of being an industrial town, being located on rail lines in an area rich with natural resources. Historic fire stations, as well as other industrial facilities remain in Birmingham (National Register of Historic Places, 1990). The Alabama coast features small towns involved in maritime activities along the Gulf Coast, as well as vacation communities dating to the 20th century.

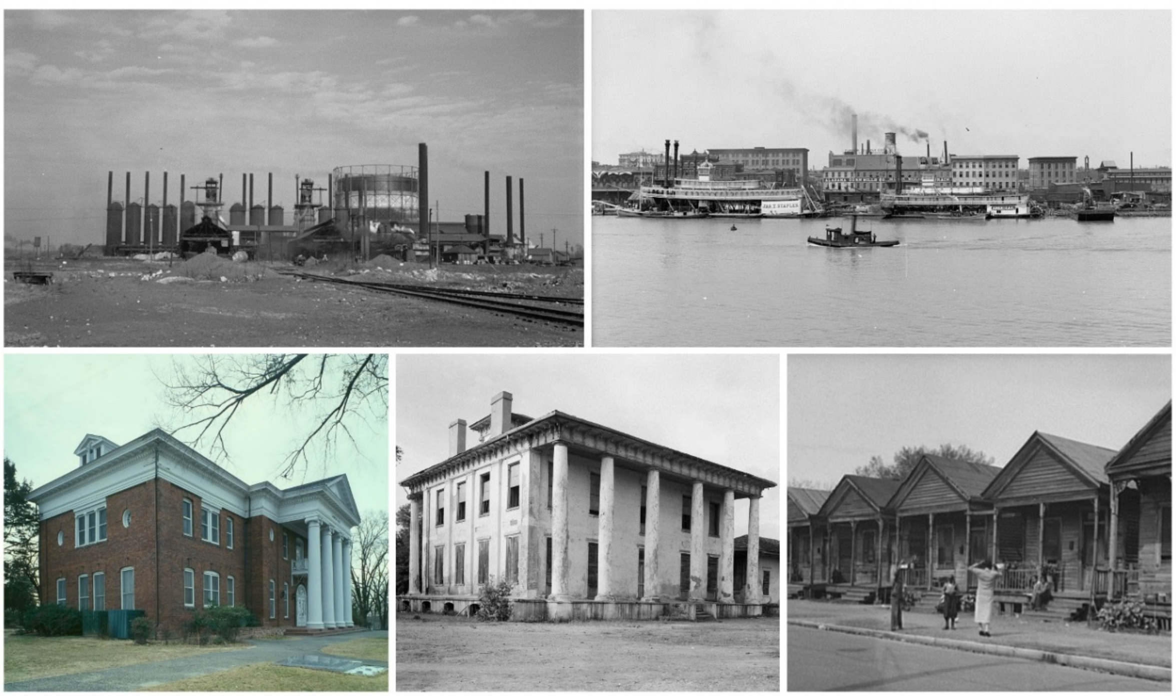

**Figure 3.1.11-4: Representative Architectural Styles of Alabama**

- Top Left – Steelworks (Birmingham, AL) – (Rothstein, A., 1937a)
- Top Right – Mobile Waterfront (Mobile, AL) – (Detroit Publishing Company, 1900)
- Bottom Left – Carnegie Hall at Tuskegee University (Tuskegee, AL) – (Historic American Buildings Survey, 1978)
- Bottom Center – Drish House (Tuscaloosa, AL) – (Johnston, 1939)
- Bottom Right – Shotgun Houses (Mobile, AL) – (Rothstein, A., 1937b)

## 3.1.12 Air Quality

### *3.1.12.1 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[132] 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)[133] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[134] This section discusses the existing air quality in Alabama. The USEPA designates areas within the United States as attainment,[135] nonattainment,[136] maintenance,[137] or unclassifiable[138] 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.

### *3.1.12.2 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[139] or secondary,[140] 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 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

[132] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[133] Equivalent to 1 milligram per liter (mg/L).
[134] 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, 2015r).
[135] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015s).
[136] 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, 2015s).
[137] 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, 2015s).
[138] 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, 2015s).
[139] 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).
[140] 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).

solvents) (USEPA, 2016b). 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.

The Alabama Department of Environmental Management (ADEM), Air Division, mimics the National Ambient Air Quality Standards (NAAQS), as stated in Alabama Admin Code r. 335-3-1.-03(1). (ADEM, 2015k)

### Title V Operating Permits/State Operating Permits

Alabama 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 requirements for the facility into one permit (USEPA, 2015f). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015f). ADEM Administrative Code r. 335-3-16 (Major Source Operating Permits) regulation describes the applicability of Title V operating permits. Alabama 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 (Table 3.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014a).

**Table 3.1.12-1: Major Air Pollutant Source Thresholds**

| Pollutant | Tons per year (TPY) |
|---|---|
| Any Pollutant | 100 |
| Single HAP | 10 |
| Total/Cumulative HAPs | 25 |

Source: (USEPA, 2014a)

### Exempt Activities

ADEM requires all sources[141] with plans to construct or modify equipment and activities with the potential to emit any air pollutants to apply for a permit with the Air Division. No emission sources and activities are exempt from applying for a permit. The ADEM Air Division Director determines if the emissions source will require a permit on a case by case basis. The Air Division has established specific pollutant thresholds to assist on what level of permit is necessary. The ADEM Air Division issues many types of permits and certifications, see Table 3.1.12-2 for details.

[141] ADEM defines a new sources as "any source built or installed on or after the date of initial adoption of an applicable rule or regulation, and any source existing at said stated time which later undergoes modification. Any source moved to another premise involving a change of location after the date of initial adoption of an applicable rule or regulation shall be considered a new source…" (ADEM, 2015k).

**Table 3.1.12-2: ADEM Air Quality Permits/Certifications**

| Type | ADEM Admin. Code r. Chapter |
|---|---|
| Air Permit (Minor Source) | 335-3-14-.01 |
| Air Permit (NSR/PSD) | 335-3-14-.04 |
| Air Permit (Gasoline Transporters) | 335-3-6-.20 |
| Major Source Operating Permit (MSOP) | 335-3-16-.03 |
| Synthetic Minor Operating Permit (SMOP) | 335-3-15-.03 |
| Acid Rain Permit | 335-3-18 |
| Clean Air Interstate Rule (CAIR) Permit | 335-3-8-.18 |
| NOx Budget Trading Program Permit | 335-3-8-.05 |
| Clean Air Mercury Rule (CAMR) Permit | 335-3-21 |
| Asbestos Removal Contractor Certifications | 335-3-11-.05 |

Source: (ADEM, 2015m)

### Temporary Emissions Sources Permits

ADEM Administrative Code r. 335-3-16-.09 (Temporary Sources) permits temporary sources that move at least once while the permit is applicable. If a source will not move at least once it does not meet this regulation and the source should review applicable construction and stationary source requirements or contact ADEM Air Division for additional assistance.

### State Preconstruction Permits

Alabama does not have State Preconstruction Permits for Minor Sources. Preconstruction permits are applicable to Major Sources as stated in ADEM Administrative Code r. 335-3-14-.04 (Air Permits Authorizing Construction in Clean Air Areas PSD)) and 335-3-14-.05 (Air Permits Authorizing Construction in or Near Non-Attainment Areas). Construction of any emission sources should review applicable construction and stationary permitting requirements or contact ADEM Air Division for additional assistance.

### 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 (e), 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*[142] levels. These values are the minimum thresholds for which a conformity determination must be performed (Table 3.1.12-3). No Alabama counties lie in the Ozone Transport Region.

**Table 3.1.12-3: *De Minimis* Levels**

| Pollutant | Area Type | TPY |
|---|---|---|
| Ozone (Volatile Organic Compound [VOC] or $NO_X$) | Serious Nonattainment | 50 |
| | Severe Nonattainment | 25 |
| | Extreme Nonattainment | 10 |
| Ozone ($NO_X$) | Maintenance | 100 |
| CO, Sulfur Dioxide ($SO_2$), Nitrogen Dioxide ($NO_2$) | All Nonattainment and Maintenance | 100 |
| $PM_{10}$ | Serious Nonattainment | 70 |
| | Moderate Nonattainment and Maintenance | 100 |
| $PM_{2.5}$<br>(Direct Emissions)<br>($SO_2$)<br>($NO_X$ (unless determined not to be a significant precursor))<br>(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 3.1.12-3, 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 3.1.12-3, 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 new violation of the NAAQS. To demonstrate conformity[143], 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;

[142] 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, 2016)
[143] Conformity: Compliance with the State Implementation Plan.

- 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 Alabama SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Alabama's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Alabama's SIP actions are codified under 40 CFR Part 52 Subpart B. A list of all SIP actions for all six criteria pollutants can be found on USEPA's website: http://www3.epa.gov/region4/air/sips/al/content.htm.

### *3.1.12.3 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 3.1.12-1 and Table 3.1.12-4 present the nonattainment areas in Alabama as of January 30, 2015. Table 3.1.12-4 contains a list of the counties and their respective current nonattainment status of each criteria pollutant. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standard for that pollutant; note that, for $PM_{2.5}$, $O_3$, and $SO_2$, these standards listed are in effect. Note certain pollutants have more than one standard in effect (e.g., $PM_{2.5}$, $O_3$, and $SO_2$). Unlike Table 3.1.12-4, Figure 3.1.12-1 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.

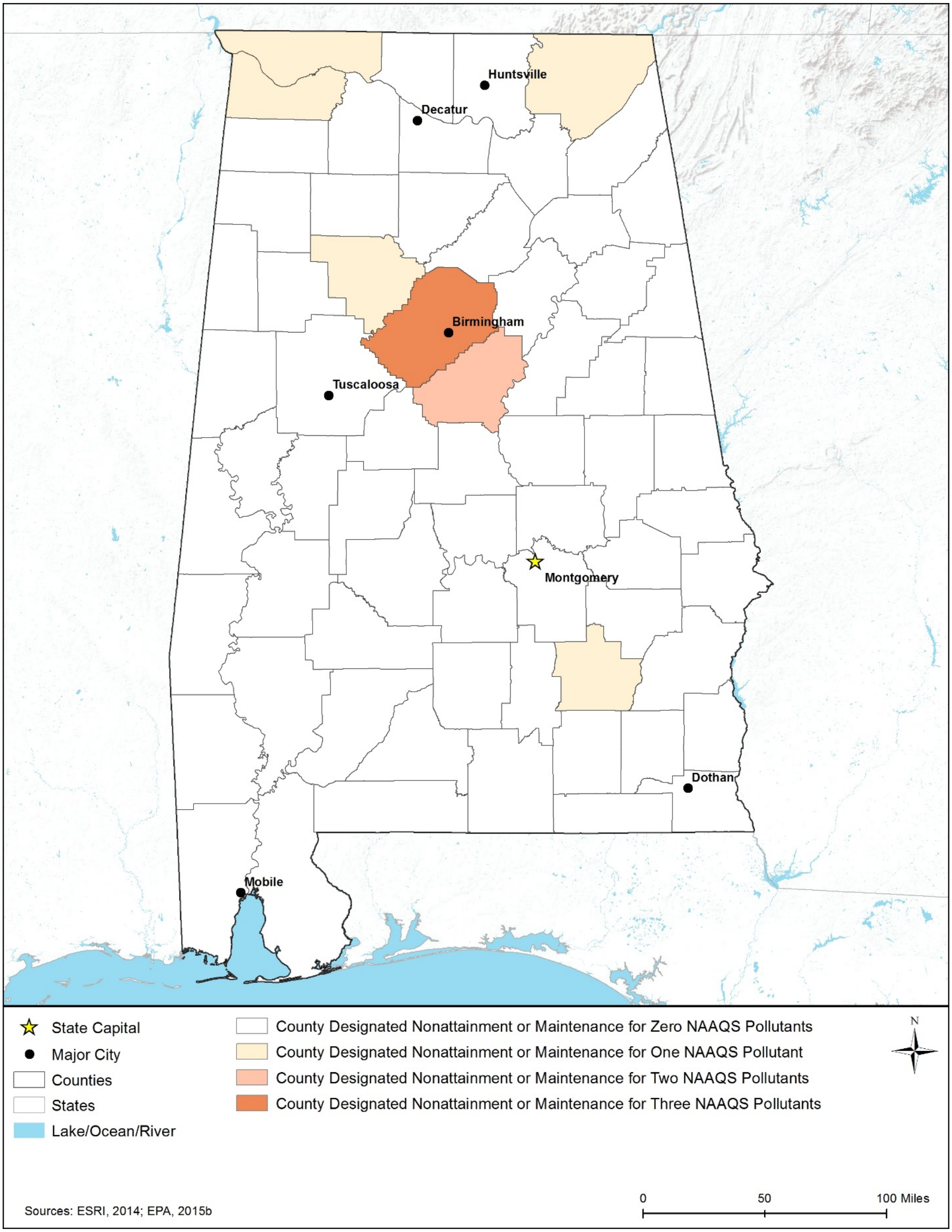


**Figure 3.1.12-1: Nonattainment and Maintenance Counties in Alabama**

**Table 3.1.12-4: Alabama Nonattainment and Maintenance Areas by Pollutant Standard and County**

| County | Pollutant and Year USEPA Implemented Standard | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO | Lead | | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ | | $O_3$ | | $SO_2$ | |
| | 1971 | 1978 | 2008 | 1971 | 1987 | 1997 | 2006 | 1997 | 2008 | 1971 | 2010 |
| Colbert | | | | | | | | | | M | |
| Jackson (Chattanooga, TN-GA-AL (AL portion) | | | | | | M | | | | | |
| Jefferson | | M | | | | M | M | M | | | |
| Lauderdale | | | | | | | | | | M | |
| Pike | | | X-6 | | | | | | | | |
| Shelby | | | | | | M | M | M | | | |
| Walker | | | | | | M | M | | | | |

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

Source: (USEPA, 2015g)

### Air Quality Monitoring and Reporting

Alabama has three agencies who monitor the air quality. They are the ADEM, the Jefferson County Department of Health (JCDH), and the Huntsville Department of Natural Resources and Environmental Management (HDNREM). ADEM, JCDH, and HDNREM measure air pollutants at 38 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual Alabama State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. ADEM reports real-time pollution levels of $O_3$ and $PM_{10}$ on the AirNOW[144] website: http://www.airnow.gov/ to inform the public, as $O_3$ and $PM_{10}$ is the main pollutant of concern.

In 2012 and 2013, lead exceeded the federal standard of 0.15 $\mu g/m^3$ at the Henderson Road facility. No other pollutants exceeded federal standards. (ADEM, 2015o)

### Air Quality Control Regions

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

[144] AirNow is a government website that posts daily Air Quality Index for more than 400 cities.

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 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. § 7472).

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[145] of a Class I area. If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (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 50 kilometers[146] (the normal useful range of EPA-approved Gaussian plume models" (USEPA, 1992).

Alabama contains one Federal Class I area and the rest of the 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 need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Louisiana does have a Class I area where the 100-kilometer buffer intersects a few Alabama counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 3.1.12-2 provides a map of Alabama 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 3.1.12-2 correspond to the numbers and Class I areas listed in Table 3.1.12-5.

**Table 3.1.12-5: Relevant Federal Class I Areas**

| #[a] | Area | Acreage | State |
|---|---|---|---|
| 1 | Sipsey Wilderness Area | 12,646 | AL |
| 2 | Breton Wilderness | 5,000+ | LA |

[a] The numbers correspond to the shaded regions in Figure 3.1.12-2.
Source: (USEPA, 2012b)

[145] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.
[146] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

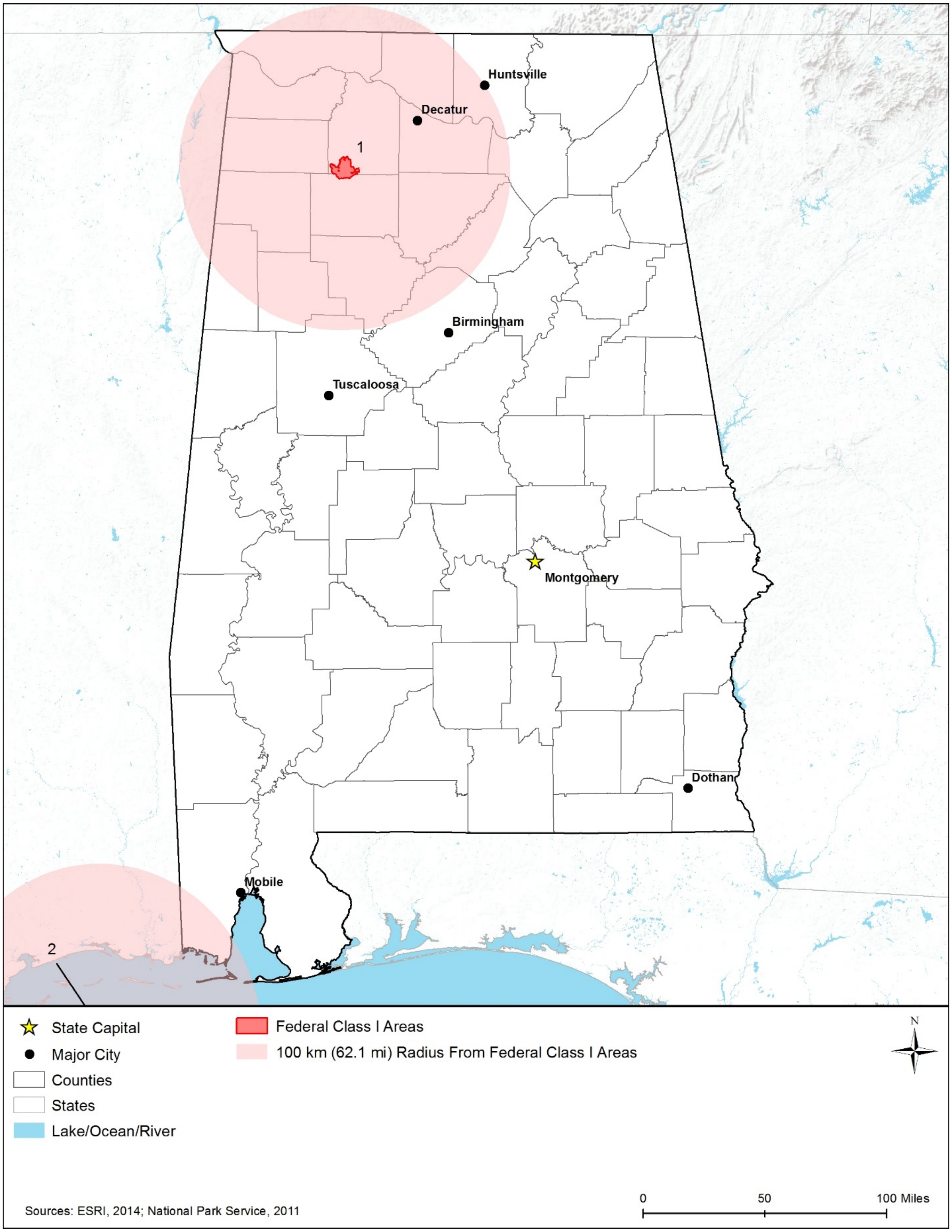


**Figure 3.1.12-2: Federal Class I Areas With Implications for Alabama**

## 3.1.13 Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

### *3.1.13.1 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.

**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"). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (Federal Transit Authority, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015h). 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, 2013).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (Federal Transit Authority, 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.
- The changes in frequency characteristics or pressure levels through time.

Figure 3.1.13-1 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.

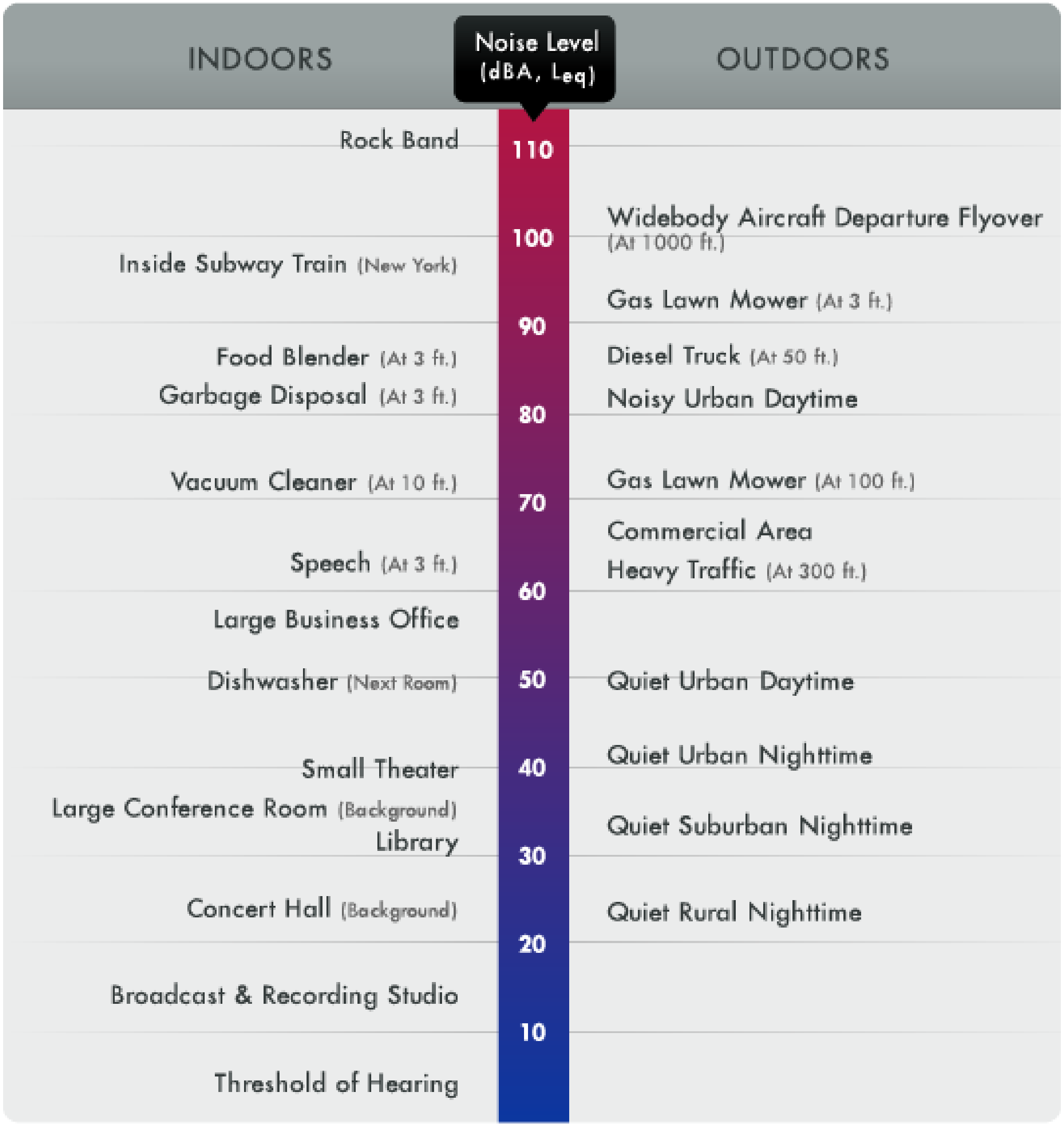


**Figure 3.1.13-1: Sound Levels of Typical Sounds**

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 is categorized as follows (Federal Transit Authority, 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.

### *3.1.13.2 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.

Alabama does not have any state-wide noise regulations. However, many cities and towns may have local noise ordinances to 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 Birmingham, Mobile, and Montgomery, 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).

### *3.1.13.3 Environmental Setting: Ambient Noise*

The range and level of ambient noise in Alabama varies widely based on the area and environment of the area. The population of Alabama can choose to live and interact in areas that are large cities, rural communities, and national and state parks. Figure 3.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Alabama may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Alabama. As such, this section describes the areas where the population of Alabama 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) (DOI, 2008). The areas that are likely to have the highest ambient noise levels in the state are: Birmingham, Montgomery, and Mobile.
- **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, 2015g). There are a number of major highways within the state that may contribute to higher ambient

noise levels for residents living in those areas. 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, 2015g). See Section 3.1.1, Infrastructure, and Figure 3.1.1-1 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 (Federal Transit Authority, 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 (USDOT, 2015b). Alabama has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors include lines that extend mainly from Birmingham to other cities in Alabama, Louisiana, Arkansas, Mississippi, and Florida, such as the Burlington Northern Santa Fe, CSX Transportation Line, and the Norfolk Southern. There are also a number of other rail corridors that join these major rail lines and connect with other cities (ALDOT, 2008). See Section 3.1.1, Infrastructure, and Figure 3.1.1-1 for more information about rail corridors in the state.
- **Airports:** Areas surrounding airports tend to be more sensitive to noise 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 are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels 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 Alabama, Birmingham-Shuttlesworth International Airport (BHM), Huntsville International Airport (HSV), and Mobile Regional Airport (MOB) have more than 191,000 annual operations combined (FAA, 2015i). These operations result in increased ambient noise levels in the surrounding communities. See Section 3.1.1, Infrastructure, and Figure 3.1.7-7 for more information about airports 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. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014e). Alabama has seven National Parks and seven National Natural Landmarks (NPS, 2015s). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 3.1.8, Visual Resources, for more information about national and state parks for Alabama.

#### *3.1.13.4 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, and towns in Alabama 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 Alabama.

### 3.1.14 Climate Change

#### *3.1.14.1 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 (MT $CO_2e$),[147] which equalizes for the different global warming potential of each type of GHG. Where this document references 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

[147] $CO_2e$ 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, 2015k)

Section 3.2, Environmental Consequences). 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).

### *3.1.14.2 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. Alabama has not established goals and regulations to reduce GHG emissions to combat climate change.

### *3.1.14.3 Greenhouse Gas Emissions*

Estimates of Alabama's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Administration (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 methane ($CH_4$) and nitrous oxide ($NO_x$), but these are not broken down by state (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015h). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHG 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 $CH_4$, they will be described and cited.

According to the EIA, Alabama emitted a total of 119.8 MMT of $CO_2$ in 2013. The largest proportion of total emissions comes from coal (53.3 percent) mostly used by the electric power sector, which also accounts for most of the emissions from coal (Table 3.1.14-1) (EIA, 2015c). Total annual emissions from 1980 to 2013 are displayed in Figure 3.1.14-1. Annual emissions decreased between 1980 and 1983, then increased to a high of 146.5 MMT in 2007 before beginning a decrease to their current level. Alabama was one of the few states whose $CO_2$ emissions from fossil fuels continued to decline in 2013 (EIA, 2015c). In 2013, Alabama was ranked 15$^{th}$ among the 50 states and the District of Columbia for total $CO_2$ emissions and 14$^{th}$ for per capita $CO_2$ emissions (EIA 2015b).

**Table 3.1.14-1: Alabama $CO_2$ Emissions from Fossil Fuels by Fuel Type and Sector, 2013**

| Fuel Type (MMT) | | Source (MMT) | |
|---|---|---|---|
| Coal | 53.3 | Residential | 2.2 |
| Petroleum Products | 33.2 | Commercial | 1.8 |
| Natural Gas | 33.3 | Industrial | 21.3 |
| | | Transportation | 30.3 |
| | | Electric Power | 64.2 |
| **TOTAL** | **119.8** | **TOTAL** | **119.8** |

Source: (EIA, 2015c)

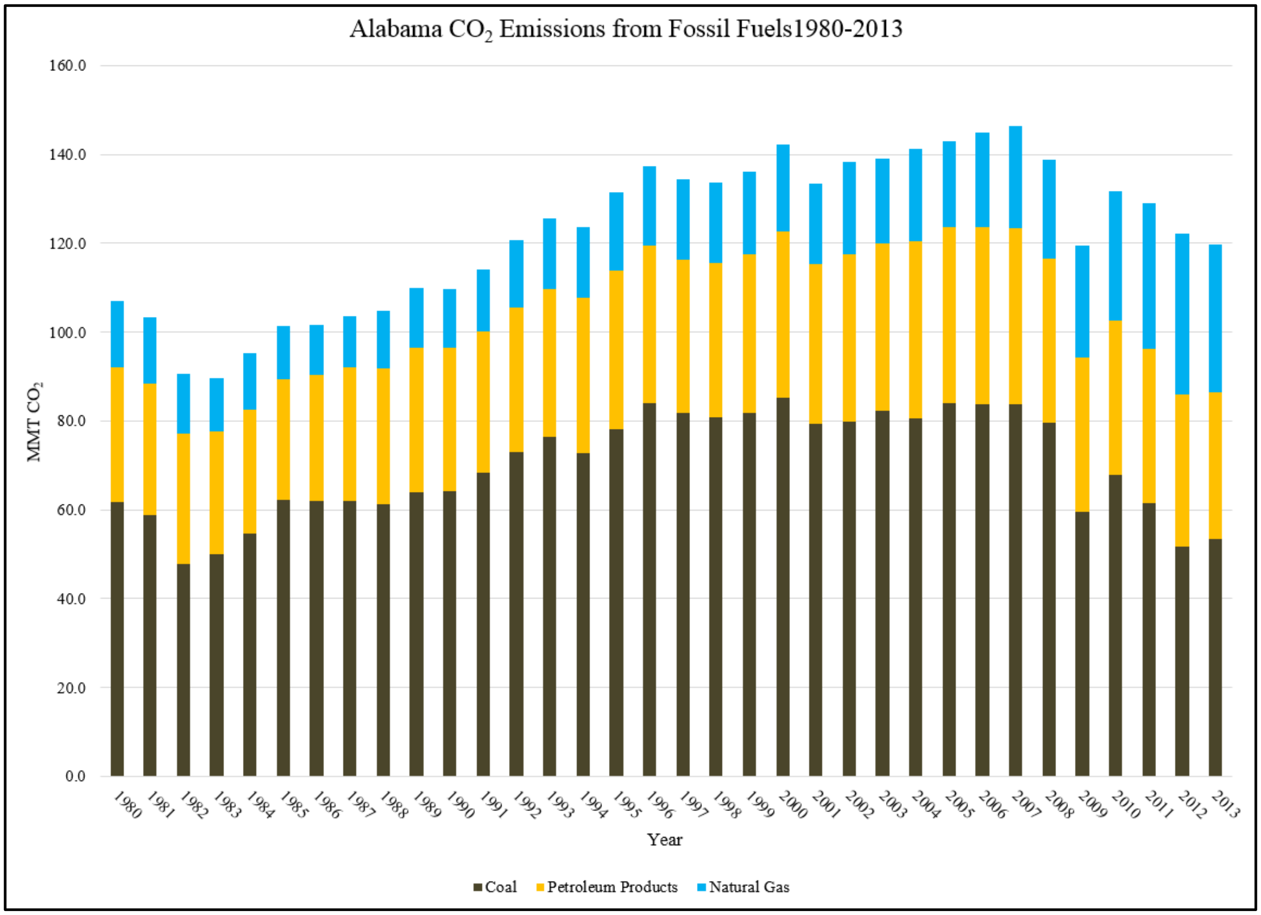


**Figure 3.1.14-1: Alabama $CO_2$ Emissions from Fossil Fuels by Fuel Type 1980-2013**

Source: (EIA, 2015c)

The majority of Alabama's GHG emissions is $CO_2$. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly petroleum products from electric power generating facilities and coal-fired power plants. Alabama is rich in energy resources, has a large industrial base, and is a net exporter of electric power: hence it has higher than average per-capita energy use (EIA, 2015e). Total U.S. GHG greenhouse were 6,673 million metric tons

(14.7 trillion pounds) in 2013 (USEPA, 2014e), however, the state of Alabama does not publish a GHG emissions inventory, and therefore reliable data on non-$CO_2$ emissions such as $NO_x$ and $CH_4$ are not available.

### *3.1.14.4 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).

The entirety of Alabama falls into climate group (C). Climates classified as (C) are warm, with humid summers and mild winters. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a) (NWS, 2011b). During summer months, (C) climate groups experience regularly occurring thunderstorms. Alabama has one sub-climate category, which is described in the following paragraphs.

Cfa – The Köppen-Geiger climate classification system classifies the entire state of Alabama as Cfa (Figure 3.1.14-2).

Cfa climates are generally warm, with humid summers and mild winters. Within this climate classification zone, the secondary classification (f) indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. Within this climate classification zone, the tertiary classification (a) indicates mild, hot summers with average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F. Overall, Alabama is classified as a "humid-subtropical climate with access to continental polar outbreaks" (Christy, 2015). (NWS, 2011a) (NWS, 2011b)

This section discusses the current state of Alabama's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., tropical storms, tropical cyclones, flooding, thunderstorms, and hurricanes) in the state's climate region, Cfa.

#### Air Temperature

The mostly confined waters of the Gulf of Mexico play a big role in Alabama's warm, humid climate. As the waters of the Gulf of Mexico warm, "Alabama's climate is in large part driven by the moisture that evaporates from these waters, providing humid air which bathes the state for much of the year" (Christy, 2015). Although average temperatures throughout the state are generally above 60 °F, arctic air does move southward and into Alabama occasionally (Christy, 2015). Although Alabama is located south of the 35$^{th}$ parallel, average annual temperature highs are comparably lower than two-thirds of other southern states “due to the always present moisture in the thick, natural forest vegetation” (Christy, 2015).

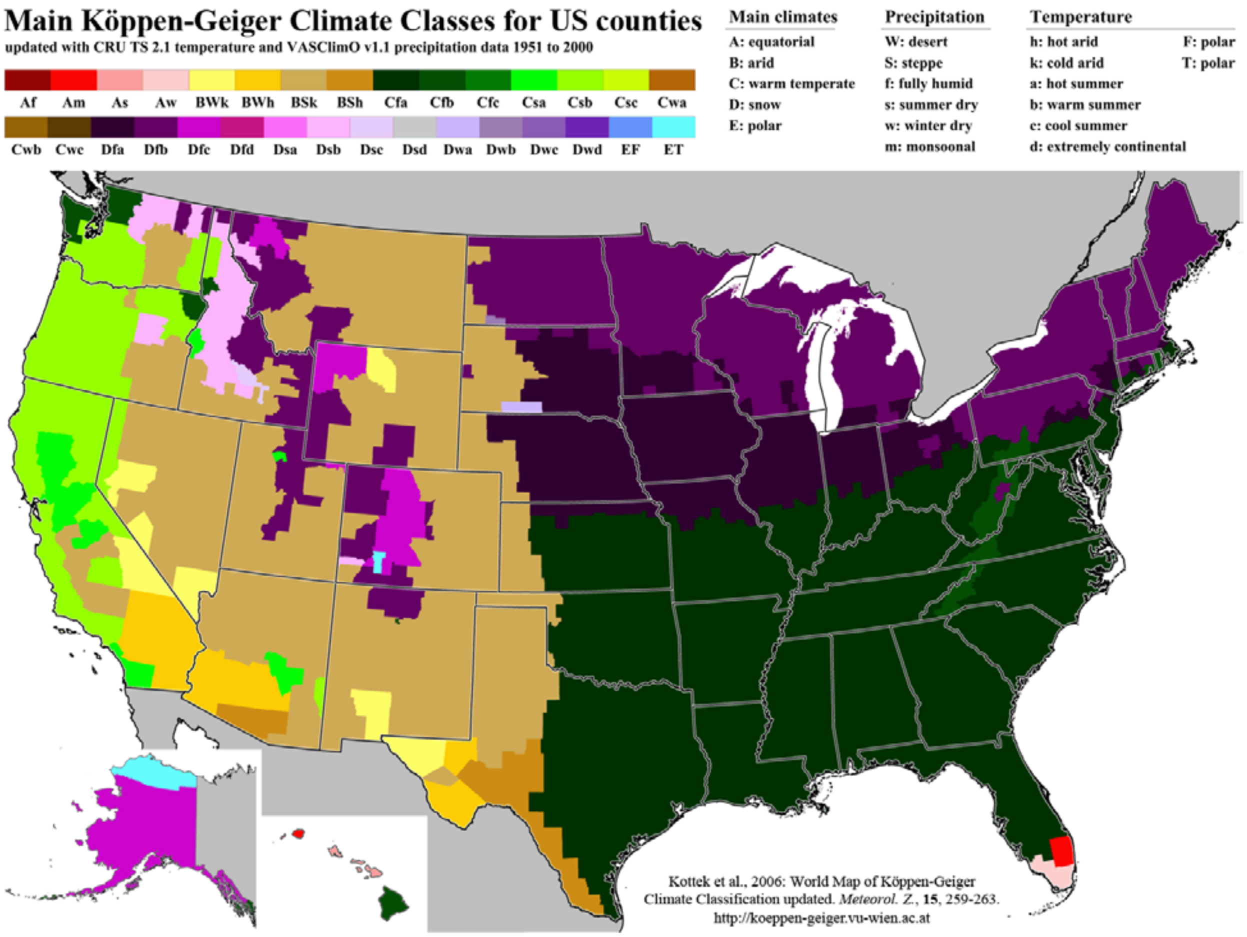


**Figure 3.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties**

Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

The annual average temperature in Alabama is approximately 63.1 °F (NOAA, 2015h). The highest temperature to occur in Alabama was on September 6, 1925 with a record high of 112 °F (NOAA, 2015c). The lowest temperature to occur in Alabama was on January 30, 1966 with a record low of negative 27 °F (NOAA, 2015c).

Cfa – Although the entire state of Alabama is located within the climate classification zone Cfa, the state still experiences slight temperature fluctuations, largely determined by the area’s proximity to the Gulf of Mexico. For example, average annual summer (August) temperatures range from 61.8 °F in the Northern Valley to 68.1 °F in the Gulf region (NOAA, 2015h). In the Eastern Valley of Alabama, annual summer (August) temperatures average approximately 63.1 °F (NOAA, 2015h). In Montgomery, the state capital of Alabama, the average annual temperature is approximately 65.1 °F; 48.5 °F during winter months; 80.8 °F during summer months; 64.6 °F during spring months; and 66.2 °F during autumn months (NOAA, 2015i).

### Precipitation

In addition to modifying Alabama's temperature, the Gulf of Mexico plays a large role in Alabama's annual precipitation accumulation. On average, the state of Alabama receives approximately 54 inches of rainfall per year, mainly due to the state's close proximity to the Gulf. Rain in Alabama is "most plentiful in winter through early summer with a relatively dry period – August to October – when on average only 11 inches [fall during] these three months" (Christy, 2015). The heaviest rainfall in Alabama is typically the result of tropical storms and/or hurricanes. The highest 24-hour precipitation accumulation in Alabama was the result of Hurricane Danny, with a record of 32.52 inches (NOAA, 2015c). (Christy, 2015)

During most winters, snow falls in the northern region of the state; averaging one to four inches each year. During two particularly historic snowstorm events, northern Alabama received over 20 inches of snow in 1963 and approximately 20 inches of snow in March 1993. The highest 24-hour snowfall accumulation was on March 13, 1993 with a record of 20 inches (NOAA, 2015c). (Christy, 2015)

Cfa – Although the entire state of Alabama is located within the climate classification zone Cfa, the state still experiences slight precipitation fluctuations, largely determined by the area's proximity to the Gulf of Mexico. For example, the average annual winter (December) precipitation accumulation (1900 to 2014) ranges from 53.97 inches in the Northern Valley to 62.15 inches in the Gulf region (NOAA, 2015h). In the Eastern Valley of Alabama, average annual winter (December) precipitation accumulations (1900 to 2014) average approximately 54.15 inches (NOAA, 2015h). In Montgomery, the state capital of Alabama, annual precipitation accumulations average approximately 53.07 inches; 14.79 inches during winter months; 13.27 inches during summer months; 13.51 inches during spring months; and 11.50 inches during autumn months (NOAA, 2015i).

### Sea Level

Alabama has approximately 53 miles of coastal shoreline, 826 miles of tidal shoreline, over 28,000 acres of marsh, and 1,600 acres of subaquatic vegetation along the Gulf of Mexico (Boyd, 2015) (NMFS, 2015). Much of this shoreline is at risk for damage from strong winds, heavy rainfall, flooding, and hurricanes. Since 1900, relative sea level rise along the Gulf of Mexico "has been rising substantially faster (5 to 10 mm/yr) than the global trend (1.7 mm/yr) primarily due to land subsidence" (NOAA, 2012a). Land subsidence along the Gulf of Mexico is related to "a combination of groundwater withdrawal, regional tectonic loading on the Earth's crust from the Mississippi River Delta, and possibly faulting" (NOAA, 2012a). Evidence also suggests that mean sea level in the Gulf of Mexico is also rising at a faster pace than the global average (NOAA, 2012a) (Bilskie, Hagen, Medeiros, & Passeri, 2014). As sea level continues to rise, the risks associated with living and developing along the coast also rise. Hurricane Katrina in 2005 highlighted the risks and vulnerabilities associated with living near unprotected or low-lying tidal shoreline. (Bilskie, Hagen, Medeiros, & Passeri, 2014) (NOAA, 2012a)

### Severe Weather Events

The heaviest rains in Alabama are typically the result of hurricanes and/or tropical storms. Heavy rains in Alabama lead to flash flooding, river flooding, tropical systems/coastal flooding, dam breaks and/or levee failures (NWS, 2015a). During Hurricane Danny in 1997, approximately 32.52 inches of rain was recorded during a 24-hour period over Mobile Bay. However, due to strong winds blowing across the rain gauge, this value is believed to be an underestimate, by as much as 50 percent (Christy, 2015). Regardless, 32.52 inches of rainfall is the "greatest 24-hour total recorded at an officially established weather station in the coterminous U.S." (Christy, 2015).

Alabama is exposed to both cold air masses from the north and "humid southerly breezes from the warm Gulf" (Christy, 2015). As a result, the state experiences a fair share of both tornadoes and hurricanes. Although most tornadoes are small, 22 tornadoes on average touch down each year in Alabama (Christy, 2015). During one particular tornado outbreak in March 1932, "at least two waves of storms struck the state, producing at least 15 strong or violent tornadoes in which more than 300 people were killed" (NOAA, 2009a). This storm even is considered one of the worst in Alabama's history, with the single deadliest tornado occurring during this event. During another tornado outbreak in April 1974, "at least 8 tornadoes, including 4 violent, long-lived storms, brought widespread destruction to northern Alabama" (NOAA, 2009a). "The F5 tornado, that nearly wiped the town of Guin off the map, was one of the most powerful twisters ever to strike the United States" (NOAA, 2009a). This "Super Outbreak" caused over $50 million in damages and 86 deaths in Alabama. (NOAA, 2009a)

With regard to hurricanes, Alabama "feels the effects of many land-falling Gulf hurricanes" at least somewhere in the state, "since most storms that make land-fall at or to the west of Alabama's coast tend to curve north, then northeast, and travel across the state" (Christy, 2015). During one particularly damaging event, tropical storm Alberto produced eight to 16 inches of rain across Alabama, causing massive flooding throughout the state, particularly in southeastern regions. During this storm, the most destructive flooding occurred along the Choctawhatchee and Pea Rivers, with many points along both rivers nearly reaching record crest levels. Once the floodwaters receded, the government declared 10 counties in Alabama disaster areas. The flood resulted in $112 million in damages, with over a thousand homes and businesses either damaged or destroyed. (NWS, 2015a) (NOAA, 2009a)

During another historical flooding event, Hurricane Opal made landfall on October 4, 1995 as a Category 3 storm, quickly moving through central Alabama and affecting "virtually every country in the state" (NOAA, 2009a). Peak wind gusts during this storm reached 100 miles per hour (mph) in the south and 50 mph in the north, causing more than $100 million in damages and leaving more than 2.5 million people without electricity. (NOAA, 2009a)

## 3.1.15 Human Health and Safety

### *3.1.15.1 Definition of the Resource*

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the construction, 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 implementation 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 vehicular traffic. Vehicle traffic is evaluated in Section 3.1.1, Infrastructure.

### *3.1.15.2 Specific Regulatory Considerations*

Federal organizations, such as Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Alabama, the Alabama Department of Labor (ADOL) regulates public sector occupational safety, and the ADEM regulates waste and environmental pollution. Federal OSHA regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. Alabama does not have an OSHA-approved "State Plan." Therefore, private and public sector occupational safety and health programs in the State of Alabama are enforced by OSHA. Health and safety of the general public is regulated by the Alabama Department of Public Health (ADPH).

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 3.1.15-1 below summarizes the major Alabama laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

**Table 3.1.15-1: Relevant Alabama Human Health and Safety Laws and Regulations**

| State Law/Regulation | Regulatory Agency | Applicability |
|---|---|---|
| Alabama Administrative Code, Chapter 335-13 | Alabama Department of Environmental Management (ADEM) | Regulates design, location, operation, closure, and post-closure of solid waste landfill units. |
| Alabama Administrative Code, Chapter 335-15 | ADEM | Provides a mechanism for implementation of a cleanup program for voluntarily assessment, remediation, and reuse of contaminated areas. |

| State Law/Regulation | Regulatory Agency | Applicability |
|---|---|---|
| Alabama Administrative Code, Chapter 480-3-3 | Alabama Department of Labor (ADOL) | Regulates mine safety requirements pertaining to ladders, fire prevention, explosives, and health requirements. |
| Alabama Administrative Code, Chapter 480-3-6 | ADOL | Assigns responsibility for resolving problems such as mine fires, mine subsidence, dangerous highwalls, open shafts and portals, mining-impacted water supplies and other hazards which have resulted from historical coalmining, as a requirement set forth by the federal Office of Surface Mining. |
| Alabama Administrative Code, Chapter 420-3-26 | Alabama Department of Public Health (ADPH) | Sets safety standards for managing radioactive materials. |
| Alabama Administrative Code, Chapter 770 | Alabama Public Service Commission | Requirements for operation and maintenance of electric, natural gas, and gas pipeline utilities. |

#### *3.1.15.3 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 waterbodies, 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, 2016a). 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 (International Finance Corporation, 2007).

*Trenches and confined spaces* – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work in trenches or confined spaces. Installation of underground utilities, building foundations, and work in utility manholes[148] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width) would occur. Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when

[148] 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.

inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (OSHA, 2016b)

*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 trucks, and cranes are used to prepare the ground, transport materials and soil, and raise large sections of towers and antennas. Telecommunication 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, 2016b)

*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. (International Finance Corporation, 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 (International Finance Corporation, 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 3.1.13, 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, 2016b)

*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 treatments, such as pesticide application. Secondary hazardous materials, like exhaust fumes, may be a greater health risk than the primary hazardous material (i.e., 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 paint on 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, 2016b)

*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, 2016b)

*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, 2016b)

**Telecommunication Worker Occupational Health and Safety**

The Bureau of Labor Statistics (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 and 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).

As of May 2014, there were 4,020 telecommunication equipment installers and repairers, and 960 telecommunication line installers and repairers (Figure 3.1.15-1) working in Alabama (BLS, 2015c). Alabama has not reported any nonfatal occupational injuries or illnesses in the telecommunications industry or telecommunications occupations since 1996, when data are first available (BLS, 2013a). There were 2.1 nonfatal occupational injuries or illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014a).

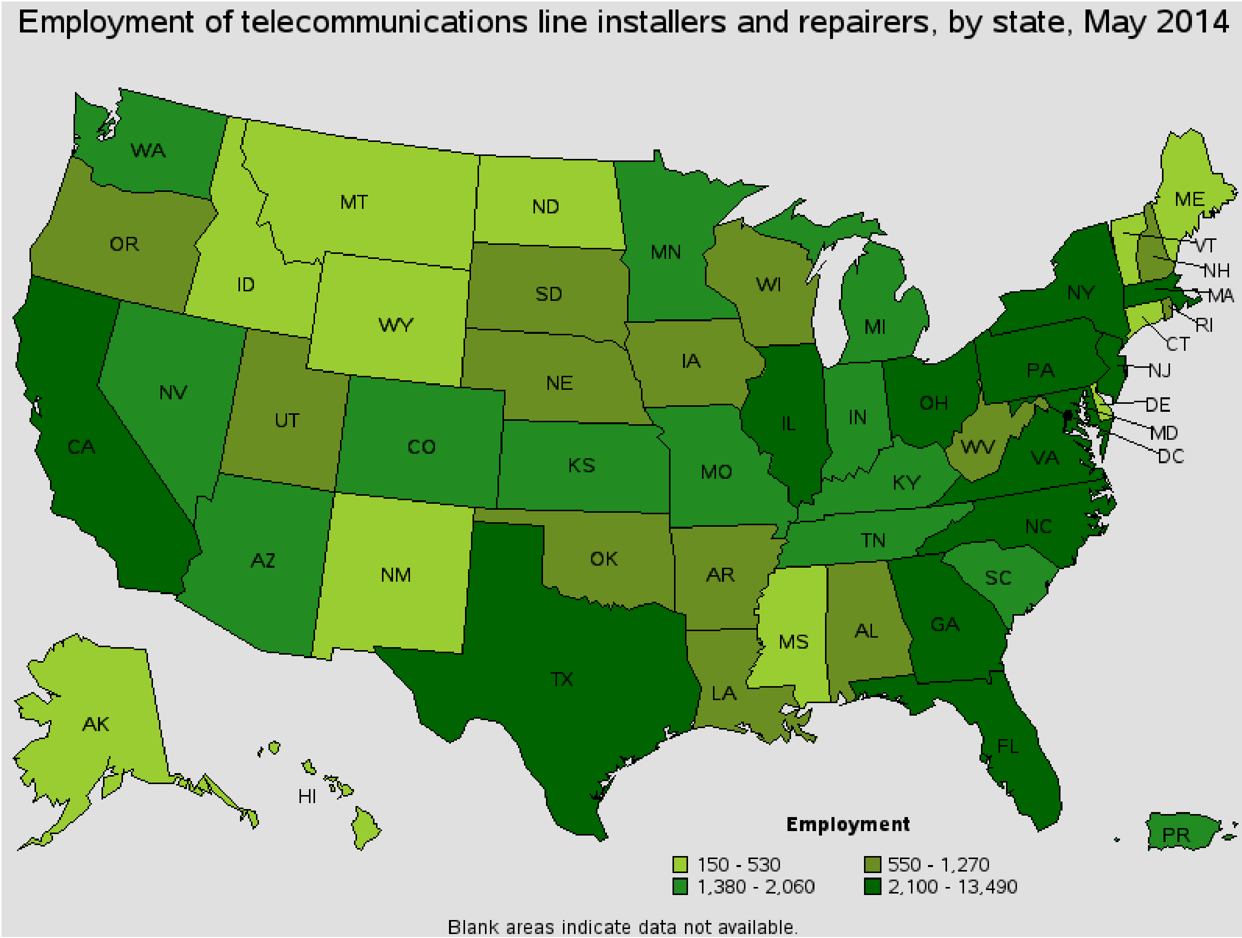


**Figure 3.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014**

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). Alabama has not reported fatalities in the telecommunications industry or telecommunications occupations since 2003 when data are first available. In the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 118 fatalities, including 6 fatalities[149] in 2014, with the highest fatality year being 2005 with 14 fatalities (BLS, 2015e).

[149] 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 Health and Safety**

The general public is unlikely to encounter occupational hazards at telecommunication sites, due to limited access. Alabama has not recorded incidents of injuries from the public to these sites (Alabama Department of Public Health, 2015a). The same data are reported with more specificity at the federal level through the Centers for Disease Control and Prevention (CDC) 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, in Alabama, between 1999 and 2013, there were 113 fatalities due to a fall from, out of, or through a building or structure; 32 fatalities due to exposure to electric transmission lines; and 30 fatalities due to being caught, crushed, jammed, or pinched in or between objects. (CDC, 2015a) Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

#### *3.1.15.4 Environmental Setting: Contaminated Properties 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[150] 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 ADEM's Land Division oversees the state Remediation Program, which is responsible for cleaning up hazardous waste contaminated sites. ADEM assists the USEPA with superfund sites in the state, and also conducts cleanups on its own under the Alabama Hazardous Substance Cleanup Fund Act (ADEM, 2015o). As of September 2015, Alabama had 69 RCRA Corrective Action sites,[151] 197 brownfields, and 15 proposed or final Superfund/NPL sites (USEPA, 2015i). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database,

[150] 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).

[151] Data gathered using the U.S. Environmental Protection Agency's Cleanups in My Community (CIMC) search on October 2, 2015, for all sites in the State of Alabama, 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).

there are no Superfund/NPL site and one RCRA Corrective Action site in Alabama where contamination has been detected at an unsafe level or a reasonable human exposure risk exists (Walter Coke, Inc. Birmingham Facility, in Birmingham, AL) (USEPA, 2015j). ADEM's Land Division also administers the state Voluntary Cleanup Program (VCP), to encourage the remediation and redevelopment of Brownfield sites in the state (ADEM, 2015o).

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 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, Alabama had 542 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, Alabama released 88.5 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from hazardous waste and solvent recovery, electric utilities, and paper industries. This accounted for 0.22 percent of nationwide releases, ranking Alabama 12 of 56 states and territories based on total releases per square mile (USEPA, 2014b).

Another USEPA program is the 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 October 15, 2015, Alabama had 198 major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015l).

The National Institutes of Health, 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 3.1.15-2 provides an overview of potentially hazardous sites in Alabama.

### 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 waterbodies. 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 were seven USEPA-regulated telecommunications sites in Alabama (USEPA, 2015m). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

Alabama has not reported fatalities within the telecommunications industry or telecommunications occupations since 2003, when data are first available. Within the broader installation, maintenance, and repair occupations (SOC code 49-0000), Alabama had total of 42 fatalities between 2003 and 2014 resulting from exposure to harmful substances or environments (BLS, 2015e). By comparison, the BLS reported three fatalities in 2011 and three 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 ADPH is responsible for collecting public health data resulting from exposure to environmental contamination, and provides publicly available health assessments and consultations for documented hazardous waste sites (Alabama Department of Public Health, 2015b).

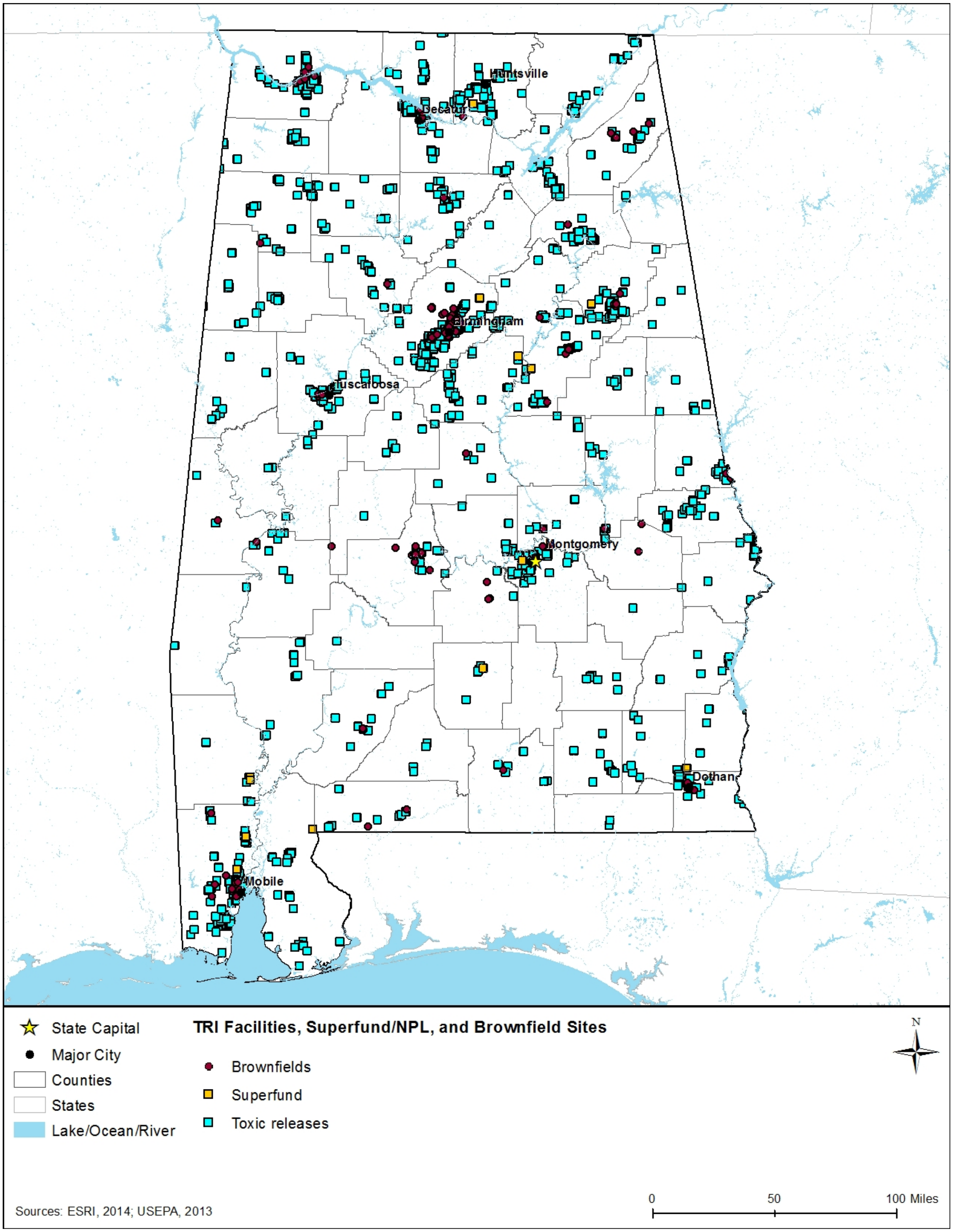


**Figure 3.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Alabama (2013)**

### Environmental Setting: Abandoned Mine Lands at or near Telecommunications Sites

Another health and safety hazard in Alabama includes surface and subterranean mines. Alabama has a large mining industry, producing 19,577,049 short tons of coal and 54,364,270 short tons of limestone in 2007 (GSA, 2008). Mining activities are concentrated in the northern portion of the state, most of which are large surface mining operations. Alabama has four major coalfields, the Plateau Field, the Warrior Field, the Cahaba Field, and the Coosa Field, underlying 9,700

### Spotlight on Alabama Superfund Sites: Monsanto Chemical (Anniston PCB)

The Anniston PCB site encompasses entire communities in and around Anniston, AL (Calhoun County) that are contaminated with PCBs from a nearby 70-acre chemical plant.

Between 1929 and 1971, hydraulic fluids containing PCBs were manufactured at the plant by Monsanto Chemical Corporation or a subsidiary (Figure 3.1.15-3). During this period, PCB-containing hazardous waste was disposed in adjacent landfills and into drainage ditches flowing into Snow Creek and downstream Choccolocco Creek. Since 1999, the USEPA has sampled 8,000 residential properties surrounding the plant, many of which contain high levels of PCBs. Properties with high-level PCBs are remediated by removing and replacing the top foot of soil, and tested for indoor contamination. PCB contamination was also found in surface water sediments in Snow Creek and Choccolocco Creek, as well as the surrounding floodplains. As a result, ADPH and USEPA have issued fish consumption advisories and conducted a removal action of a baseball field located in the floodplain to mitigate health and safety risks in the community. Currently, contamination at the site presents a reasonable human exposure risk. (USEPA, 2015t)

The Anniston PCB site is administered through the Superfund Alternative Approach Program. Sites using the Superfund Alternative Approach qualify for listing on the NPL and use the same investigation and cleanup process, but are remediated through an agreement between the potentially responsible parties and USEPA to expedite cleanup funding and resources (USEPA, 2014d).

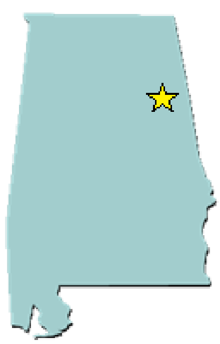

**Figure 3.1.15-3: Former Monsanto PCB Plant (now owned by Eastman Corporation)**

Source: (CDC, 2015b)

square miles of Alabama lands with coal deposits (Office of Surface Mining Reclamation and Enforcement, 2015). In 2014, the Alabama mining industry ranked 22nd for non-fuel minerals, generating a value of $1.25B. Alabama's leading nonfuel mineral commodities were portland cement, crushed stone, lime, construction sand and gravel, and industrial sand and gravel (USGS, 2016a). In 2013, coal production in Alabama ranked 5th in the United States, with 47 coalmining operations (13 underground and 34 surface) (EIA, 2013).

Health and safety hazards at active mines and abandoned mine lands (AML) 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 (BLM, 2015). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 3.1.3, Geology.

The ADOL, Abandoned Mine Reclamation Program, created by the Surface Mining and Control Reclamation Act, manages AML health and safety hazards resulting from pre-1977 mining operations (Alabama Department of Labor, 2015). As of 2015, there were 15,000 acres of abandoned mine lands in the State of Alabama (Federal Mining Dialogue, 2015). Figure 3.1.15-4 shows the distribution of High Priority (Priority One, Two, and adjacent Priority Three) AMLs in Alabama, where Priority One and Two sites pose a significant risk to human health and safety and Priority Three sites pose a risk to the environment. As of October 2015, Alabama had 741 Priority One and Two AMLs with 620 unfunded problem areas (DOI, 2014).

### Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near AMLs or coalmine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during deployment and maintenance operations.

### Public Health and Safety

Subterranean mines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and coalmine fires in particular, can result in evacuations of entire communities (DOI, 2015a).

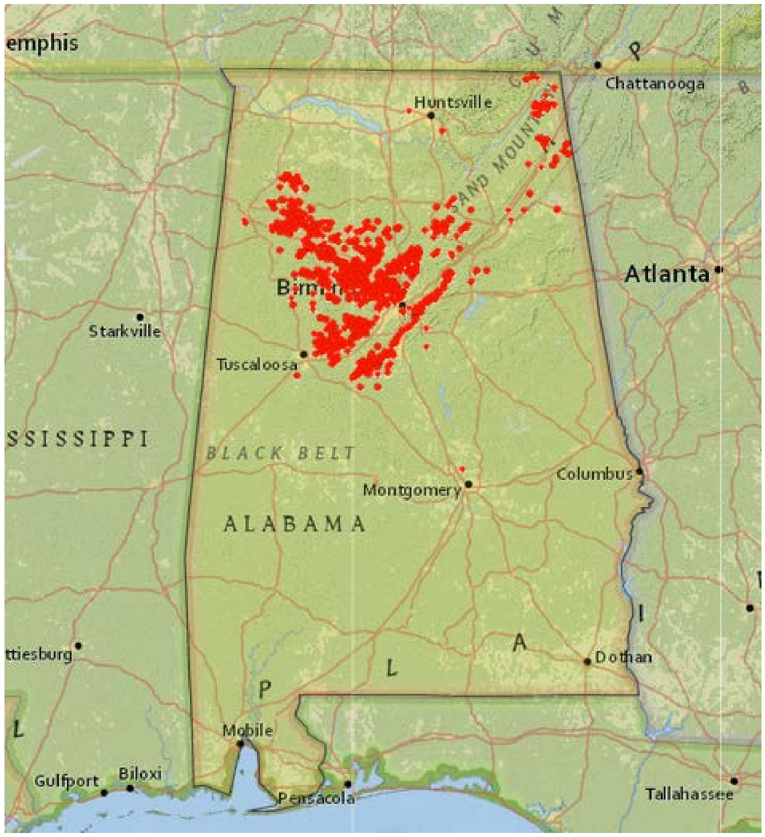


**Figure 3.1.15-4: High Priority Abandoned Mine Lands in Alabama (2015)**

Source: (DOI, 2015b)

### *3.1.15.5 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 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 is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Floodwaters 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).

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 not 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 and repair operations, their rescue and treatment might over-extend first responder staff and medical facilities that are delivering care to victims of the initial incident.

Currently, ADOL 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 312 NRC-reported incidents for Alabama in 2015 with known causes, only 10 were attributed to natural disaster (natural phenomenon), while the majority (302) were attributed to manmade disasters (equipment failure and operator error) (U.S. Coast Guard, 2015). Such incidents present unique, hazardous challenges to telecommunication workers during natural or manmade disasters.

### 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. Infrastructure damage was extensive during the 2011 tornado outbreak, with several storage tank spills due to flooding and fallen transformers. According to the NRC, between April and June 2011, at least five hazardous material releases were caused by a tornado. Reported incidents included downed utility poles releasing transformer oil in Tuscaloosa, AL and Blountsville, AL; gasoline releases from sunken houseboats in Peterson, AL releasing gasoline; a used motor oil release at a truck terminal in Birmingham, AL; and exposed asbestos from a destroyed chicken house in Leighton, AL (U.S. Coast Guard, 2011). In 2014, Alabama experienced 84 weather-related injuries and ten fatalities (2 due to flooding, 2 due to tornadoes, 1 due to wind, 1 due to winter storms, and 4 of unknown causes) (NWS, 2015b). For comparison, in 2011, the year the tornado outbreak affected Alabama, there were 250 weather-related fatalities (245 due to tornadoes) and more than 2,000 weather-related injuries (NWS, 2012).

**Spotlight on Alabama Natural Disaster: April 2011 Tornado**

Between April 25-28, 2011, the southeast United States was impacted by more than 200 tornadoes, 62 of which occurred in Alabama (including 2 EF-5 tornadoes) on April 27, 2011. The storm system also produced large hail, straightline wind damage, and extensive flash flooding. In Alabama, there were 248 storm-related fatalities and 2,200 injuries, with unprecedented damage to infrastructure (NWS, 2015c). According to the FEMA, public assistance grants exceeded $200M, with another $77M in individual and household assistance (FEMA, 2011).

Six National Oceanic and Atmospheric Administration (NOAA) Weather Radio All Hazards (NWR) transmitter tower sites for Weather Forecast Offices in (WFO) Huntsville, AL (HUN) and Birmingham, AL (BMX) were significantly impacted with power outages and communications failures. One NWR transmitter tower in Cullman, AL, was directly struck by a tornado (Figure 3.1.15-5). In Hytop, AL, the Weather Surveillance Doppler Radar (WDR-88D) suffered a communications failure due to widespread infrastructure damage. As a result, two of Alabama's three WFOs were forced to rely on backup services from WFO Jackson, MS (JAN) and WFO Peachtree City, GA (FFC), significantly impacting forecasting capabilities and weather alert services. (NOAA, 2011)

ADPH Environmental Health (EH) staff and other first responder teams were tasked with conducting rapid health assessments of food establishments, calculating injuries and fatalities, re-routing ambulances, and administering various contingency plans for debris removal. Due to the extensive damage, many EH staff could not commute to work, delaying response activities and creating a backlog for active workers. (CDC, 2011)

**Figure 3.1.15-5 Destroyed NWR Transmitter Tower at Cullman, AL**

Source: (NOAA, 2011)

## 3.2 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 have been 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.

## 3.2.1 Infrastructure

### *3.2.1.1 Introduction*

This section describes potential impacts to infrastructure in Alabama 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.1.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 3.2.1-1. As described in Section 3.2, 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 3.2.1-1: 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) | NA |

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with BMPs and Mitigation Measures Incorporated** | **Less than Significant** | **No Impact** |
| | | | | during the construction and deployment phase. | |
| 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

### *3.2.1.3 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. In Alabama, the Alabama Department of Transportation (ALDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state, while local counties have jurisdiction for smaller streets and roads. Coordination and consultation with ALDOT or county government(s) may be required if FirstNet activities would have the potential to impact transportation system capacity or safety.

Based on the impact significance criteria presented in Table 3.2.1-1, such impacts would be less than significant 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 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 3.2.1-1, potential negative impacts would be less than significant. 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 3.2.1-1, any potential impacts would be less than significant during deployment. As described above, during construction 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 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.[152] Anticipated impacts would be less than significant 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 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 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

[152] 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.

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. However, coordination and consultation with the Alabama PSC, Alabama Power Company, and/or Alabama Municipal Electric Authority could be required, depending on the exact location and configuration of proposed projects in the state.

#### *3.2.1.4 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 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, would not be expected to interfere with existing equipment, and

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 (POP), 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 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 use 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 water bodies 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 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, 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 Cell on Wheels (COW), Cell on Light Trucks (COLT), and Site on Wheels (SOW) are comprised 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 launched or recovered on 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-into 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 at the programmatic level 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 of 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 the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.1.5 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 to infrastructure at the programmatic level 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 the 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 at the programmatic level 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 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 the 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 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 3.1.1, Infrastructure.  The state also would not realize positive, beneficial impacts to infrastructure resources described above.

## 3.2.2 Soils

### *3.2.2.1 Introduction*

This section describes potential impacts to soil resources in Alabama 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.

### *3.2.2.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 3.2.2-1.  As described in Section 3.2, 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 3.2.2-1: 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

### *3.2.2.3 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 Alabama 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). Many of Alabama's soil types occur on mild slopes, but have medium to high potential for erosion depending on slope and drainage patterns, as many are somewhat poorly drained to poorly drained. These soil types include: Alfisols, Entisols, Inceptisols, Aquults, Histosols, and Udults (see Section 3.1.2.4, Soil Suborders and Figure 3.1.2-2).

Based on the impact significance criteria presented in Table 3.2.2-1, 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 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 3.2.2-1, 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 3.1.2.4, Soil Suborders). The most compaction susceptible soils in Alabama are Aqualfs, Aquents, Aquepts, Aquults, Saprists, and Udepts, which are hydric soils and with poor drainage conditions. These soils constitute specific pockets across the state in southern, central, and northern bands (see Figure 3.1.2-2). 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 3.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant, due to the extent of susceptible soils in the state.

### *3.2.2.4 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 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 nationwide public safety broadband network (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 shore to accept 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 use existing roadways and utility ROWs for deployment activities. 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.

**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 at the programmatic level 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 of 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. These 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.2.5 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. 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 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 soil resources at the programmatic level 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 of established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result at the programmatic level 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 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 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 3.1.2, Soils.

## 3.2.3 Geology

### *3.2.3.1 Introduction*

This section describes potential impacts to Alabama 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.3.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 3.2.3-1. As described in Section 3.2, 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 3.2.3-1: 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 |

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with BMP and Mitigation Measures Incorporated** | **Less than Significant** | **No Impact** |
| Potential Paleontological Resources Impacts | 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. |
| | 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

#### *3.2.3.3 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**

As discussed in Section 3.1.3, the majority of Alabama is at low to medium risk for earthquake events. As shown in Figure 3.1.3-4, central and northern Alabama are at greatest risk to earthquakes throughout the state, though no earthquake over magnitude 5.2 on the Richter scale has ever occurred in the state. Based on the impact significance criteria presented in Table 3.2.3-1, 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. 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. Given the potential for minor to moderate earthquakes in parts of Alabama, some amount of infrastructure could be subject to earthquake hazards. 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.

**Volcanic Activity**

Volcanoes were considered but not analyzed for Alabama, as they do not occur in Alabama; 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 3.1.3, the majority of Alabama is at low to no risk of experiencing landslide events. Based on the impact significance criteria presented in Table 3.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts 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. 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. There are however a few localized areas in the state that are at moderate to high risk of landslides, mostly in the northern areas of the state. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Alabama's major cities, including Albany and Binghamton, are in areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards. 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.

### Land Subsidence

Equipment that is exposed to land subsidence, such as sinkholes created by karst topography or mine collapse, 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[153] and inundation of equipment. All of these activities could result in connectivity loss.

As discussed in Section 3.1.3.8 and shown in Figure 3.1.3-6, portions of Alabama are vulnerable to land subsidence due to karst topography, leading to sinkholes. Based on the impact significance criteria presented in Table 3.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts; 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 karst topography or mining areas. 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[154] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas of karst topography or where historic sinkholes have developed. However, where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 16, could help avoid or minimize the potential impacts. 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.

### 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 3.2.3-1, impacts to

[153] 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." (U.S. Geological Survey, 2015)
[154] 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, 2015j)

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 the 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 3.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 3.1.3.7, fossils are abundant throughout parts of Alabama. 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 may be required help to help further avoid or minimize the potential impacts. 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.

**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 3.2.3-1, 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 less than significant, 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 the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.3.4 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

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 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 POP, 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 and inland bodies of water is not expected to impact geologic resources including marine paleontological 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 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. However, 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 projects 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 the same reason, impacts to deployment from geologic hazards are likely to be less than significant at the programmatic level as well. 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.

### 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 at the programmatic level 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 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 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.3.5 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 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 at the programmatic level 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 was 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 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 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 3.1.3, Geology.

## 3.2.4 Water Resources

### *3.2.4.1 Introduction*

This section describes potential impacts to water resources in Alabama 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.

### *3.2.4.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 3.2.4-1. As described in Section 3.2, 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 3.2.4-1: Impact Significance Rating Criteria for Water Resources

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with BMPs 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 |
| 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 | 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. |

| Type of Effect | Effect Characteristics | Impact Level: Potentially Significant | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: No Impact |
|---|---|---|---|---|---|
| | | | | floodplain within a state or territory. | |
| | 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 |
| 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 |

| Type of Effect | Effect Characteristics | Impact Level: Potentially Significant | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: No Impact |
|---|---|---|---|---|---|
| | 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-considering-stakeholder-input).

NA = Not Applicable

### *3.2.4.3 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 303(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 Alabama's rivers and streams are in good condition, although approximately half of Alabama's lakes, reservoirs, and ponds are impaired. Also, approximately 75 percent of Alabama's estuaries and bays, and nearly all of the state's coast lines are impaired (Table 3.1.4-2, Figure 3.1.4-1). Atmospheric deposition, animal feeding operations, urban runoff, storm sewers, agriculture, municipal point source discharge, legacy pollutants, and hydromodifications (e.g., impacts from hydrostructure flow regulations/modifications), all contribute to the impaired waters. Groundwater quality within the state is generally good. (USEPA, 2015n)

Deployment activities could contribute pollutants in a number of ways but the primary likely manner is increased sediment in surface waters. Vegetation removal on site 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, 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 [SDWA]), 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 3.2.4-1, water quality impacts would likely be less than significant 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[155] 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 Alabama 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.

Alabama's principal aquifers[156] consist of carbonate-rock[157] and sandstone aquifers,[158] and unconsolidated coastal-plain aquifers. Approximately 40 percent of public water supplies in Alabama are from groundwater resources (GSA, 2015d). Generally, the water quality of Alabama's aquifers is suitable for drinking and daily water needs (ADEM, 2014b). Statewide, the most serious threats to groundwater quality include underground storage tanks and failing septic systems (ADEM, 2015l). Thus, 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 significance criteria presented in Table 3.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

[155] 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).

[156] In this PEIS, the term principal aquifer refers to the USGS definition ("A regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.") for nationwide consistency (USGS, 2003c).

[157] 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, 1995a).

[158] Sandstone aquifers form from the conversion of sand grains into rock caused by the weight of overlying soil/rock. The sand grains are rearranged and tightly packed, thereby reducing or eliminating the volume of pore space, which results in low-permeability rocks such as shale or siltstone. These aquifer types are highly productive in many places and provide large volumes of water. (Olcott, 1995b)

### Floodplain Degradation

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 3.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's likely deployment activities, 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. Additionally, any effects would be temporary, lasting no more than one season or water year,[159] or occur only during an emergency.

Examples of activities that would have less than significant impacts 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.
- 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 change 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 3.2.4-1, 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.

Example of projects that could have minor changes to the drainage patterns include:

[159] 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)

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site 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. BMPs, mitigation measures could be implemented to further reduce any potentially significant impacts.

**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 3.2.4-1. 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 waterbodies that have not received that volume of stormwater previously.
- 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 impacts 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 3.1.4.7, approximately 40 percent of Alabama's public water supplies are from groundwater as a source of 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 Alabama'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 is 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.
- Use of pesticides, herbicides, or insecticides during or after construction of a commercial, industrial, or recreational use.

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 since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 3.2.4-1, 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 the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

## *3.2.4.4 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 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 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, 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 and mitigation measures 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 indirect impacts on 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; 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 the 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 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 at the programmatic level as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along existing roads and utility ROWs. 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 applications to control vegetation, are not expected at the programmatic level. 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.

#### *3.2.4.5 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 to water resources if those 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 the 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 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 less than significant impacts at the programmatic level 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 of time, 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 to water quality at the programmatic level, 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 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 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 3.1.4, Water Resources.

## 3.2.5 Wetlands

### *3.2.5.1 Introduction*

This section describes potential impacts to wetlands in Alabama associated with deployment and operation of the Proposed Action and alternatives. 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.

### *3.2.5.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 3.2.5-1. As described in Section 3.2, 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 3.2.5-1: Impact Significance Rating Criteria for Wetlands

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with BMPs 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 404 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 | 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 BMPs and Mitigation Measures Incorporated** | **Less than Significant** | **No Impact** |
| degradation (spills or sedimentation) | 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, threatened and endangered species habitat, biodiversity, recreational/social value.

NA = Not Available

#### *3.2.5.3 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 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 3.4 million acres of palustrine, riverine, lacustrine, and estuarine wetlands throughout Alabama (USFWS, 2014a). Most are found throughout the state, with concentrations in the western half of the state, and southwestern corner of the state (see Figure 3.1.5-1).

Based on the impact significance criteria presented in Table 3.2.5 1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would be unlikely to violate applicable federal, state, and local regulations. In Alabama, as discussed in Wetlands, Section 3.1.5.4, there are several locations of wetlands of special concern or value, including the Weeks Bay NERR, seven National Natural Landmarks, and other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups. 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 the

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 3.2.5-1, 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 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. 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.

Examples of activities that could have other direct effects to wetlands in Alabama 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 parameter.
- 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:[160] Change in Function(s)[161] 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 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 Alabama 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, disturbance of the 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

[160] 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.
[161] 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, threatened and endangered species habitat, biodiversity, recreational/social value.

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 3.2.5-1, 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. Since the majority of the 3.4 million acres of wetlands in Alabama are not considered high quality, deployment activities could have less than significant indirect impacts on wetlands in the state. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all 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 the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.5.4 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 could 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 launched for other purposes, and the use of portable devices that use satellite technology are 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 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 wetlands, it is anticipated that this activity would have no impact on wetlands.

*Activities with the Potential to Have No 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 additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. 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, or blimps 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 (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. 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 partner(s) 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 at the programmatic level due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROWs. 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.

#### *3.2.5.5 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 at the programmatic level if the activities occur on existing paved surfaces. 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 at the programmatic level 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 the 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 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 ROWs would be used for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands at the programmatic level 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 the 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 wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.5, Wetlands.

## 3.2.6 Biological Resources

### *3.2.6.1 Introduction*

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Alabama 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.

### *3.2.6.2 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 3.2.6-1. As described in Section 3.2, 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 3.2.6.3, 3.2.6.4, and 3.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 3.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Alabama.

**Table 3.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats**

| Type of Effect | Effect Characteristics | Impact Level: Potentially Significant | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: 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 California 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 | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: 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 California 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 | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: 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 California 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 | Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: 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 California 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 |
| 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. |

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with BMPs and Mitigation Measures Incorporated** | **Less than Significant** | **No Impact** |
| | Geographic Extent | Regional effects observed within California 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 |
| 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 California. | | 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

#### *3.2.6.3 Terrestrial Vegetation*

Impacts to terrestrial vegetation occurring in Alabama 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 3.2.6-1, 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. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, FirstNet deployment 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 the 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 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. About 10 percent of Alabama has experienced extensive land use change due to pastureland creation and about 9 percent of the state has experienced extensive land use change due to urbanization. However, a large portion of the state, about 65 percent, remains relatively unfragmented forest, particularly the Talladega National Forest and the William B Bankhead National Forest (NRCS, 2012).

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 the 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 the 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*

As discussed in Section 3.1.6.3, 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. In Alabama, noxious weeds are regulated by the Alabama Department of Agriculture and Industries and addressed in Chapter 80-10-14 of the Alabama Administrative Code. Alabama's state regulated noxious weeds include 10 aquatic plants, three shrubs, nine terrestrial forbs and grasses, and six vines (ADAI, 2000). 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 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 the 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,[162] and the nature as well as the 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.

<u>Activities Likely to Have No Impacts</u>

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.
- 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.

[162] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

- 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. 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 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. BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 shore to 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. BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 new 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 deployment 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 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 partner(s) 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 partner(s) 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.

<u>Deployment Impacts</u>

As described above, implementation of deployable technologies could result in less than significant impacts 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 partner(s) 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 be less than significant at the programmatic level. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation at the programmatic level 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 the 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 3.1.6.3, Terrestrial Vegetation.

### *3.2.6.4 Wildlife*

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Alabama and Alabama'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 3.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but 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, as discussed further below. 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.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Alabama. 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 tree-roosting 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- scale and would be dependent on the location and type of deployment activity, and 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. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from likely FirstNet deployment activities in Alabama.

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 (USEPA, 2012e). Entanglements from marine debris are not anticipated from FirstNet activities because little, if any, construction work is expected to occur in or near waterbodies.

All whale species known to occur offshore of Alabama are also protected under the ESA. Environmental consequences pertaining to these whales are discussed in Section 3.2.6.6, Threatened and Endangered Species.

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), night-migrating birds, 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 would 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 is birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997).

Direct mortality and injury to birds of Alabama 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 deployment activity.  Direct injury/mortality are 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 of Alabama's reptiles and amphibians are widespread throughout the state, while some species are found only in specific environments.  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 – all listed as threatened or endangered under the ESA – occur in Alabama's offshore environment.  Environmental consequences pertaining to these reptiles are discussed in Section 3.2.6.6, Threatened and Endangered Species.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Alabama 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 3.2.6.3, 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 because of the small-scale nature of expected deployment activities. These potential impacts are described for Alabama's wildlife species below. 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.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Alabama and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bears) 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 use these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas are expected to be less than significant because of the small-scale nature of expected deployment. Loss of habitat or exclusions from these areas for terrestrial mammals could potentially be avoided or minimized by implementing BMPs and mitigation measures (see Chapter 16).

Marine Mammals

The West Indian manatee and bottlenose dolphin regularly inhabit Alabama's tidal waters (ADCNR, 2015a) (USFWS, 2001a) (NOAA, 2016a). In addition, species of whales can be observed off the coast of Alabama, including finback whales and humpback whales.

Loss of habitat or exclusions from these areas for manatees, dolphins, and whales could potentially be avoided or minimized by implementing 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 3.2.6.6, Threatened and Endangered Species.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the Alabama Department of Conservation and Natural Resources (ADCNR) 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, et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[163] 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). Exclusion from resources are expected to be less than significant because of the small-scale nature of expected deployment. 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. Impacts to sensitive bird species are discussed below in Section 3.2.6.6, Threatened and Endangered Species.

Reptiles and Amphibians

Important habitats for Alabama's amphibians and reptiles typically consist of wetlands and, in some cases as the black speckled kingsnake in prairie habitat in Central Alabama and the Tennessee cave salamander in the limestone caves in northern Alabama. Impacts are expected to be less than significant, 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 3.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on Alabama's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[164] Impacts to sensitive reptile species are discussed below in Section 3.2.6.6, Threatened and Endangered Species.

Terrestrial 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. Impacts to sensitive invertebrate species are discussed below in Section 3.2.6.6, Threatened and Endangered Species.

*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 due to the short-term nature and limited geographic scope of expected activities, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet

[163]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.
[164] See Section 3.2.5, Wetlands, for a discussion of BMPs for wetlands.

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 not 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 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 if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

Reptiles and Amphibians

Changes in water quality, 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 not occur.

Terrestrial 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 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.

*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 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 Alabama’s amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below. 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.

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.[165]

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 because they would be unlikely to result in long-term avoidance. 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 Alabama 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.[166] Marine mammals have the capacity to divert from sound sources during migration, and therefore impacts are expected to be less than significant 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 distances often involving many different countries. For example, as a group, shorebirds migrating through Alabama undertake some of the longest-distance migrations of all animals. Many states have identified IBAs, but Alabama is relatively new to the program and identification of sites is ongoing. Currently, 16 IBAs have been identified in Alabama. Alabama's IBAs are found throughout the state, however close to 40 percent are found adjacent to and along the Gulf of Mexico coastline (The Audubon Society, 2015b). 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, and impacts are expected to be

[165] A location chosen by an animal for hibernation.

[166] 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).

less than significant, given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to further avoid or minimize effects to birds that make use of migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate in Alabama. For example, wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). 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. BMPs could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature and not substantially disturb migration of terrestrial invertebrates, such as pollinators. No effects to migratory patterns of Alabama's terrestrial 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 due to the short-term and limited nature of expected activities. 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.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as black bears, has the potential to negatively affect body condition and reproductive success of mammals in Alabama. For example, pregnant black bears use certain types of habitats that allow for more effective defense of their cubs from predators (FFWCC, 2015).

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 therefore impacts are expected to be less than significant. 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.  Restricted access, such as the displacement of female manatees from preferred calving habitats, may reduce fitness and survival of calves potentially affecting overall productivity.  Impacts from the FirstNet activities are unlikely because little or no work is expected to occur in waterbodies or on shorelines that potentially include marine mammals.  Activities that might occur near shorelines would be small-scale construction projects that could potentially cause minimally to minor, short-term displacement, and are therefore expected to be less than significant.  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, et al., 1997).  The majority of FirstNet deployment or operation activities are likely to be small-scale in nature.  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 3.2.6.6, 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, diamondback terrapin habitat in Alabama is largely restricted to Dauphin Island area, where the species is under threat due to various anthropogenic activities that potentially impact terrapin reproduction, recruitment, and mobility (ADCNR, 2015a).

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of breeding habitat if deployment activities occur near breeding or nesting areas or impact water quality by increased sedimentation or contamination.  Potential impacts are anticipated to be less than significant due to the short-term and limited nature of expected activities.  BMPs and mitigation measures could help avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature and not use pesticides or substantially reduce habitat, which could impact the reproductive success of pollinators or other terrestrial invertebrates.  Therefore; no reproductive effects to terrestrial 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 Alabama has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select terrestrial wildlife species. The ADCNR regulates specific animals via the AAC 220-2-.26: Restrictions on Possession, Sale, Importation and/or Release of Certain Animals and Fish (ADCNR, 2012).

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.

Potential invasive species effects to Alabama's wildlife are described below.

Terrestrial Mammals

In Alabama, feral hogs adversely impact several native large and small mammals, including preying on juvenile deer and outcompeting other wildlife (e.g., squirrels) acorns and invertebrates. They also destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans (ADCNR, 2014d).

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. 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 project sites from other locations.

Marine Mammals

Invasive species displace native fauna and flora communities and/or radically change the nature of the habitats they invade. Similarly, mitigation measures to control the spread of invasive species could impact other species. For example, "Essential freshwater food supplies for manatees outside of protected areas may be damaged by dispersal of herbicides to control exotic aquatic plants" (USFWS, 1999b). Proposed FirstNet deployment activities near water would likely occur onshore with limited activities what would either introduce non-native species or implement BMPs and mitigation measures would be implemented to control invasive species that could harm marine mammals (Chapter 16).

Birds

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. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities, therefore impacts are expected to be less than significant.

Reptiles and Amphibians

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.

Invasive bird species are not expected to be introduced at project sites from machinery or laborers during deployment operations.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects could pose a threat to Alabama'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, 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 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 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 to 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 development 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., armadillos), 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 limited nearshore or inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife, marine mammals in particular (see Section 3.2.4, 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 radio frequency 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 new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency 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, Radio Frequency Emissions. Deployment of drones, balloons, blimps, and 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 would be unlikely to cause population-level impacts, and are 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 partner(s) 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 partner(s) 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 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 partner(s) 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 partner(s) 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 3.1.6.4, Terrestrial Wildlife.

### *3.2.6.5 Fisheries and Aquatic Habitats*

Impacts to fisheries and aquatic habitats occurring in Alabama and Alabama's near offshore environment are discussed in this section. Chapter 16, BMPs and Mitigation Measures, provides a list 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 in fisheries and aquatic habitats are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012f).

Based on the impact significance criteria presented in Table 3.2.6-1, less than significant impacts would be anticipated at the programmatic level given 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.  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*

Potential water quality impacts that could cause injury of mortality to aquatic organisms include exposure to contaminants from accidental spills (e.g., from vehicles and equipment) and sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, and streams.  These impacts could change habitat and food sources and result in indirect mortality/injury to fish and aquatic invertebrates.  These impacts are expected to be less than significant due the short-term nature and limited geographic scope of deployment activities BMPs and mitigation measures to protect water resources (see Section 3.2.4, Water Resources) 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 small-scale, and therefore are expected to be less than significant.  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.  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 vehicles and equipment being transported from one region to another, or when site restoration (e.g., revegetation) is conducted after deployment activities are complete. 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. 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 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.

<u>Activities Likely to Have No Impacts</u>

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 habitat 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.

<u>Activities with the Potential to Have Impacts</u>

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. 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 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 could, 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 and inland bodies of water and construction of landings and/or facilities on the shore to 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 (rainbow trout). 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 new power units, replacement towers, structural hardening, or physical security measures required ground disturbance, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency 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 significant at the programmatic level due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. 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 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 that, at the programmatic level, there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance activities that may result in accidental spills from maintenance equipment or pesticide runoff near fish habitat are expected to have less than significant effects to fisheries and aquatic habitats. Potential spills of these materials would be expected to be in small quantities.

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 the BMPs and mitigation measures that FirstNet and/or its partner(s) 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 state. 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 the BMPs and mitigation measures that FirstNet and/or its partner(s) 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 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 the 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 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 3.1.6.5, Fisheries and Aquatic Habitats.

#### *3.2.6.6 Threatened and Endangered Species*

This section describes potential impacts to threatened and endangered species in Alabama and Alabama'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 3.2.6-2. 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 3.2.6-2: 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 take of an individual of a listed species. | 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. | |

| Type of Effect | Effect Characteristics | Impact Level: May Affect, Likely to Adversely Affect | Impact Level: May Affect, Not Likely to Adversely Affect | Impact Level: No Effect |
|---|---|---|---|---|
| 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. |
| | 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 3.2.6-2, any direct injury or mortality of a listed species at the individual-level, as well as any impact that has the potential to result in 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 terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Alabama 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.

<u>Terrestrial Mammals</u>

Four endangered and one threatened terrestrial mammals are federally listed and known to occur in Alabama (Table 3.1.6-3); they are the Alabama beach mouse, gray bat, Indiana bat, Northern long-eared bat, and Perdido Key beach mouse. Direct mortality or injury to the federally listed Indiana bat or northern long-eared bat could occur if tree clearing activities occurred at roosting sites while bats were present (USFWS, 2012a). Direct mortality or injury to the federally listed gray bat could occur if caves were flooded or blocked off while bats were present (USFWS, 1997a). While proposed projects would not likely directly affect winter hibernacula (e.g., caves), 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 until the spring (USFWS, 1997a).

Direct mortality or injury to the federally listed Alabama beach mouse and Perdido Key beach mouse could occur from vehicles strikes or trampling due to increased traffic near the beaches and sand dunes these mice inhabit. 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.

<u>Marine Mammals</u>

Two federally listed endangered whale species and one endangered manatee species are known to occur in Alabama's near offshore environment (Table 3.1.6-3): finback whale, humpback whale, and West Indian manatee. Entanglements from marine debris as well as ingestion of marine debris are unlikely, as marine debris is unlikely to result from FirstNet activities and the majority of FirstNet actions would not occur in the marine environment. Impacts would likely be isolated, individual events.

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

One endangered and three threatened bird species are federally listed and known to occur in Alabama (Table 3.1.6-4); they are the piping plover, red knot, red-cockaded woodpecker, and wood stork. Depending on the project types 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 areas where they are known to nest. 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

Eight endangered and eight threatened fish species are federally listed and known to occur in Alabama as summarized in Table 3.1.6-6. Direct mortality or injury to this 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.

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

One federally listed threatened amphibian is known to occur in Alabama; the Red Hills salamander (Table 3.1.6-7). Direct mortality to this species could occur in construction zones either by excavation activities or by vehicle strikes. Impacts would likely be isolated, individual events, and FirstNet would attempt to avoid areas where the species may occur. Therefore potential impacts may affect, but would not likely adversely affect, the listed species.

One endangered and four threatened terrestrial reptile species are known to occur in Alabama (Table 3.1.6-5): black pine snake, Alabama red-belly turtle, Eastern indigo snake, flattened musk turtle, and western gopher tortoise. 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.

Three federally listed marine reptiles listed as endangered and two listed as threatened are also known to occur in the coastal area and offshore environment of Alabama (Table 3.1.6-5): green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle. Direct injury or mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

FirstNet would attempt to avoid these areas inhabited by listed reptiles and amphibians. Therefore, potential impacts may affect, but would not likely 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

There are 52 endangered and 15 threatened invertebrate species that are federally listed for Alabama as summarized in Table 3.1.6-8. The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to these species are unlikely but could occur from water quality impacts resulting from the Proposed Action.

Potential impacts may affect, but are not likely to adversely affect, the 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

There are 14 endangered and 8 threatened plants that are federally listed for Alabama as summarized in Table 3.1.6-9. 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 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.

*Reproductive Effects*

Reproductive effects are considered those that either directly or indirectly reduce 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 known to occur in Alabama are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action near rookeries of endangered bats or coastal habitat of the Perdido Key beach mouse could adversely affect federally listed terrestrial 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 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.

Marine Mammals

The two federally listed whale species are found in the offshore areas of Alabama are migrants. Therefore, no long-term reproductive effects to federally listed marine mammals are expected as a result of the Proposed Action.

The West Indian manatee often uses secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving (USFWS, 2015f). Noise, light, and other human disturbances associated with the Proposed Action could adversely affect manatees within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. 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 wood stork, to abandon their nests or relocate to less desirable locations, or may result in stress to individuals, reducing survival and reproduction. 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.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, could cause stress resulting in lower productivity. Further, 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., human activity, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to reproduction of the federally listed fish species in Alabama 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 mollusk species known to occur in Alabama. In addition, introduction of nonnative (invasive) aquatic species could indirectly affect mollusks as a result of fish populations that they rely on for their reproductive cycle being altered (USFWS, 2012f).

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 terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Alabama are described below.

Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Alabama could affect 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. “It is clear that behavioral responses are strongly affected by the context of exposure and by the animal’s experience, motivation, and conditioning;” however, marine mammals have the capacity to divert from sound sources during migration (Southall et al, 2007).

Terrestrial 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 would likely not 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 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 sites year and after year in Alabama (USFWS, 2013c) (USFWS, 2016c). 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 would likely not 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 species, resulting in reduced survival and productivity; however, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed reptiles or amphibians, particularly because few, if any, of the activities are expected to occur in wetlands, waterways, and other important reptile and amphibian habitat. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not 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 fish species in Alabama. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or altering migration patterns. Behavioral changes to these listed species are unlikely as the majority of FirstNet deployment projects would not occur in aquatic environment. 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 nonnative (invasive) species could impact food sources for federally listed mollusks resulting in lower productivity. Disturbances to food sources used by the federally listed terrestrial invertebrate 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 would likely not 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 in Alabama 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 birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in Alabama are described below.

Terrestrial Mammals

Two federally listed terrestrial mammals in Alabama have federally designated critical habitat. In Baldwin County, critical habitat is designated for the Alabama beach mouse along the coast of the Fort Morgan Peninsula and for the Perdido Key beach mouse. Land clearing, excavation activities, and other ground disturbing activities in this region of Alabama could lead to habitat loss or degradation, which could lead to adverse effects to the Alabama beach mouse or Perdido Key beach mouse depending on the duration, location, and spatial scale of the associated activities. Effects to designated critical habitat that would diminish the value of the habitat for listed species are not anticipated. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. 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 critical habitat has been designated for the other federally listed terrestrial mammal species in Alabama; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Marine Mammals

No designated critical habitat occurs for marine mammals in Alabama. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

In Alabama, one federally listed bird species has federally designated critical habitat. Critical habitat for the piping plover has been designated along the coast of Mobile County. FirstNet would attempt to avoid areas where these species are known to nest; 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 Alabama; 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

One of the federally listed amphibians and reptiles in Alabama has federally designated critical habitat. Critical habitat for the loggerhead sea turtle was designated along the coast of Baldwin County. 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 reptile and amphibian species in Alabama; 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

Seven of the federally listed fish species in Alabama have federally designated critical habitat. Critical habitat for the Alabama cavefish was designated in Key Cave in Lauderdale County. Critical habitat for the Alabama sturgeon was designated in the lower Alabama River and where the Alabama River meets the Tombigbee River and Cahaba River. Critical habitat for the goldline darter was designated as a portion of the Cahaba River. Critical habitat for the Gulf sturgeon was designated in the Escambia, Yellow, and Choctawhatchee River systems, and Lake Borgne. Critical habitat for the rush darter was designated in tributaries and spring systems of the Turkey Creek (Jefferson County), Clear Creek (Winston County), and Little Cove-Bristow Creek watersheds (Etowah County). Critical habitat for the slackwater darter was designated in the Buffalo River and its tributaries in Lauderdale County. Critical habitat for the vermilion darter was designated within its habitat in Jefferson County. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb critical habitat. 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 fish species in Alabama; 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

Thirty of the 67 federally listed invertebrate species in Alabama have designated critical habitat as shown in Table 3.1.6-8. All of the invertebrate species with critical habitat in Alabama are either freshwater mussels or aquatic snails, and the critical habitat is either a stream or river. Land clearing, excavation activities, and other ground disturbing activities near Alabama waterbodies could potentially lead to habitat loss or degradation, which could lead to adverse effects to 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 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 invertebrate species in Alabama; 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

Three of the 22 federally listed plants in Alabama have federally designated critical habitat: whorled sunflower, fleshy-fruit gladecress, Georgia rockcress. 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 plant species in Alabama; 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 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. 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 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 affected, 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 effects 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 not affect protected species, it is anticipated that this activity would have no effect on protected species.

<u>Activities with the Potential to Affect Listed Species</u>

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 – Submarine Fiber Optic Plant: The installation of cables in bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could 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., beach mice), or that are defending nest sites (e.g., 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. 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 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 shore to accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 3.2.4, 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 radio frequency 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 radio frequency 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 radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, piloted aircraft, or blimps 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 to adversely affect protected species at the programmatic level. 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. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species at the programmatic level due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections since this activity would not result in ground disturbance. 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 at the programmatic level. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. 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.

Threatened and endangered species may be affected, but are not likely to be adversely affected at the programmatic level, 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. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. 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 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 at the programmatic level. 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 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.

*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 at the programmatic level 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 effect 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 3.1.6.6, Threatened and Endangered Species.

## 3.2.7 Land Use, Recreation, and Airspace

### *3.2.7.1 Introduction*

This section describes potential impacts to land use, recreation, and airspace resources in Alabama 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.

### *3.2.7.2 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 3.2.7-1. As described in Section 3.2, 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 3.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace**

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less Than Significant with Mitigation Measures 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 |

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less Than Significant with Mitigation Measures Incorporated** | **Less Than Significant** | **No Impact** |
| | 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 |
| 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 | 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. |

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less Than Significant with Mitigation Measures Incorporated** | **Less Than Significant** | **No Impact** |
| make recreational activity less desirable) | 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 |
| 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

### *3.2.7.3 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 ROWs 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 above-ground 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 ROWs 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 ROW, 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 3.2.7-1, less than significant impacts 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 ROWs 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 above-ground 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 3.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scaleand short-term during the construction phase.

### Loss of Access to Public or Private Recreation Land or Activities

Access to public or private recreation land or activities could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. 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 3.2.7-1, less than significant impacts 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. Enjoyment of recreation land could be temporarily impacted by crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features. 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 3.2.7-1, less than significant impacts 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 3.2.7-1, 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 of time, FirstNet would be unlikely to have a significant impact on airspace resources.

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#### *3.2.7.4 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 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 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 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 ROWs.
        - 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 Federal Aviation Regulation (FAR) 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace.
    - 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.

- 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 anticipated 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 and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See *Activities with the Potential to Have Impacts* below.
  - Recreation: See *Activities with the Potential to Have Impacts* below.
  - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities 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 3.1.7.5 Airspace).
- 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 3.1.7.5 Airspace).

- 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.
    - 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 Above Ground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria.
- 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 ROWs.
    - 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 shore to 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. 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 Alabama'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.
- 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 Alabama airports. Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, 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 partner(s) 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 at the programmatic level 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 at the programmatic level to land use, recreation resources, or airspace associated with routine inspections, 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.

The degree of change in the visual environment (see Section 3.2.8, 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.7.5 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 to land use if deployment occurs in areas with compatible land uses. 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 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 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 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 land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 3.1.7, Land Use, Recreation, and Airspace.

## 3.2.8 Visual Resources

### *3.2.8.1 Introduction*

This section describes potential impacts to visual resources in Alabama 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.

### *3.2.8.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 3.2.8-1. As described in Section 3.2, 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 3.2.8-1: 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. |

### *3.2.8.3 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 Alabama, residents and visitors travel to national monuments, historic sites, and state parks, to view its scenic areas and visit the state's coast and beaches. 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. 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.

Based on the impact significance criteria presented in Table 3.2.8-1, 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.

**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 3.2.8 1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term could 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 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.

### *3.2.8.4 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 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 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 lighting, 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 POP 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 were 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 ROWs would not affect visual resources unless vegetation were 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 and 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 shore to accept 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 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 lightning.

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 at the programmatic level 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 partner(s) 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 at the programmatic level 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 would 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.8.5 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 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 at the programmatic level 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. 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 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 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 3.1.8, Visual Resources.

## 3.2.9 Socioeconomics

### *3.2.9.1 Introduction*

This section describes potential impacts to socioeconomics in Alabama 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.

### *3.2.9.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 3.2.9-1. As described in Section 3.2, 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 3.2.9-1: Impact Significance Rating Criteria for Socioeconomics**

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | Potentially Significant | Less than Significant with 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 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

### *3.2.9.3 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. 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 Affected Environment, property values vary across Alabama. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $172,000 in the greater Huntsville area, to just over $100,000 in Anniston/Oxford. 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 partners 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 users 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. 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, 2006a). 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. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Alabama. The average unemployment rate in 2014 was 6.8 percent, higher than the national rate of 6.2 percent. County-level unemployment rates were highly variable across the state. Only 12 counties had unemployment rates below the national average (that is, better employment performance); most of these counties were located near one of the 10 largest population concentrations in Alabama. Counties with the highest unemployment rates were mostly in the southern half of the state, where population density is generally lower than the rest of 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 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 3.2.9-1 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 in Table 3.2.9-1. 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.

### *3.2.9.4 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 they represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measureable by economists, even if very small, but their significance is determined by application of the criteria in Table 3.2.9-1. 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*

- 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 summarizes how 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.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - 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.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- 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.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- 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.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- 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.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- 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.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

  - 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.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- 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 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.
    - 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.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - 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.

- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- 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.
  - 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.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- 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.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

**Operation Impacts**

*Activities with the Potential to Have 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.
- 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 the region and Alabama. 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.

### *3.2.9.5 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 partner(s) 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 Alabama. 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 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 3.1.9, Socioeconomics.

## 3.2.10 Environmental Justice

### *3.2.10.1 Introduction*

This section describes potential impacts to environmental justice in Alabama 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.

### *3.2.10.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 3.2.10-1. As described in Section 3.2, 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 3.2.10-1: 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

#### *3.2.10.3 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 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 3.2.9).

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 3.1.10.4) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 3.1.10.3, Environmental Setting:

Minority and Low-Income Populations, Alabama has a considerably higher percentage of Black/African American population than the region or the nation. Alabama's percentage of All Minorities population is lower than that of the region or nation. The state has a higher rate of poverty than the region and a considerably higher rate than the nation. A high proportion of Alabama has high potential for environmental justice populations. The distribution of these high potential areas is somewhat uneven across the state, with much of the southern, less densely populated portion of the state showing high potential. High Potential areas also occur frequently within the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is fairly even in the northern part of the state, but moderate potential areas occur somewhat less frequently in the southern part of the state. Further analysis using the data developed for the screening analysis in Section 3.1.10.4, 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, 2015e; USEPA, 2016c).

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.

### *3.2.10.4 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 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 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 is 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 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 to 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.

- 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. Thus, as discussed above, this activity would only potentially impact environmental justice communities if it involves new construction that generates noise and dust, or disrupts traffic, and occurs disproportionately in environmental justice communities.

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 partner(s) 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. 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.

#### *3.2.10.5 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 partner(s) 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 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 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 3.1.10, Environmental Justice.

## 3.2.11 Cultural Resources

### *3.2.11.1 Introduction*

This section describes potential impacts to cultural resources in Alabama 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.

### *3.2.11.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 3.2.11-1. As described in Section 3.2, 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 3.2.11-1: 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 propertiesb | 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 State Historic Preservation Office (SHPO)/Tribal Historic Preservation Office (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.

### *3.2.11.3 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 3.2.11-1, 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 Alabama, 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 alter historic architectural features. 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.

**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.

### *3.2.11.4 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 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 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 of historic artifacts. The types of infrastructure deployment 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 POP, 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.
  - 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 and inland bodies of water could impact cultural resources, as coastal areas of Alabama 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 shore to 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 Montgomery 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 at the programmatic level 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 partner(s) 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 impacts at the programmatic level 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 affect, 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.11.5 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 at the programmatic level 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 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 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 at the programmatic level 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 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 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 3.1.11, Cultural Resources.

## 3.2.12 Air Quality

### *3.2.12.1 Introduction*

This section describes potential impacts to Alabama'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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.12.2 Impact Assessment Methodology and Significance Criteria*

The impacts of the Proposed Action on Alabama's air quality were evaluated using the significance criteria presented in Table 3.2.12-1. As described in Section 3.2, 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 Alabama's air quality addressed in this section are presented as a range of possible impacts.

**Table 3.2.12-1: Impact Significance Rating Criteria for Air Quality**

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | **Potentially Significant** | **Less than Significant with 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

### *3.2.12.3 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 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. Areas exist in Alabama that are in maintenance or nonattainment for one or more criteria pollutants, particularly, PM and ozone are state-wide issues (see Section 3.1.12, Air Quality and Figure 3.1.12-1).

Seven counties in Alabama are designated as nonattainment or maintenance areas for one or more of the following NAAQS pollutants: lead, PM, $SO_2$, and ozone (Table 3.1.12-4 and Figure 3.1.12-1).

Based on the significance criteria presented in Table 3.2.12-1, air emission impacts would likely be less than significant 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 Alabama; however, NAAQS exceedances are not anticipated. Given that some nonattainment areas are present in Alabama (Figure 3.1.12-1), 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.

### *3.2.12.4 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 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 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 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 and 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 shore to 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 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 partner(s) 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

#### *3.2.12.5 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 partner(s) 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 on 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. Environmental conditions would therefore be the same as those described in Section 3.1.12, Air Quality.

## 3.2.13 Noise

### *3.2.13.1 Introduction*

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in Alabama. 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.

### *3.2.13.2 Impact Assessment Methodology and Significance Criteria*

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 3.2.13-1. As described in Section 3.2, 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 Alabama addressed in this section are presented as a range of possible impacts.

## Table 3.2.13-1: 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. |

### *3.2.13.3 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 3.1.13 Noise).

Based on the significance criteria presented in Table 3.2.13-1, noise impacts would likely be less than significant 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 concentration 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.

### *3.2.13.4 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 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 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, POP

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 and nearshore and 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 shore to 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 basis 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. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft) 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. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. 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 partner(s) 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.

### *3.2.13.5 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, 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 partner(s) 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 at the programmatic level 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 partner(s) 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 on 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. Environmental conditions would therefore be the same as those described in Section 3.1.13, Noise.

## 3.2.14 Climate Change

### *3.2.14.1 Introduction*

This section describes potential impacts to climate and climate change-vulnerable resources in Alabama 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.

### *3.2.14.2 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 3.2.14-1. As described in Section 3.2, 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 (CEQ, 2014).

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 (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920$^{th}$) of the total U.S. emissions of 6,673 MMT $CO_2e$ in 2013 (USEPA, 2015o), 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 (CEQ, 2014). 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 3.2.14-1: 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

### *3.2.14.3 Projected Future Climate*

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 3.2.14-1 and Figure 3.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Alabama from a 1969 to 1971 baseline.

Cfa – Figure 3.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the Cfa region of Alabama under a low emissions scenario would increase by approximately 2 °F or 3 °F depending on the section of the region, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in this region of Alabama would increase by approximately 5 °F for the majority of the region and by 4 °F in parts of the state by the southern border. (USGCRP, 2009)

Figure 3.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F in the northern portion of Alabama, and would increase by approximately 4 °F in the remainder of the state. Under a high emissions scenario for the period (2080 to 2099) in the Cfa region of Alabama, temperatures would increase by approximately 8 °F in the majority of the state and by 9 °F in the northern portion of the state. (USGCRP, 2009)

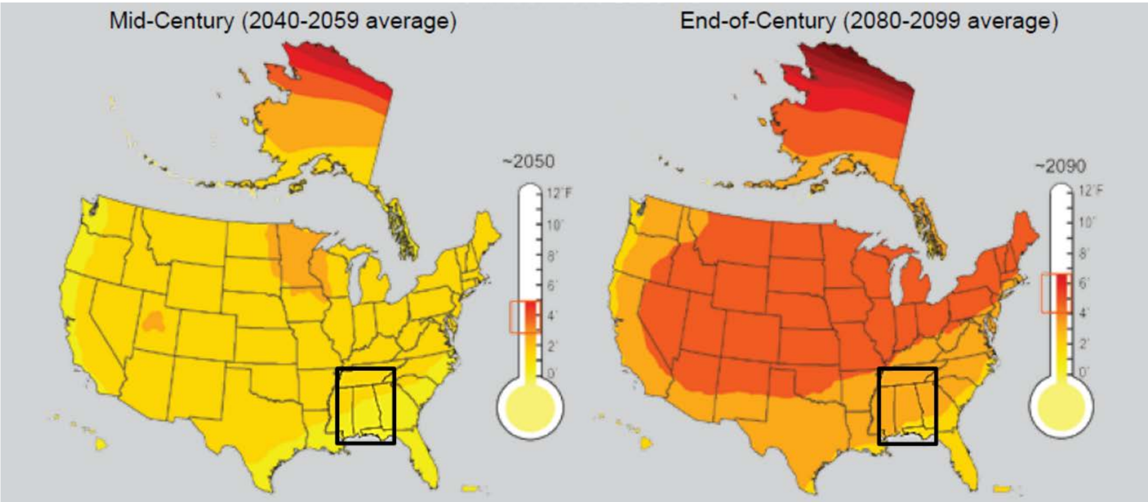


**Figure 3.2.14-1: Alabama Low Emission Scenario Projected Temperature Change**

Source: (USGCRP, 2009)

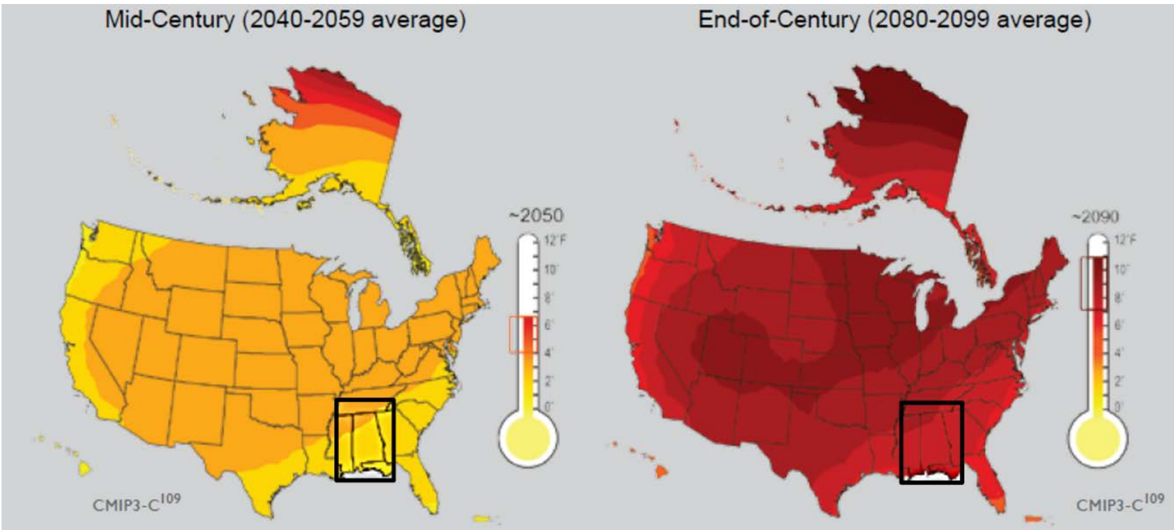


**Figure 3.2.14-2: Alabama High Emission Scenario Projected Temperature Change**

Source: (USGCRP, 2009)

*Precipitation*

Predicting future precipitation patterns in the southeast are much less certain that 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)

Total seasonal snowfall has generally decreased in southern and some western areas although snow is melting earlier in the year and more precipitation is falling as rain versus snow. Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow spends on the ground. (USGCRP, 2014b)

In the majority of Alabama, there is an expected increase of about 10 percent in the number of consecutive dry days under a low emissions scenarios by mid-century (2041 to 2070) as compared to the period (1971 – 2000). Under a high emissions scenario in the majority of the state there is a projected increase of about 20 percent in the number of consecutive dry days. An increase in consecutive dry days could lead to drought. (USGCRP, 2014c)

Figure 3.2.14-3 and Figure 3.2.14-4 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 3.2.14-3 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, 2014c)

Figure 3.2.14-4 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, 2014c)

Cfa - Figure 3.2.14-3 shows that under the low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in spring for the entire state of Alabama. There are no expected increases in precipitation in winter other than fluctuations due to natural variability. In summer and fall, there are no expected increases in precipitation for the majority of the state while some eastern portions of the state could expect to see a 10 percent increase. (USGCRP, 2014c)

Figure 3.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase 10 percent in the northern portion of the state, but have no expected changes in the remainder of the state over the period 2071 to 2099. In summer, precipitation in this scenario is expected to decrease by 10 percent in the majority of the state while the northern portion is not expected to show any changes in precipitation. Fall precipitation is expected to increase as much as 20 percent along the southern border/coast of Alabama; increase 10 percent in the middle of the state; and there are no expected changes in precipitation in the northern most portion of the state. (USGCRP, 2014c)

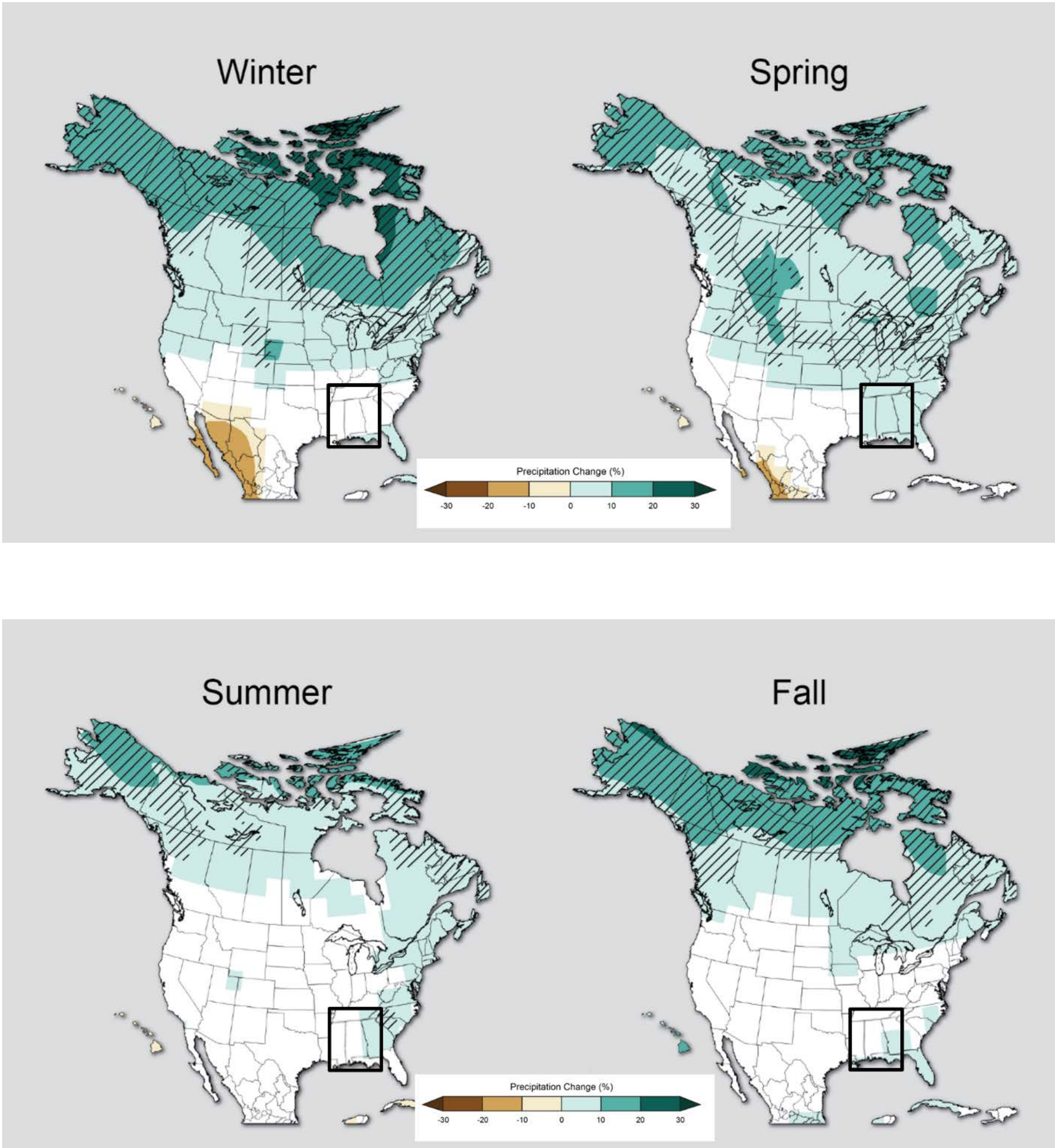


**Figure 3.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario**

Source: (USGCRP, 2014c)

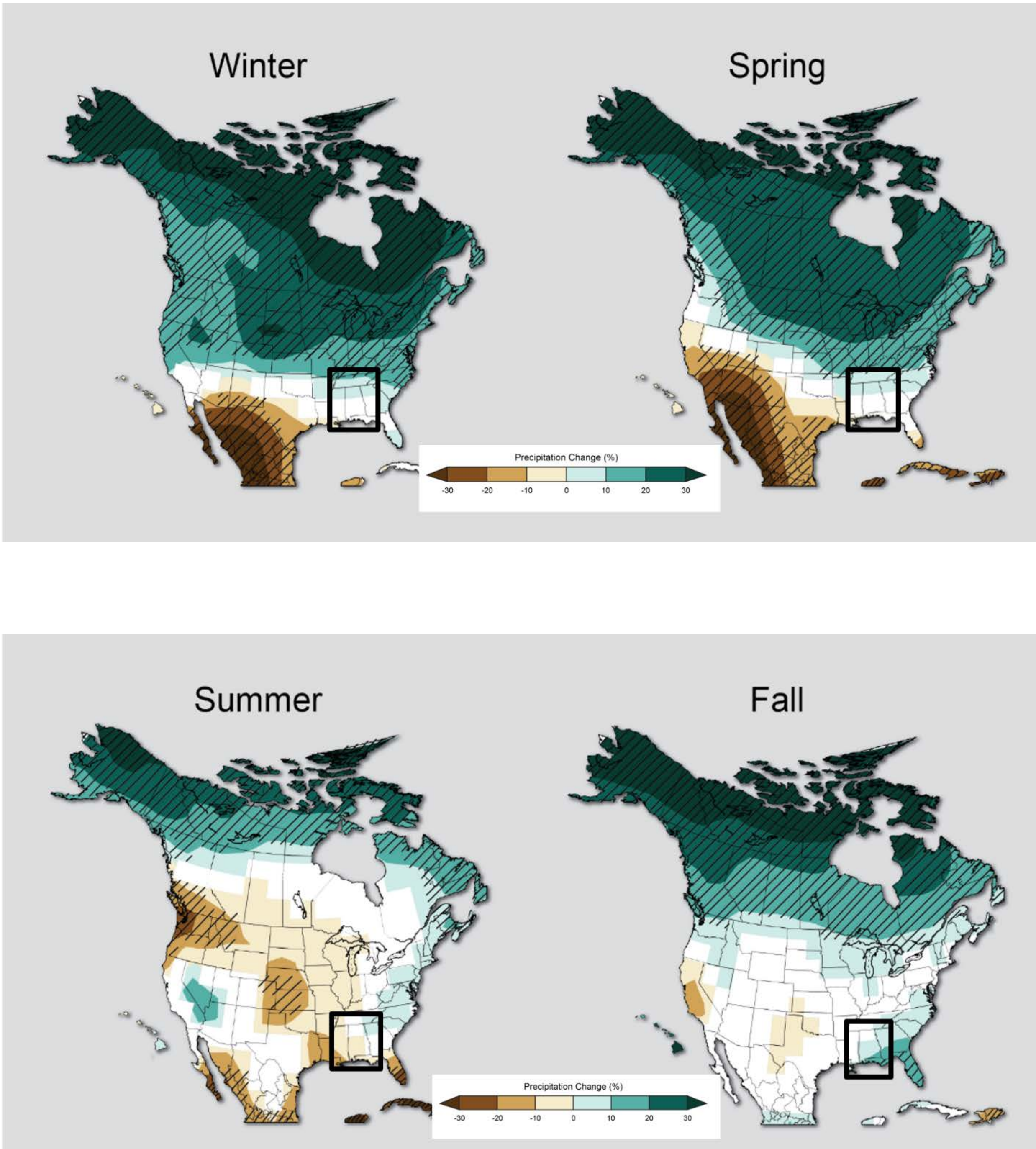


**Figure 3.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario**

Source: (USGCRP, 2014c)

## 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, 2012g). 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, 2012g). Sea level and currents could be influenced by the amount of heat stored in the ocean (USEPA, 2012g).

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 lever 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 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, 2012b). Figure 3.2.14-5 and Figure 3.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 3.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 3.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014d).

Cfa – In Alabama, only a small southwestern portion of the state borders the ocean, and is and will continue to be affected by sea level rise. Figure 3.2.14-5 shows that an 8-inch global average sea level rise above 1992 levels, would result in a 0.7 to 1 foot sea level rise in 2050 along the portion of Alabama that borders the coast. Figure 3.2.14-6 indicates that a 1.24-foot sea level rise above 1992 level would result in a 1.0 to 1.3 foot sea level rise in 2050 along the coast of Alabama. (USGCRP, 2014d)

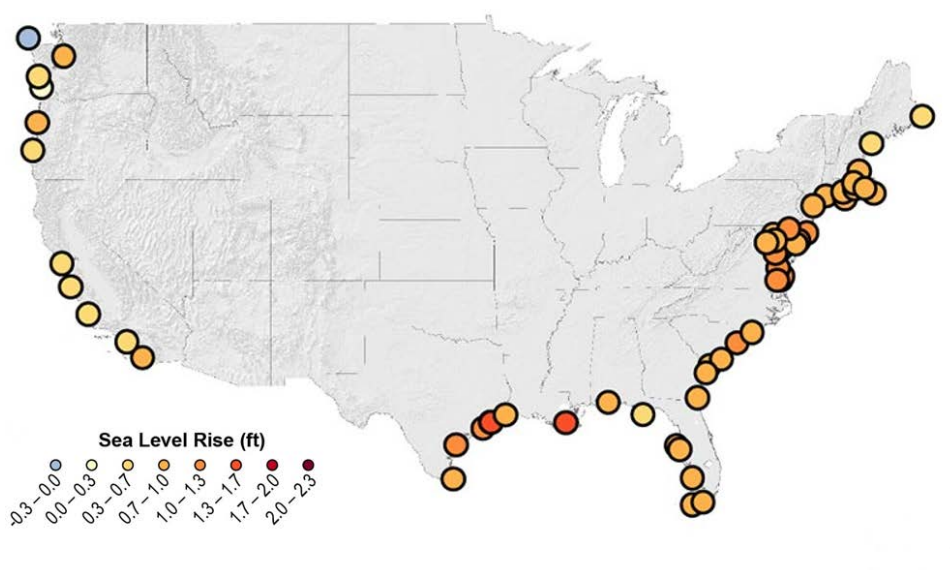


**Figure 3.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050**

Source: (USGCRP, 2014d)

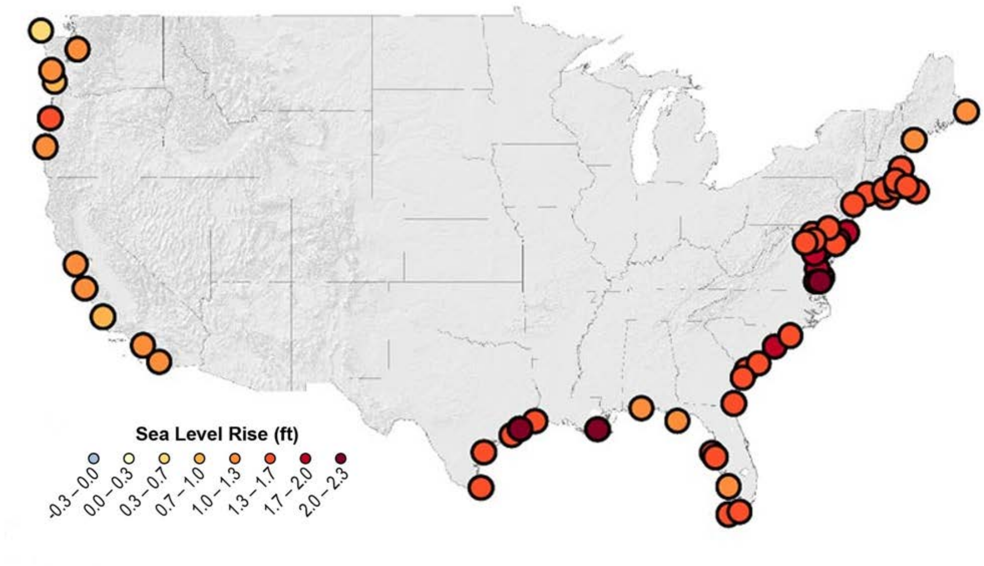


**Figure 3.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050**

Source: (USGCRP, 2014d)

## Severe Weather Events

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, 2014e)

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, 2014e). 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 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 (USGCRP, 2009).

### *3.2.14.4 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 3.2.14-1, 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, 2015d). 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, 2015p), 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. Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. 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 (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

**Impact of Climate Change on Project-Related Resource Effects**

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. Forested areas of the southeast, including Alabama, 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 Alabama, especially the estuarine areas of Mobile Bay (USGS, 2011b), resulting in erosion and permanent loss of coastal habitat.

**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. In Alabama, the entire 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, 2014f). Stronger storms may also increase the potential for damage to infrastructure from high winds and wind-borne debris. 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 in southern states than for other regions of the U.S. (USGCRP, 2014g) Extended periods of extreme heat may impede the operation of the grid in the south (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 3.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

### *3.2.14.5 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 Alabama, 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 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.
- Satellites and Other Technologies
  - 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.
  - Distribution 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 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 ROWs 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 back-up), 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 back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, 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 partner(s) 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 should 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.

### *3.2.14.6 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 partner(s) 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 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 to 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 partner(s) 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 at the programmatic level 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 3.1.14, Climate Change.

## 3.2.15 Human Health and Safety

### *3.2.15.1 Introduction*

This section describes potential impacts to human health and safety in Alabama 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.15.2 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 3.2.15-1. As described in Section 3.2, 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 3.2.15-1: Impact Significance Rating Criteria for Human Health and Safety**

| Type of Effect | Effect Characteristics | Impact Level | | | |
|---|---|---|---|---|---|
| | | Potentially Significant | Less than Significant with Mitigation Measures 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, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (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 | Impact Level: Less than Significant with Mitigation Measures Incorporated | Impact Level: Less than Significant | Impact Level: 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 Measures 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

#### *3.2.15.3 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 3.2.15-1, 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 then
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[167], 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.

[167] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016)

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 (OSHA, 2015b). 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 (OSHA, 2015b). 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.

**Hazardous Materials, Hazardous Waste, and Mine Lands**

The presence of environmental contamination 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 as a result of site activities. Mines may cause unstable surface and subsurface conditions as a result because of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 3.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. 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 database and U.S. Department of Interior's (DOI) Abandoned Mine Lands inventory, through the Alabama Department of Environmental Management (ADEM), or through an equivalent commercial resource.

By screening sites for environmental contamination 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, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination 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 Alabama 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 ADEM 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 3.2.15-1, 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, 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. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

### *3.2.15.4 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 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 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 and 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 shore to accept 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 radio frequency 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 radio frequency 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 radio frequency 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 is 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 partner(s) 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. 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. 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 partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

### *3.2.15.5 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 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 hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety at the programmatic level. 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 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 human health and safety at the programmatic level 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 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 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 3.1.15, Human Health and Safety.

# AL APPENDIX A – WATER RESOURCES

**Table A-1: Characteristics of Alabama's Watersheds, as Defined by ADEM**

| Watershed/Size<br>Land Area within AL<br>(square miles) | Major Surface Waterbodies | Major Water Quality Concerns |
|---|---|---|
| Tennessee River Basin (6,826) | Tennessee River<br>Guntersville Lake | • Sediment<br>• Nitrogen<br>• Phosphorous<br>• Pathogens |
| Black Warrior River Basin (6,288) | Sipsey Fork<br>Lewis Smith Lake<br>Black Warrior River | • Aluminum<br>• Iron<br>• Pathogens<br>• Copper<br>• Sediment<br>• Zinc |
| Upper and Lower Tombigbee River Basin (7,570) | Tombigbee River | • Pathogens<br>• Nitrogen<br>• Phosphorous |
| Middle Coosa River Basin (2,585) | Coosa River<br>Little River | • Phosphorous |
| Upper Coosa River Basin and Weiss Lake (852) | Coosa River<br>Little River | • Pathogens<br>• Phosphorous<br>• Polychlorinated Biphenyls (PCB) |
| Lower Coosa River Basin (1,963) | Coosa River | • Phosphorous |
| Cahaba River Basin (1,818) | Cahaba River | • Phosphorous<br>• Pathogens<br>• Sediment |
| Tallapoosa River Basin (4,024) | Martin Lake<br>Tallapoosa River | • Pathogens<br>• Phosphorous |
| Chattahoochee and Chipola River Basin (2,830) | Chattahoochee River | • Ammonia |
| Alabama River Basin (4,747) | Alabama River | • Pathogens |
| Choctawhatchee, Pea, and Yellow River Basin (3,637) | Choctawhatchee River<br>Pea River | • Lead<br>• Pathogens<br>• Mercury |
| Conecuh, Sepulga, and Blackwater River Basin (3,996) | Conecuh River | • Mercury<br>• Sediment |
| Coastal Alabama Basin (3,696) | Mobile River<br>Mobile bay | • Pathogens<br>• Phosphorous |

Source: (USEPA, 2015q) (ADEM, 2011)

## Table A-2. Alabama Outstanding National Resource Waters, Outstanding Alabama Waters, and Treasured Alabama Lakes

| River Name | River Segment |
|---|---|
| ***Waterbody Segments designated as Outstanding National Resource Waters*** | |
| Black Warrior River | Sipsey Fork and tributaries between Sandy Creek and the River's source. |
| Coosa River | (a) Little River and tributaries between Coosa River (Weiss Lake) and the junction of East Fork of Little River and West fork of Little River. |
| | (b) East Fork of Little River and tributaries between Little River and Alabama-Georgia state line. |
| | (c) West Fork of Little River and tributaries between Little River and Alabama-Georgia state line. |
| Mobile River | Weeks Bay between Bon Secour Bay and Fish River. |
| ***Waterbody Segments designated as Treasured Alabama Lakes*** | |
| Tallapoosa River | (a) Tallapoosa River (Lake Martin) between Martin Dam and Highway 280. |
| | (b) Tallapoosa River (Lake Martin) between Highway 280 and Hillabee Creek. |
| | (c) Little Kowaliga Creek (Lake Martin) between Big Kowaliga Creek (Lake Martin) and Reservoir Limits. |
| | (d) Manoy Creek (Lake Martin) between Tallapoosa River (Lake Martin) and Reservoir Limits. |
| ***Waterbody Segments designated as Outstanding Alabama Waters*** | |
| Cahaba River | (a) From Alabama River to Junction of lower Little Cahaba River |
| | (b) From Junction of lower Little Cahaba River to Shelby County Road 52. |
| | (c) From Dam near U.S. Highway 280 to Grant's Mill Road. |
| | (d) From U.S. Highway 11 to the River's source. |
| Little Cahaba River (Bibb County) | (a) From Cahaba River to the River's source (junction of Mahan and Shoal Creeks). |
| Hatchet Creek | (a) From Coosa River (Lake Mitchell) to Norfolk Southern Railway. |
| | (b) From Norfolk Southern Railway to the Junction of East Fork Hatchet Creek and West Fork Hatchet Creek. |
| East Fork Hatchet Creek | From Hatchet Creek to the River's source. |
| West Fork Hatchet Creek | From Hatchet Creek to the River's source. |
| Shoal Creek | From Whitesides Mill Lake to the River's source. |
| Tensaw River | (a) From the Junction of Tensaw and Apalachee Rivers to the Junction of Briar Lake. |
| | (b) From the Junction of Briar Lake to the Junction of Tensaw Lake. |
| Briar Lake | From the Junction of Tensaw River to the Junction of Tensaw Lake. |

| River Name | River Segment |
|---|---|
| Tensaw Lake | From the Junction of Tensaw River to Bryant Landing. |
| Magnolia River | From Weeks Bay to the River's source. |
| Wolf Bay and all connecting coves and bayous | From Intracoastal Waterway to Moccasin Bayou. |
| Tallapoosa River | From Cane Creek to Alabama-Georgia state line. |
| Estill Fork | From Paint Rock River to Alabama-Tennessee state line. |
| Hurricane Creek | From Paint Rock to Alabama-Tennessee state line. |

Source: (ADEM, 2015m), (ADEM, 2015n)

# AL APPENDIX B – BIOLOGICAL RESOURCES

**Table B-1. 2015-2025 Alabama Wildlife Action Plan (30 July 2015 Draft) Key Habitats and Associated Communities**

| Habitat | Associated NatureServe Ecological Systems |
|---|---|
| Mesic Hardwood Forest | • Southern Piedmont Mesic Forest CES202.342<br>• South-Central Interior Mesophytic Forest CES202.887<br>• East Gulf Coastal Plain Southern Mesic Slope Forest CES203.476<br>• East Gulf Coastal Plain Northern Mesic Hardwood Forest CES203.477<br>• East Gulf Coastal Plain / Central Florida Hydric Hammock CES203.501<br>• East Gulf Coastal Plain Limestone Forest CES203.502<br>• East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods CES203.557 |
| Dry Hardwood Forest | • Southern Piedmont Dry Oak-(Pine) Forest CES202.339<br>• Allegheny-Cumberland Dry Oak Forest and Woodland CES202.359<br>• Southern Ridge and Valley Dry Calcareous Forest CES202.457<br>• Northeastern Interior Dry Oak Forest CES202.592<br>• Southern Interior Low Plateau Dry Oak Forest CES202.898<br>• East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest CES203.506<br>• East Gulf Coastal Plain / Central Florida Upland Hardwood Forest CES203.560<br>• East Gulf Coastal Plain Northern Dry Upland Hardwood Forest CES203.483 |
| Floodplain Forest | • Cumberland Riverscour CES202.036<br>• Southern Piedmont Small Floodplain and Riparian Forest CES202.323<br>• Southern Piedmont Large Floodplain Forest CES202.324<br>• South-Central Interior Large Floodplain CES202.705<br>• South-Central Interior Small Stream and Riparian CES202.706<br>• East Gulf Coastal Plain Large River Floodplain Forest CES203.489<br>• East Gulf Coastal Plain/Cent. FL Blackwater Riv. Floodplain Forest CES203.493<br>• East Gulf Coastal Plain Small Stream and River Floodplain Forest CES203.559 |
| Dry Longleaf Pine Forest | • Southeastern Interior Longleaf Pine Woodland CES202.319<br>• Southern Appalachian Low Mountain Pine Forest CES202.332<br>• East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland CES203.496 |
| Wet Pine Savanna and Flatwoods | • East Gulf Coastal Plain Near-Coast Pine Flatwoods CES203.375<br>• East Gulf Coastal Plain Treeless Savanna and Wet Prairie CES203.192<br>• South-Central Interior/Upper Coastal Plain Wet Flatwoods CES203.480 |

| Habitat | Associated NatureServe Ecological Systems |
|---|---|
| Swamp | • Southern Piedmont Upland Depression Swamp CES202.336<br>• East Gulf Coastal Plain Tidal Wooded Swamp CES203.299<br>• East Gulf Coastal Plain Non-riverine Basin Swamp CES203.384<br>• East Gulf Coastal Plain / Central FL Seepage Swamp and Baygall CES203.505<br>• Southern Coastal Plain Nonriverine Cypress Dome CES203.251 |
| Maritime Forest and Coastal Scrub | • East Gulf Coastal Plain Maritime Forest CES203.503 |
| Glades and Prairie | • Ridge and Valley Calcareous Valley Bottom Glade and Woodland CES202.024<br>• Southern Piedmont Glade and Barrens CES202.328<br>• Southern Piedmont Granite Flatrock CES202.329<br>• Cumberland Sandstone Glade and Barrens CES202.337<br>• Alabama Ketona Glade and Woodland CES202.338<br>• Southern Ridge and Valley Patch Prairie CES202.453<br>• Central Interior Highlands Calcareous Glade and Barrens CES202.691<br>• East Gulf Coastal Plain Black Belt Calcareous Prairie and Woodland CES203.478 |
| Bogs and Seepage Communities | • Southern Piedmont Seepage Wetland CES202.298<br>• Cumberland Seepage Forest CES202.361<br>• East Gulf Coastal Plain Herbaceous Seepage Bog CES203.078<br>• East Gulf Coastal Plain Interior Shrub Bog CES203.385 |
| Caves and Mines | • NA |
| River and Stream *Strategic Habitat Units* and *River Reach Units* (SHUs and SRRUs) | • NA |
| Isolated Wetland | • Cent. Interior Highlands & Appalachian Sinkhole & Depression Pond CES202.018<br>• Atlantic and Gulf Coastal Plain Interdunal Wetland CES203.258<br>• East Gulf Coastal Plain Northern Depression Pondshore CES203.558 |
| Artificial Habitats | • NA |
| Beach and Dune | • Florida Panhandle Beach Vegetation CES203.266<br>• East Gulf Coastal Plain Dune and Coastal Grassland CES203.500 |
| Intertidal Marshes and Flats | • Mississippi Sound Salt and Brackish Tidal Marsh CES203.303 |
| Submerged Aquatic Vegetation | • East Gulf Coastal Plain Northern Gulf of Mexico Seagrass Bed CES203.263 |

| Habitat | Associated NatureServe Ecological Systems |
| --- | --- |
| Cliffs and Rockhouses | • Southern Interior Sinkhole Wall CES202.357<br>• Southern Appalachian Spray Cliff CES202.288<br>• Southern Interior Acid Cliff CES202.309<br>• Southern Appalachian Montane Cliff and Talus CES202.330<br>• Allegheny-Cumberland Sandstone Box Canyon and Rockhouse CES202.349<br>• Southern Interior Calcareous Cliff CES202.356<br>• Southern Piedmont Cliff CES202.386<br>• East Gulf Coastal Plain Dry Chalk Bluff CES203.492 |

Source: (ADCNR, 2015a)

# ACRONYMS

| Acronym | Definition |
|---|---|
| AAC | Alabama Administrative Code |
| AAF | Army Airfield |
| AARC | Average Annual Rate of Change |
| ACHP | Advisory Council on Historic Preservation |
| ACS | American Community Survey |
| ADAH | Alabama Department of Archives and History |
| ADAI | Alabama Department of Agriculture and Industries |
| ADCNR | Alabama Department of Conservation and Natural Resources |
| ADECA | Alabama Department of Economic and Community Affairs |
| ADEM | Alabama Department of Environmental Management |
| ADOL | Alabama Department of Labor |
| ADPH | Alabama Department of Public Health |
| AEMA | Alabama Emergency Management Agency |
| AFRN | Alabama First Responder Network |
| AHAM | Association of Home Appliance Manufacturers |
| AHP | Alabama Highway Patrol |
| AGL | Above Ground Level |
| AIM | Aeronautical Information Manual |
| AIRFA | American Indian Religious Freedom Act |
| AL | Alabama |
| ALDOT | Alabama Department of Transportation |
| ALEA | Alabama Law Enforcement Agency |
| ALNHP | Alabama Natural Heritage Program |
| AMEA | Alabama Municipal Electric Authority |
| AML | Abandoned Mine Lands |
| APE | Area of Potential Effect |
| AQCR | Air Quality Control Region |
| ARCS | Alabama Regional Communications System |
| ARPA | Archaeological Resources Protection Act |
| ASL | Above Sea Level |
| ASPA | Alabama State Port Authority |
| ATC | Air Traffic Control |

| Acronym | Definition |
|---|---|
| ATO | Air Traffic Organization |
| AWF | Alabama Wildlife Federation |
| BGEPA | Bald and Golden Eagle Protection Act |
| BHM | Birmingham-Shuttlesworth International Airport |
| BLM | Bureau of Land Management |
| BLS | Bureau of Labor Statistics |
| BMP | Best Management Practice |
| CAA | Clean Air Act |
| CAIR | Clean Air Interstate Rule |
| CAMR | Clean Air Mercury Rule |
| CCMP | Comprehensive Conservation Management Plan |
| CDC | Centers for Disease Control and Prevention |
| CEQ | Council on Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFA | Controlled Firing Area |
| CFR | Code of Federal Regulations |
| CGP | Construction General Permit |
| $CH_4$ | Methane |
| CIMC | Cleanups In My Community |
| CIO | Chief Information Officer |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| COA | Certificate of Waiver Authorization |
| COLT | Cell on Light Truck |
| COW | Cell on Wheels |
| CRS | Community Rating System |
| CSC | Connecticut Siting Council |
| CWA | Clean Water Act |
| D.C. | District of Columbia |
| DISDI | Defense Installations Spatial Data Infrastructure |
| DOC | Department of Commerce |
| DoD | Department of Defense |
| DOE | Department of Energy |
| DOI | Department of Interior |

| Acronym | Definition |
|---|---|
| EFH | Essential Fish Habitat |
| EIA | Energy Information Administration |
| EMS | Emergency Medical Services |
| EO | Executive Order |
| EPCRA | Emergency Planning and Community Right to Know Act |
| ESA | Endangered Species Act |
| ESRI | Environmental Systems Research Institute |
| FAA | Federal Aviation Administration |
| FAR | Federal Aviation Regulation |
| FCC | Federal Communications Commission |
| FDMA | Frequency Division Multiple Access |
| FEMA | Federal Emergency Management Agency |
| FGDC | Federal Geographic Data Committee |
| FHWA | Federal Highway Administration |
| FL | Flight Level |
| FLM | Federal Land Manager |
| FR | Federal Register |
| FSDO | Flight Standards District Office |
| FSS | Flight Service Station |
| FWC | Florida Fish and Wildlife Conservation Commission |
| GADNR | Georgia Department of Natural Resources |
| GAO | Government Accountability Office |
| GAP | Gap Analysis Program |
| GHG | Greenhouse Gas |
| GPO | U.S. Government Publishing Office |
| GIO | Geospatial Information Officer |
| GNIS | Geographic Names Information System |
| GSA | Geological Survey of Alabama |
| GWP | Global Warming Potential |
| HAP | Hazardous Air Pollutants |
| HAPC | Habitat Areas of Particular Concern |
| HASP | Health and Safety Plans |
| HDNREM | Huntsville Department of Natural Resources and Environmental Management |
| HHRA | Human Health Risk Assessment |

| Acronym | Definition |
|---|---|
| HSV | Huntsville International Airport |
| IBA | Important Bird Area |
| IFR | Instrument Flight Rules |
| IPCC | Intergovernmental Panel on Climate Change |
| ITU | International Telecommunication Union |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| JCDH | Jefferson County Department of Health |
| LBS | Locations-Based Services |
| LCCS | Land Cover Classification System |
| LLC | Limited Liability Company |
| LMR | Land Mobile Radio |
| LRR | Land Resource Regions |
| LTE | Long Term Evolution |
| MALE | Mutual Aid Law Enforcement |
| MBTA | Migratory Bird Treaty Act |
| MHI | Median Household Income |
| MHz | Megahertz |
| MLRA | Major Land Resource Areas |
| MMPA | Marine Mammal Protection Act |
| MMT | Million Metric Tons |
| MOA | Military Operation Area |
| MOB | Mobile Regional Airport |
| MSFCMA | Magnuson Stevens Fishery Conservation and Management Act |
| MSL | Mean Sea Level |
| MSOP | Major Source Operating Permit |
| MT | Metric Ton |
| MTR | Military Training Route |
| MYA | Million Years Ago |
| $N_2O$ | Nitrous Oxide |
| NA | Not Applicable |
| NAAQS | National Ambient Air Quality Standards |
| NAGPRA | Native American Graves Protection and Repatriation Act |
| NAICS | North American Industry Classification System |
| NAS | National Airspace System |

| Acronym | Definition |
|---|---|
| NASAO | National Association of State Aviation Officials |
| NCED | National Conservation Easement Database |
| NECWA | New England Coastal Wildlife Alliance |
| NEP | National Estuary Program |
| NEPA | National Environmental Policy Act |
| NERR | National Estuarine Research Reserve |
| NFIP | National Flood Insurance Program |
| NHL | National Historic Landmark |
| NHPA | National Historic Preservation Act |
| NIST | National Institute of Standards and Technology |
| NM | Nautical Miles |
| NMFS | National Marine Fisheries Service |
| NNL | National Natural Landmarks |
| $NO_2$ | Nitrogen Dioxide |
| NOAA | National Oceanic and Atmospheric Administration |
| NOTAM | Notices to Airmen |
| $NO_X$ | Nitrogen Oxides |
| 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 |
| NTFI | National Task Force on Interoperability |
| NTIA | National Telecommunications and Information Administration |
| NWI | National Wetlands Inventory |
| NWR | National Wildlife Refuge |
| NWS | National Weather Service |
| OE/AAA | Obstruction Evaluation and Airport Airspace Analysis |
| OHV | Off-Highway Vehicle |
| ORV | Off-Road Vehicle |
| OSHA | Occupational Safety and Health Administration |

| Acronym | Definition |
|---|---|
| PCB | polychlorinated biphenyl |
| PEIS | Programmatic Environmental Impact Statement |
| PEM | Palustrine Emergent Wetlands |
| PFO | Palustrine Forested Wetlands |
| PGA | Peak Ground Acceleration |
| PM | Particulate Matter |
| POP | Point of Presence |
| PPE | Personal Protective Equipment |
| PSAP | Public Safety Answering Points |
| PSC | Public Service Commission |
| PSCR | Public Safety Communications Research |
| PSD | Prevention of Significant Deterioration |
| PSS | Palustrine Scrub-Shrub |
| RCRA | Resource Conservation and Recovery Act |
| RF | Radio Frequency |
| ROW | Right-of-way |
| SAA | Sense and Avoid |
| SAIPE | Small Area Income and Poverty Estimates |
| SASP | State Aviation System Plan |
| SCEC | State Climate Extremes Committee |
| SCIP | Statewide Communication Interoperability Plan |
| SDS | Safety Data Sheets |
| SDWA | Safe Drinking Water Act |
| $SF_6$ | Sulfur Hexafluoride |
| SGCN | Species of Greatest Conservation Need |
| SHPO | State Historic Preservation Office |
| SIP | State Implementation Plan |
| SMOP | Synthetic Minor Operating Permit |
| $SO_2$ | Sulfur Dioxide |
| SOC | Standard Occupational Classification |
| SOP | Standard Operating Procedure |
| SOW | Site on Wheels |
| $SO_X$ | Sulfur Oxides |
| SPL | Sound Pressure Level |

| Acronym | Definition |
|---|---|
| SRF | State Revolving Fund |
| STATSGO2 | State Soil Geographic |
| SUA | Special Use Airspace |
| SWPPP | Stormwater Pollution Prevention Plan |
| TDMA | Time Division Multiple Access |
| TFR | Temporary Flight Restriction |
| THPO | Tribal Historic Preservation Officer |
| TMDL | Total Maximum Daily Load |
| TPY | Tons per year |
| TRI | Toxics Release Inventory |
| TSCA | Toxic Substances Control Act |
| TVA | Tennessee Valley Authority |
| TWA | Time Weighted Average |
| U.S. | United States |
| U.S.C. | U.S. Code |
| UA | Unmanned Aircraft |
| UAS | Unmanned Aerial Systems |
| UAV | Unmanned Aerial Vehicles |
| UHF | Ultra High Frequency |
| USACE | U.S. Army Corps of Engineers |
| USDA | U.S. Department of Agriculture |
| USDOT | U.S. Department of Transportation |
| USEPA | U.S. Environmental Protection Agency |
| USFA | U.S. Fire Administration |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| USGCRP | U.S. Global Change Research Program |
| USGS | U.S. Geological Survey |
| USS | United States Ship |
| UVA | University of Virginia |
| VCP | Voluntary Cleanup Program |
| VFR | Visual Flight Rules |
| VHF | Very High Frequency |
| VOC | Volatile Organic Compound |

| Acronym | Definition |
|---|---|
| WCS | Wetlands Classification Standard |
| WMA | Wildlife Management Area |
| WONDER | Center for Diseases Control and Prevention Wide-ranging Online Data for Epidemiologic Research |
| WQC | Water Quality Certification |
| WWI | World War I |
| WWII | World War II |

## REFERENCES

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